The Environment-Cognition Fit Perspective in Determining Team Adaptive Performance

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Abstract

The work described in this dissertation is focused on understanding the relationship between team adaptation and team cognition. Team adaptation represents the adjustment of behavior and cognition to the demands of novel situations or to changing circumstances. Team cognition, which refers to the interpretation of novel events or changing circumstances, represents a cornerstone of effective adaptation as it enables the team to assign meaning to the events and to represent the means via which it can overcome them. Despite numerous calls to expand investigations of these relationships, there has been limited research devoted to studying the relationship between team adaptation and team cognition. In this work therefore, I take on the task of investigating these relationships more in-depth. To do this, I derive a series of theoretical propositions which I integrate in a theoretical framework and I empirically test some of these propositions in three studies.

In the theoretical framework, I derive a contingency perspective on the relationship between team cognition and team adaptation by proposing that in order to effectively adapt to the demands of their environments the teams must develop certain cognitive characteristics that reflect the central features or dimensions of those environments. In line with this contingency perspective, I conduct three studies to investigate the role of team mental models, a team cognitive construct, for team adaptation. The work takes a longitudinal perspective, by emphasizing that team cognition develops over time and that this development is relevant for performance as opposed to cross-sectional influences.

In the first study, I find that both dissimilar and similar mental models lead to higher performance of project teams that meet changes but at different performance stages. Specifically, I find that at the onset of changes more dissimilar mental models are more favorable while at later performance stages more similar mental models are needed for the integration of the team strategies and to reach higher performance. In the second study, I find that team mental models can be represented as a long term team capability. Specifically, I find that mental models developed in the context of a changing or varied task affected positively the teams' performance on a novel task. In the third study, I find that goal mental models that become more similar over time differentiate positively between high and low performance of interdisciplinary student

project teams, but that procedural mental models differentiate negatively between high and low performance. Overall, this work furthers the understanding of team adaptation by advancing a contingent perspective on the relationship between team cognition and team adaptation and by explicitly modeling context and time as elements of the study design that can bear on team outcomes.

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1. Introduction

The work reported in this thesis has been fueled by a need to understand how teams adapt to novel work circumstances. As organizational life has become more complex, there has been an increasing realization that the tasks conducted in organizations cannot be handled effectively by one person but depend on the allied efforts of multiple persons. According to Kozlowski and Bell (2003) "Work teams and groups: (a) are composed of two or more individuals, (b) who exist to perform organizationally relevant tasks, (c) share one or more common goals, (d) interact socially, (e) exhibit task interdependencies (i.e., workflow, goals, outcomes), (f) maintain and manage boundaries, and (g) are embedded in an organizational context that sets boundaries, constrains the team, and influences exchanges with other units in the broader entity." (p. 6). Spurred by the dynamism and uncertainty of organizational life, a new domain of inquiry has emerged within the stream of team research—team adaptation[1] research. Team adaptation refers to a cognitive or behavioral goal directed action aimed at overcoming a novel or unexpected work event that disturbs team functioning.

Team adaptation depends critically on the behavioral and cognitive adjustments realized by the team members when they encounter nonroutine events. Behavioral adaptation refers to changes in strategies, structures, roles, and communication structures made by the team when encountering unexpected events. Cognitive adjustments refer to teams shifting their cognitive frames to correspond to the changes in their environments. So far, research on team adaptation has investigated various types of team changes, such as structural changes, role changes, communication structure changes, resource changes, and various types of nonroutine events.

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[1]In this dissertation, the terms team adaptation and team adaptive performance will be used interchangeably.

In relation with these changes, researchers have looked at how teams adapt behaviorally by examining their role structure adaptation, resources adjustment, coordination adjustment, strategy changes, and speed of response changes. There has been though much less emphasis on understanding how teams adapt cognitively to the changes experienced. This limits our knowledge of team adaptation to behavioral adaptation. Cognition, which represents the team's representation and understanding of its immediate environment, has emerged as a significant determinant of adaptation in organizational research. Cognition provides a frame to interpret events and to take future action. Without clear understanding of the relationships between team adaptation and team cognition, new models cannot be proposed and the literature cannot move forward. Therefore, in this dissertation I take on the task to explore the relationship between team adaptation and team cognition.

Secondly, research on adaptation has tended to take a more static approach. Although adaptation is considered a longitudinal process of overcoming events which is supported by emergent capabilities, much work in this area is done on stable relationships. This does not enable to determine when specific processes are relevant and how interventions can be designed to address the supportive mechanisms at the right times. Adaptation models especially consider the longitudinal effects of team cognition on team adaptive outcomes. But much of this work is theoretical which requires more exact investigation for validating the models.

Considering the focus on behavioral adaptation to the exclusion of cognitive adaptation, and the focus on stable relationships as opposed to longitudinal views, in this work I aimed to contribute to the literature by addressing these two limitations. Specifically, in the studies reported here I investigate the dynamic role of team cognition for team adaptation. I look at a particular team cognitive construct, which is the focus of much research on team adaptation—team mental models.

1.1.Team mental models

Mental models represent meaningful patterns or organized knowledge structures that are stored in long-term memory. They contain information such as concepts, their features, relationships between concepts and features, and relationships between concepts. These relationships can refer to categorical membership, temporal sequence, or causality. Mental models stand at the basis of naturalistic cognition in that they enable people to process information in a rapid and flexible manner, thereby enhancing the potential to understand and explain situations, objects, and environments. The concept of mental model derives from the work of Craik (1943) who conceptualized it as: “If the organism carries a “small-scale model” of external reality and of its own possible actions within its head, it is able to try out various alternatives, conclude which is the best of them, react to future situations before they arise, utilize the knowledge of past events in dealing with the present and the future, and every way to react in a much fuller, safer, and more competent manner to the emergencies which face it.” (Craik, 1943, p. 61). On a cognitive psychological basis, Johnson-Laird (1983) conceives mental models as theoretical constructs serving to explain implicit and explicit inferences. They provide better explanations for meaning, comprehension, and discourse than other semantic representations. According to Johnson-Laird (1983), mental models: “Enable individuals to make inferences and predictions, to understand phenomena, to decide what action to take and to control its execution, and to experience events by proxy; they allow language to be used to create representations comparable to those derived from direct acquaintance with the world; and they relate the words to the world by way of conception and perception” (p. 397).

Mental models are constrained by three principles: computability, which reflects that mental models and the mechanisms for constructing them are computable; finitism, a mental model must be finite in size and cannot represent an infinite domain; constructivism, a mental model is constructed from tokens arranged in a particular structure to represent a state of affairs (p. 398). Johnson-Laird (1983) also argues that the structure of mental models is identical to the structure of the state of affairs (principle of identity), whether perceived or conceived that they represent.

Mental models are characterized by a certain structure and a certain content. The structure of the mental model, which represents the organization of concepts in memory, is assumed to follow a one-to-one mapping between the source and the representations but differs in terms of its complexity as related to the type of entities represented. In this sense, mental models may introduce a minimal analogical structure, such as the use of separate elements to stand for different objects, or may introduce increasing complexity, such as modeling spatial layouts in two or three dimensions, dynamism and sequence of events, and multidimensionality. As to the content, it is highly specific in that mental models refer to specific instances. They are composed of tokens that represent objects and relations between them which can be static, spatial, temporal, or causal. They also include higher order properties and relations such as properties of properties and relations of relations.

From a human factors perspective, Rouse and Morris (1986) conceptualize mental models in terms of their functionality as: “Mental models are the mechanisms whereby humans are able to generate descriptions of system purpose and form, explanations of system functioning and observed system states, and predictions of future system state.” (p. 351). According to Rouse and Morris (1986) the construct of mental model was used in the human factors literature (i.e., the manual control literature) before its emergence in the cognitive sciences (i.e., psychology and computer information sciences). The human factors approach relies on normative models to answer questions regarding how the systems should be designed such that it facilitates the work of the operator. Thus, in the manual control research, mental models are used as assumptions regarding underlying mental representations that allow calculations of expected control performance. The cognitive sciences, on the other hand, treat the construct from an explanatory framework, focusing on their role for human reasoning in understanding how systems work (i.e., cause-effect relationships). Explanations include the use of multiple models to deal with unfamiliar situations and analogical or metaphorical reasoning.

On a different note, combining the cognitive psychology and the human factors literature, Wilson and Rutherford (1989) conceptualize a mental model as: “a representation formed by a user of a system and/or task, based on previous experience as well as current observation, which provides most (if not all) of their subsequent system understanding and consequently dictates the level of task performance” (p. 619). Their conceptualization is more objective focusing on what a mental model represents than on its functions as is the focus in Rouse and Morris (1986). Wilson and Rutherford (1989) further qualify the notion of mental model by differentiating it from similar concepts of schema, scripts, and scenarios (Schank & Abelson, 1975; Bartlett, 1932).

Scenarios or scripts refer to knowledge of what to do when engaged in certain activities or social situations. Schemas represent organized knowledge structures that represent stereotypical entities. They are formed of nodes that characterize the attributes of the entity organized hierarchically. The nodes are defined by default values which serve to characterize a configuration of situation stimuli. By activating a schema, people fill in the gaps in a certain situation where not all information is provided or available which supports making inferences. Schemas are active in that when the situation suggests a different configuration of stimuli than the schema, the schema can be changed or adjusted. The difference between schemas and mental models then is that while schemas are conceived as stable structures in long term memory which can be retrieved and used, mental models rely on past knowledge structures which they manipulate in a computationally dynamic manner (Rutherford & Wilson, 1989), which has also been termed "running a model". This enables people to represent causal relationships and sequences of relationships internally, enabling them to anticipate outcomes of certain actions or situation developments. Mental models are more manipulable knowledge structures than schemas, they allow for various transitions between states, and their values are easier to model than the default values in schemas.

According to the original conceptualization of mental models by Johnson-Laird (1983) mental models are also more specific than schemas, in that they refer to particular situations and cases, and more concrete than schemas, in that they incorporate different elements with various relationships among them. Mental models are considered internal images of objects, phenomena, and their relationships, therefore the terms mental model and internal representation can be used interchangeably. Mental models are either concrete representations or mental images of objects and relations (Rouse & Morris, 1986) or can be represented as abstract models of relations and system states.

The major difference between the treatment of the mental model concept in cognitive psychology and the human factors literature lies in the perspective towards the utility of the construct: whereas psychology takes an explanatory view, trying to understand the construct in terms of its usefulness for human reasoning and understanding, the human factors literature is concerned with the usefulness of the construct in terms of how they can aid operator work design. Thus, in the latter, there is less emphasis on the processes underlying the functionality of mental models and more on the objects or outcomes of using a mental model. Concretely, in order to plan the interaction with a system, the designer must be aware of the structural configuration of the system elements and their interactions.

In the team mental model (TMM) literature, the inception of the TMM construct is traced to its usage by Kleinman and Serfaty (1989) to explain performance differences between teams working under demanding situations (e.g., Cannon-Bowers, Salas, & Converse, 1993). Specifically, they investigated teams participating in a tactical decision-making simulation working under high workload conditions. They observed that teams that were more effective had effective situation management strategies, that is, they maintained open and flexible communication lines and were more attentive to the workload and performance of other members (Entin & Serfaty, 1999).

The authors reasoned that at the basis of this flexible behavior lies the development of team mental models that enable members to anticipate how the situation will evolve and other members' needs. These TMMs become particularly relevant in rapidly changing and demanding situations where information changes quickly and is ambiguous such that members can't rely entirely on the cues available to construct an understanding of the situation and potential developments and appropriate actions. Thus TMMs should be predicted in this conceptualization from less team overt communication during demanding situations. TMMs have garnered general interest from a number of domains in the past 15 years in fields as diverse as organizational psychology, human factors, information sciences, engineering, communication sciences, and sport (Mohammed, Ferzandi, & Hamilton, 2010).

Rouse, Cannon-Bowers, and Salas (1992) describe the TMM phenomenon in line with its conceptualization at the individual level as a mechanism describing the what, the how, and the why of a task activity. Rouse et al. (1992) differentiate between mental models and the explanations and expectations that they engender. The latter are outputs. Teams may be trained a set of general mental models that can aid their performance but cannot be trained to form explanations and expectation for any possible situation that they are likely to encounter. In this sense, proper training aids them to form mental models that support their potential to form explanations and expectations in a variety of domains.

Converse, Cannon-Bowers, and Salas (1991) provide an initial conceptualization of the TMM construct which they term shared mental model. They describe knowledge contents of TMMs as lower level contents nested within higher level categories: a higher level environment TMM, composed of a team TMM and a task TMM. They also introduce the notions of accuracy, which refers to how accurately the TMM reflects reality, and sharedness, which refers to how similar the mental models of team members are. They specify that a highly functional team requires both accurate and shared TMMs. Further, they assert that to be functional, TMMs must be specific and detailed, to allow the formation of specific inferences regarding the task changes and member needs.

The first theoretical account of TMMs was advanced in 1993 by Cannon-Bowers et al. They reviewed theoretical and empirical work on mental models and TMMs, conceptualized construct content, clarified issues such as content sharedness requirements and TMM form, and discussed the TMMs limitations and how they can be developed. They define TMMs as: "knowledge structures held by members of a team that enable them to form accurate explanations and expectations for the task, and, in turn, to coordinate their actions and adapt their behavior to demands of the task and other team members." (p. 228). They held that team members may hold different types of TMMs: equipment, task, team interaction, and team TMM.

The equipment TMM refers to equipment functioning and causes of equipment failures. The team interaction TMM provides information regarding each individual's function in the task and his contribution. Task TMMs permit members to reach the same conclusions with respect to task developments and thus form similar expectations regarding the use of strategies. Team TMMs enable members to adjust their behavior according to the characteristics of other members serving the fluency of their common work. As to the exact contents that need to be shared, they depend on the specifics of each task. As to the exact form of sharing, Canon-Bowers et al. (1993) argue that it is not relevant whether members hold similar or identical representation or simply compatible representations as long as these serve them to develop similar expectations regarding their performance.

As Rouse et al. (1992), they note that given the multifarious and complex nature of real world performance, it is impossible to train members to develop TMMs of every aspect that they will encounter in task situations. But they should be trained into the mechanism that will offer potential to develop flexibly and quickly accurate task expectations. Importantly, the authors address the need for a balance between mental model sharedness and unicity of the members' contributions—mental models that overlap to a little extent can impair team coordination and reduce their capability to deal with changing task requirements; but mental models that overlap to a large extent can reduce creativity and lead to excessive conformity or groupthink.

Klimoski and Mohammed (1994) advance a theoretical framework in which they try to differentiate the construct from other similar constructs and to establish whether it has a role of its own or the potential effects can be better accounted by other constructs. They titled their work—"Team mental model: Construct or metaphor?". They defined TMMs as "organized mental representations of the key elements within a team's relevant environment that are shared across team members" (Mohammed et al., 2010, p. 2).

In another review of the TMM construct, Kraiger and Wenzel (1997) further refine the conceptualization by modeling TMMs determinants and outcomes and by proposing a method to assess it. They define TMMs as "a shared knowledge about the team and its objectives, as well as common information about team roles, behavior patterns, and interaction patterns." (p. 66). According to their framework, TMMs facilitate information processing, structuring knowledge, the development of common attitudes, and shared expectations. They enrich the conceptualization of TMMs by providing a framework of antecedents and outcomes.

Among the antecedents, at the organizational level they specify: culture, reward systems, and training; at the team level: task characteristics, process characteristics, team composition, and shared efficacy; at the individual level: motivation and personality variables. As to the outcomes, they define broadly team performance as consisting of team process variables—decision making and communication, problem definition, strategy definition, strategy selection, and implementation—and team effectiveness. They propose the use of structural assessment based on relatedness ratings and similarity indexed through pairwise similarity coefficients as a useful procedure to assess the structure of TMMs. They extend this measure from the individual level, where it has been used as a measure of knowledge predicting post-training performance and classroom performance.

Klimoski and Mohammed (1994) state that "There can be (and probably would be) multiple mental models co-existing among team members at a given point in time." (p. 432). To be more specific, along different conceptualizations the following TMMs contents have been emphasized: equipment, task, and team (Rouse et al., 1992); external environment, team environment (teammates behaviors, abilities, general characteristics; team task—goal, relationships between team actions and success; task structure—task links, the interdependence and redundancy of various tasks and the command and decision hierarchies; individual task—own task; teammates' tasks—action plans, procedures, temporal knowledge about actions and behaviors; equipment) (Converse et al., 1991); equipment—equipment limitations, likely failures; task—task procedures, likely contingencies, task strategies, environmental constraints; team interaction—roles and responsibilities, information sources, interaction patterns, communication channels, role interdependencies; team—teammates' knowledge, skills, abilities, and preferences

(Cannon-Bowers et al., 1993); nature of tools/technology, team task, problems faced by the team, members' knowledge, skills, and abilities, patterns of member interaction, events and projected future states, beliefs, assumptions, perceptions (Klimoski & Mohammed, 1994); task, team, situation, work relationships, beliefs (Mohammed & Dumville, 2001); procedural, declarative, and strategic knowledge (Converse & Kahler, 1992); knowledge, behavior, attitudes (collective orientation, collective efficacy), perceptions, expectations (about behaviors, responsibilities, mentoring activities, decision making) (Kraiger & Wenzel, 1997); processes, representations of other team members, characteristics of the individual task (Langan-Fox, Code, & Langfield-Smith, 2000); taskwork (work goals and performance requirements), teamwork (teammate preferences, skills, and habits), types of knowledge—declarative, procedural, strategic, shared, evaluative beliefs (Mohammed et al., 2010).

To summarize this literature on TMMs, teams are formed to solve various types of tasks and problems. Some of the tasks that the teams work on can be better defined, having clear goals and task accomplishment requirements. Other tasks are less well defined, the teams have to actively define the requirements and their goals for performance. When the teams form, the members bring with them past experiences and knowledge as well as an incipient understanding of what the task is about (i.e., meaning of the task terms, goals, strategies to achieve goals, procedures to work on the task), how the team members should be working together towards the accomplishment of the task (i.e., role and distribution responsibilities, communication and interaction), and what the defining characteristics of the team members relevant for the task are (i.e., knowledge, skills, abilities, and preferences relevant for work on the task).

These inchoate understandings are termed mental models and they refer to task, team interaction, and team member related knowledge. As the teams starts to define the task and the team interaction requirements, and as they start to develop a more complete image of the other members, these understanding become more complete and they give rise to team level mental models. Team level mental models or TMMs are collective understandings, shared among the members about performance relevant aspects. TMMs form around a certain task and may be more or less specific to a team, which differentiates them from other forms of collective knowledge that are formed for example around social issues such as society or family level mental models. As such, the task becomes the most relevant aspect that dictates the formation of specific mental models.

Team mental models can be described on a continuum where at one end members have highly shared or similar mental models in that they consider the same goals, strategies, and procedures to work on the task as effective. For example, a medical team composed of a doctor, nurse, and anesthesiologist hold the same mental model related to their goal of treating the patient. Moving towards moderate similarity members can have partially overlapping mental models where each member has a partially similar understanding on the task and an unshared understanding corresponds to the view based on their task role or previous experiences. In a task force tasked with the resolution of certain organizational problems for example, some members may view the goal for performance from partially similar perspectives, due to their previous experiences and knowledge or their role in the company.

At the other end of the continuum, we find dissimilar mental models. Dissimilar TMMs can be represented through two typologies—first, members can form a dissimilar TMM when each member brings to the team a mental model as corresponds to his task role. For example, in a medical team, the doctor will bring a mental model, the nurse a mental model, and the anesthesiologist another mental as corresponds to their role on the job and together their mental models will define the TMM. Second, members can form dissimilar TMMs when each member has a different vision on their team's goals, procedures, strategies, and on their interaction and communication structure. For example, in a top management team, one manager may consider specific strategies to reach a goal while another manager may consider different strategies or even different goals. These differences will become relevant when I discuss the theoretical framework of this dissertation.

In their review on the role of TMMs for design teams, Badke-Schaub, Neumann, Lauche, and Mohammed (2007) emphasize the necessity to consider TMM similarity as being a domain-specific requirement. They differentiate between tactical teams that perform proceduralized, directed tasks, with high role and task clarity and strictly defined standard operating procedures, and creative teams with less clearly defined roles, with ambiguous tasks and large autonomy in solving their tasks, requiring high degrees of exploration and openness to uncertainty. They discuss that a higher divergence of TMMs at the beginning of a task is likely to aid design teams' project development. As to the need for TMM similarity the authors argue that teams that perform highly coordinated work in demanding situations may benefit TMM sharedness whereas teams that perform creative tasks with larger individual discretion may benefit more from divergent TMMs.

1.2. Overview of the chapters

In this work, I focus in particular on the role of dissimilar TMMs for the performance of teams that face different changes throughout their work in line with an emphasis on team adaptation. I focus on the dissimilar end of the TMMs continuum because as argued in this dissertation, their role should be more salient for situations that require the production of novelties or the adaptation to different work events. However, I go beyond a limited focus on a specific construct and its role in a specific context. In the first chapter of this dissertation, I derive and explain an environment-cognition fit hypothesis. In deriving this hypothesis, I integrate previous work by detailing a typology of environments, a typology of TMMs types on a similarity continuum, and their reciprocal relationships. This addresses the lack of integration in previous work on the relationship between team cognition and team contexts.

Specifically, I relate the performance environment dimensions of complexity, coupling, and path/goal structure with the TMMs characteristics of similarity, accuracy, and complexity and describe how the fit between the environmental dimensions and the TMMs types influences performance contingent on the degree of dynamism in the environment. This chapter organizes previous knowledge around a set of common components which can become useful for future hypotheses derivation and testing in the area of team adaptation and team cognition. In addition to advancing these theoretical propositions, I conducted and report three studies that assess the relationship between TMMs and the team performance.

In a first study, I drew on team adaptation and individual problem solving models in proposing that dissimilar TMMs are relevant for the adaptation of teams that face changes throughout their work. Changing situations are often ambiguous, ill-structured, ill-defined, and uncertain. This requires that team members are able to generate a variety of strategies, to define multiple goals, and to define multiple solutions in order to adapt to changing situations. This requirement for perspective diversity is likely to be more salient at early stages of problem solving when the teams have not yet defined the space of the ill-defined task. Later, however, when the team strives to implement the derived strategies, a higher similarity of perspectives may be necessary because it enables members to focus on one goal and action plan and to coordinate efficiently. To be more concrete I advanced that during the situation assessment phase of adaptation, when the team collects information about the changed situation, more dissimilar TMMs should have a positive effect on performance but that during solution implementation, when members must pool their perspectives to construct a coherent action plan, more similar perspectives should have a positive effect on performance.

I focused in this study on team and task TMMs as determinants of performance. To test the hypotheses, I conducted an experiment on a sample of 39 teams ($N = 117$) in which I manipulated changes, by introducing change throughout the work of half of the groups, and group composition, by forming 18 similar and 21 dissimilar teams. The dissimilar teams were formed of one member with an educational background in psychology, one member with a background in economics, and one member with a background in educational science. The similar teams were composed of three members with the same educational background, specifically psychology, economics, or educational sciences. In this study, the independent variables were initial TMMs similarity and TMMs convergence. The dependent variable was performance. The moderator of the effect of initial TMMs similarity on performance was situational change. The directed hypotheses were that TMMs similarity will have a negative effect on the performance of teams that faced changes and that TMMs convergence will have a positive effect on team performance.

Consistent with the hypotheses, I found that task TMMs similarity had a negative effect on the performance of teams that faced changes. I found however less support for the prediction that later convergence of TMMs will have a positive effect on performance, which I discuss in the future chapters. This study contributed to the literature on team adaptation and team cognition by showing that adaptation must be considered as a process and the role of supportive mechanisms such as team mental models must be considered with this process view. This may aid future researchers in building models including the role of team mental models for different stages of adaptation or may generate additional research on the relevance of the TMMs divergence-convergence mechanism for team adaptation.

In the second study, I explored the perspective on adaptation as long term adaptive performance or performance transfer. There are two perspectives on adaptation, a short term perspective as punctuated change experienced during the work on a task and a long term perspective as performance considered over multiple tasks. The second view is important because it offers insight into the mechanisms that enhance team performance for the longer term. It is however less explored. Therefore, in this study I undertook this exploration by looking at the role of an intervention aimed at producing long term performance benefits, task variation, and at the role of TMMs for long term performance benefits. Specifically, I looked at the development of TMMs in a context of task variation and on the role of the TMMs developed during the varied task for future team performance. In this study, members worked initially on a varied task and then on a new more complex task. Varied tasks represent tasks in which the task conditions or task requirements change during the task performance.

Varied tasks have been advanced in the individual expertise literature as having a positive effect on novel task performance. Task variation is assumed to contribute to these outcomes because the variations experienced induce the learners to explore the task which should lead to better understanding of the task's fundamental principles and better information processing on a future task. Critically, though, the research on individual expertise advances that these outcomes will be achieved only if the learner, individual or team, is able to develop comprehensive and diverse understandings of the varied task situation which corresponds to the development of TMMs.

In this context, therefore, I tested the hypothesis that the effects of task variation on novel task performance will be moderated positively by the development of TMMs during the varied task. I focused on two TMMs characteristics which have been emphasized in work at the individual level to determine the extent to which task variation will prove effective for obtaining adaptive outcomes—TMMs complexity and TMMs divergence. TMMs divergence corresponds to the development of more dissimilar TMMs during the work on the varied task. TMMs complexity refers to the number of task dimensions and their interaction that members are able to represent in their mental models during the work on the varied task.

I advanced that the development of more complex and more divergent TMMs during the work on the varied task should moderate positively the effects of task variation on future performance. I tested these predictions in an experimental study with 26 teams ($N = 69$) in which I manipulated task variation by introducing changes throughout the work of half of the groups. The experiment was realized in two phases—in a first phase, members worked on the initial varied task and in a second phase, two days following the first phase, they worked on the second, more complex task. In this study, task variation represented the independent variable and mental models complexity and similarity were the moderators of the effect of task variation on future task performance, the dependent variable.

Contrary to previous literature, I did not find that task variation led to increased team performance. This may be due to the complexity of the task investigated in comparison with previous studies that focused on more basic problem solving tasks. In line with predictions, however, I found that the effects of task variation on future performance were moderated by the mental models developed by teams. This suggests that more complex mechanisms are at play in determining the effect of task variation on performance transfer. Specifically, I found that the development of more similar TMMs leads to higher future performance novelty and that the development of more similar and more complex TMMs leads to higher future performance efficiency.

This study contributes to the literature by showing that TMMs can be considered a dynamic capability and that their role should be assessed across time and across contexts in order to derive accurate predictions. Previous literature takes a more static stance and focuses only on limited contexts, which restricts the explanatory breadth of the construct. It also points to the relevance of considering different TMMs characteristics as relevant for performance, encouraging future work to draw on the breadth of the construct as represented in other domains, for example the individual expertise literature, in drawing inferences regarding its influence. The main conclusion to be drawn is that mechanisms that work at the individual level may not generalize to the team level. Future studies could further explore these differences helping to determine more exact models of team adaptive performance. Also, continuing the path opened by this study, multilevel models can be constructed to compare individual and team level relationships.

In the third study, I continue the line of research on the role of TMMs for obtaining different performance outcomes by investigating interdisciplinary teams in the field using survey research. Specifically, I investigate the role of TMMs for work in interdisciplinary novel project development student teams. In this work, I wanted to know whether interdisciplinary teams develop more similar or more dissimilar TMMs contents, on which contents are more dissimilar or more similar TMMs benefiting performance, and whether there are mechanisms that translate the effects of TMMs on performance, such as coordination. I focused on the following TMMs contents, which refer to knowledge regarding different team aspects that are relevant for work in a specific domain: goal, interaction, and procedural TMMs content.

Complementing the first study's findings, in this study I aimed to understand better the development of TMMs over time by proposing a model of how different TMMs contents converge over time in project teams. This focus is relevant because although TMMs have been placed as central determinants or performance, only few previous studies have focused on the development of TMMs and most have done so in particular contexts with a view to understanding whether TMMs structure becomes more similar over time. To determine how the TMMs development affects project team performance, we need thus to conduct more extensive explorations. This study complements previous work by focusing on TMMs content and by expanding knowledge of TMMs development for project teams.

In addition, originally TMMs have been proposed to influence performance indirectly via their effect on team implicit coordination which represents a tacit understanding of the members' needs and of situation developments. This hypothesis has though been explored empirically in only one study (Fisher, Bell, Dierdorff, & Belohlav, 2012). Therefore, more tests are needed to determine whether the mechanism holds across settings. The study was conducted on a sample of 14 interdisciplinary teams within a four-month course on product development. The independent variables were represented by TMMs convergence and implicit coordination and the dependent variables were performance usefulness, market potential, and novelty. The variables were measured in three distinct waves of data collection, at the beginning of teams' project work, when TMMs were assessed, at the midpoint of work when TMMs were again assessed, and towards the end of work, when coordination was assessed.

The results of this study supported the hypothesis that TMMs content convergence, which reflects increase in TMMs similarity from earlier to later stages of project development, would be positively related with performance. These results were confirmed for goal TMMs convergence but not for procedural TMM convergence, which had a negative effect on performance. The results suggest that implicit coordination is a potential mediator of the relationship between performance novelty and goals TMMs convergence but not between performance market potential and goals TMMs convergence. This study contributes to the literature by demonstrating that TMMs have a complex role for performance which is revealed when they are assessed within a developmental framework and with the view to capturing multiple TMMs content convergence.

In line with the study one findings, it shows that a focus on temporal dynamics can do much to bring the TMMs literature forward as opposed to focusing on static TMMs representation. Further, by investigating implicit coordination it contributes to the development of more comprehensive explanatory models on the TMMs role.

In the following, I report the three studies that have been described above. The studies are conducted in relation with the theoretical framework that I developed. First, I present the theoretical framework that lies at the basis of this work.

Chapter 1 - The Environment-Cognition Fit Perspective in Determining Team Adaptive Performance

Organizations meet increasingly complex and dynamic environments to which they are required to adapt if they are to survive and to be effective for the long term. The requirement to meet environmental demands spirals down across organizational levels, from the organization to the team to the individual. Much work conducted in today's organizations is team based. Teams are called upon to solve complex problems and to deal with increasing levels of change in their work environment. To understand differences between teams that are more and those that are less effective in adapting to changing demands, a new field of inquiry has emerged—team adaptation research. Team adaptation research focuses on the investigation of the factors and processes that underlie the realization of a fit between the environmental demands and the team capabilities for managing these demands. Although diversely conceptualized (Burke, Stagl, Salas, Pierce, & Kendall, 2006; Maynard, Kennedy, & Sommer, 2015), team adaptation refers to the process of issuing a cognitive or behavioral goal-directed response to novel events or changing situations.

Two central tenets underlie team adaptation research. The first states that in order to adapt effectively teams must understand and be able to interpret the meanings of the changes they are experiencing in light of their current and past circumstances. The second tenet states that teams must be able to issue the appropriate responses to meet novel challenges. As such, team adaptation assumes that teams must master cognitive and behavioral capabilities that support their resolution of novel or unexpected events (Fiol & Lyles, 1985). Researchers have consistently paid attention to these pathways in detailing theoretical and empirical models for the explanation and prediction of team adaptation. There are, however, three issues that limit our knowledge of team adaptation and that deserve further attention and development.

First, within this stream of team adaptation, much emphasis has been placed on the behavioral pathway with a view to understanding the role of team processes such as communication, coordination, feedback, and backup for team adaptation. Much less emphasis has been placed on understanding the role of the cognitive factors. Cognitive factors underlie the successful behavioral responses to demands (Burke et al., 2006). They describe the team's ability to understand, make sense of events, construct alternative interpretations, and derive in light of these understandings appropriate responses.

A recent theoretical integration of team adaptation (Burke et al., 2006) places the cognitive factors at the basis of successful adaptation to the environment. Cognition provides the contents to recognize cues related to performance problems, to assign meaning to those cues, it aids plan formulation to overcome events and plan execution by providing the general image of what is happening and how the situation will develop. Despite this theoretical work there is less empirical attention devoted to understanding the role of team cognition for team adaptation. At the organizational level, cognition has been tied to the interpretation of crises, to developing strategic responses to crises, to aiding the creation of new meanings when unexpected events are encountered. This aids the organization's sensemaking efforts and future strategy making and therefore cognition becomes critical in the face of the unexpected. Similarly, at the team level, cognition provides a frame within which to consider events and based on which to construct meanings and take action. More attention to the role that cognition plays for team adaptation is therefore warranted. This would help us build more comprehensive models to guide adaptation attempts.

Second, while much empirical work has been conducted on team adaptation in the past two decades, most of this work is limited to a specific performance environment—fast paced environments that place great demands on behavioral adaptation. For instance, researchers have investigated military teams, medical teams, power plant crews, aircrews, and sport teams (e.g., Kanki, Folk, & Irwin, 1991; LePine, 2005; Burtscher & Manser, 2012; Porter, Webb, & Gogus, 2010; Ramos-Villagrasa, Navarro, García-Izquierdo, 2012; Stachowski, Kaplan, & Waller, 2009; Waller, 1999; Waller, Gupta, & Giambatista, 2004). But there is much less research on adaptation in other environments, those in which for example project teams, product development teams, and task groups are likely to conduct their work. For these models of adaptation to be truly informative, a general scheme is needed to classify the types of environments that teams encounter and how these are related with team adaptation and team cognition. For instance, what are the general features of the tasks performed by action oriented teams and can these be generalized into an overarching framework of task environments?

I advance that environments can be defined in terms of several characteristics and that such a generalization may aid researchers in developing models of team adaptation on more specific grounds. To foreshadow the next sections, a team's task can be composed of one or multiple dimensions, these dimensions can interact or have independent effects, and they can be more or less related. The relationships between the dimensions may also change over time and they may be characterized by more complex structures such as multiplicity of goals and paths toward their achievement. Such a broader classification of the team environment, drawing on a set of common elements would enable researchers to categorize the task environment and to tie it to certain cognitive and behavioral factors, as it is advanced in this work. This would circumvent the proliferation of a multitude of team taxonomies and instead would focus only on the core elements of the task environment that are salient across contexts.

Third, adaptation has been generally construed as a response to a salient change in the team's environment (Burke et al., 2006, Gersick & Hackman, 1990). While there are different types of changes that have been addressed in the empirical literature, such as team structure changes, nonroutine events, communication breakdowns, or membership changes (Hollenbeck, Humphrey, Garza, & Ilgen, 2011; LePine, 2003, 2005; Sander, van Doorn, van der Pal, & Zijlstra, 2015; Waller et al., 2004), there is no overarching framework meant to organize these around a common set of characteristics. Maynard et al. (2015) provide an initial categorization, but their review is broadly focused and describes the changes or "adaptation triggers" only in relation with behavioral adaptation. Therefore, another aim of this work is to define the changes characteristics and content.

To summarize the discussion so far, there are three restrictions on our knowledge of team adaptation. First, we know much about team adaptive behavioral processes and their role for adaptation but little about the role of cognitive factors. Second, we know much about team adaptation in environments characterized by fast paced changing demands but little about adaptation with respect to other types of environments and environmental demands. Third, knowledge has accumulated on team adaptation to different types of changes. There is, however, no general framework to guide our understanding of how different types of changes affect behavior and cognition as a function of the contexts in which the teams operate. This implies that, if anything, we can draw our predictions about team adaptation and generalize within this limited purview.

Thus, in this work I aim to address the first two limitations by providing a more general overview of the relationship between team cognitive adaptation and the team environment. By environment in this work, I refer to the task and team context, and the larger organizational context. The environment has been considered a fundamental factor for organizational adaptation

(Burns & Stalker, 1961; Gallbraith, 1973; Lawrence & Lorsch, 1967; Thompson, 1967). As open systems, teams are at the boundary between organizations and their environment and they engage, therefore, in extensive transactions with their environment (Kozlowski & Bell, 2003). Different environments place different demands on team growth, learning, and adaptation. While there are reviews considering the role of the task and team type for team effectiveness (e.g., Cohen & Bailey, 1997; Sundstrom, McIntyre, Halfhill, & Richards, 2000; Wildman, Thayer, Rosen, Salas, Mathieu, & Rayne, 2012), so far there has been no systematic effort to derive a general typology of environments that can make more clear the effects of cognition and behavior for adaptation. There is a need thus for a more general framework to guide research and theoretical efforts. I approach this task by deriving a contingent model of environment-cognition fit.

Environments have a specific structure consisting of a number of dimensions, grouping of dimensions, and relationships among the dimensions (e.g., Duncan, 1972). The environment-cognition fit hypothesis derived in this paper assumes that adaptive teams develop cognitive structures that reflect the structure of their environments. I focus on the cognitive pathway because cognition provides a framework for interpreting and understanding events. It has been adduced as one of the most relevant factors influencing organizational and individual adaptation through concepts such as sense-making and organizational cognition (Weick, 1969; Walsh, 1995). At the organizational level in particular the relevance of cognition for making sense of environment, overcoming challenges, dealing with competitors, and generally adaptation and survival is emphasized (Bogner & Barr, 2002; Nadkarni & Narayanan, 2007).

The lack of research on the role of cognition within different team adaptation contexts provides an opportunity to create a new orientation within the research stream of team adaptation. To be more specific, this paper aims to provide a general description of team environments whose characteristics can be related to certain requirements for cognitive and behavioral adjustment. The reviews so far have worked within more narrow frames where the role of the environment is lost in different task and team typologies. But providing a more general framework enables to more clearly relate the characteristics of the environment with the characteristics of team cognition and behavior. This should provide future researchers a roadmap for categorizing tasks according to general categories and to derive thus the requirements for team cognition development and behavioral strategy development in an adaptation context.

To address the third issue, I detail a typology of changes and their relationships with behavior and cognition complementing previous efforts that have focused on detailing the effect of changes on the behavioral component of adaptation (Maynard et al., 2015). This extension aims to provide a more comprehensive view for researchers pursuing investigations within the domain of team adaptation. A general typology of the changes that teams are likely to experience could aid further future research by systemizing efforts around a common framework.

In the following, I detail the team cognitive construct on which I focus in this work, team mental models (TMMs, Cannon-Bowers et al., 993), which represent teams' collective understanding of their task environment. I focus on TMMs because these have been placed at the core of team adaptation in different frameworks (e.g., Burke et al., 2006; Rosen, Bedwell, Wildman, Fritzsche, Salas, & Burke, 2011) and have also drawn recent empirical attention (Marks, Zaccaro, & Mathieu, 2000; Randall, Resick, & DeChurch, 2011). Furthermore, unlike other cognitive constructs (e.g., group learning, Argote, Gruenfeld, & Naquin, 2001), TMMs are constructs that reflect both the content and the structure of cognition which affords the derivation of the environment-cognition fit hypothesis (Mohammed, Ferzandi, & Hamilton, 2010). Following the TMMs exposition, I discuss the environment-cognition fit hypothesis. In the second part of the paper, I discuss the changes typology defined based on previous literature and relate the changes with behavioral and cognitive adaptation.

1. The role of cognition—Team mental models

Team adaptation is a process by which the team adjusts its mechanisms in response to a factor that disturbs its equilibrium. At the core, team adaptation process represents a problem solving process by which the team attempts to reach a goal state from an initial problem state by applying a series of operators (Newell & Simon, 1972; Simon, 1977). The problem solving literature distinguishes between two approaches to solve a problem, also known as the dual space hypothesis (Klahr & Dunbar, 1988; Simon & Lea, 1974): a behavioral approach and a cognitive approach. The behavioral approach assumes that the problem solver will traverse the problem space by engaging in an active process of developing and testing goal achievement strategies. The cognitive approach assumes that the problem solver first derives one or several mental representations of the problem space and that based on these representations he develops and tests goal achievement strategies.

As opposed to the behavioral approach, the cognitive approach affords indirect testing of hypotheses, the consideration of multiple strategic alternatives, and distant search for alternative strategies by broad sampling and exploration of the problem space (Gavetti & Levinthal, 2000). In mental search, problem solvers can compare, contrast, analyze, and combine hypotheses to derive complex behavioral responses (e.g., Spiro, Vispoel, Schmitz, Samarapungavan, Boerger, Britton, & Glynn, 1987). In behavioral search, they have to verify the accuracy of their hypothesizing by actual hypothesis testing and by observing the results of the experiments conducted (Klahr & Dunbar, 1988; Simon & Lea, 1974). The behavioral approach is therefore costlier and less flexible than the cognitive approach (Frenken, Marengo, & Valente, 1999; Gavetti & Levinthal, 2000; Marengo, Dosi, Legrenzi, & Pasquali, 2000). The cognitive approach also corresponds to the development of mental models about the problem, task, situation, or environment (Johnson-Laird, 1983; Rouse & Morris, 1986).

Mental models reflect the individual's comprehension of the underlying dimensions and the causal structure of a task (Gentner & Gentner, 1983; Gick & Holyoak, 1983). Mental models are used to represent environments, to construct hypotheses, and to direct future action efforts (Rouse & Morris, 1986). At the team level, team mental modes (TMMs) represent a form of structured knowledge shared by members of a team which enables them to describe, explain, and predict team and task events (Cannon-Bowers et al., 1993; Klimoski & Mohammed, 1994). The main characteristics of TMMs explored in the literature are TMMs similarity and TMMs accuracy. TMMs similarity refers to a similar understanding among the team members of the relationships among different dimensions of their task, team, team interaction, and environment (Cannon-Bowers & Salas, 2001; Mohammed, Klimoski, & Rentsch, 2000).

This means that members that join a team, by virtue of similar experiences and knowledge or similar prior training, begin to see different aspects related to their task in a similar way. For example, a basketball team will have a similar vision on what the task represents, on the procedures to work on the task, on the task goals and strategies, and on the team interaction and knowledge of the other members' task relevant skills and abilities. TMMs accuracy refers to the extent to which members' mental models describe the true state of reality as described by the underlying task and environmental dimensions and their relationships (e.g., Edwards, Day, Arthur, & Bell, 2006). For example, a medical team preparing to conduct a surgical procedure has an accurate vision of the steps that must be performed to obtain a successful outcome.

Other characteristics of TMMs have also been considered in the TMMs literature such as TMMs centrality and TMMs complexity (Rentsch, Small, & Hanges, 2007) but these are scarcely investigated by authors. TMMs centrality refers to the extent to which the teams' TMMs are centered on a few concepts that integrate their understanding (Rentsch et al., 2007). TMMs complexity refers to the number of task dimensions and relationships among the dimensions represented in the teams' TMMs (e.g., Carley, 1997; Nadkarni & Narayanan, 2005).

1.1. TMMs similarity

In this work, I will refer to the role of TMMs similarity as the most frequently assessed TMMs characteristic (DeChurch & Mesmer-Magnus, 2010b; Mohammed et al., 2010), while also mentioning TMMs accuracy and complexity where relevant. At least one review and two recent meta-analyses point to the importance of TMMs similarity for outcomes such as team communication and coordination, decision effectiveness, strategy making, and performance (DeChurch & Mesmer-Magnus, 2010a,b; Mohammed et al., 2010) therefore it represents the most salient characteristic of TMM in the literature. TMMs similarity can be represented on a continuum where at one end of the continuum members hold highly similar TMMs whereas at the other end of the continuum members hold highly dissimilar TMMs (Cooke, Salas, Kiekel, & Bell, 2004). Similar TMMs refer to members holding a similar view on their task, team, team interaction, and environment (Cannon-Bowers et al., 1993; Converse, Cannon-Bowers, & Salas, 1991; Rouse, Cannon-Bowers, & Salas, 1992). Dissimilar TMMs can be represented through two different configurations.

On one hand, members may hold dissimilar TMMs when they focus on different aspects of the task that are complementary with the aspects on which the other members focus (Rentsch et al., 2007). This TMMs configuration is termed complementary or distributed TMMs. On the other hand, members may form dissimilar TMMs when they represent differently the same aspects of the task (Badke-Schaub et al., 2007). In this case, for instance, two members may envision different strategies to reach the same goal, they may assign different meanings to task terms, or they may regard different procedures to accomplish a task. Complementary TMMs are more relevant in teams with specialized knowledge, clear role differentiation, and clear division of labor and structure (Langan-Fox, 2005). Common or similar TMMs are more relevant in teams where interaction and communication are high, the task is unstructured, and the team roles and task distributions are not clearly defined. Dissimilar TMMs are more relevant for teams that work on ill-defined or creative tasks that require diverse approaches and understandings (Badke-Schaub et al., 2007). Usually in referring to the TMM construct, researchers have tended to implicitly use the sense of similar TMMs, without reference to complementary of dissimilar TMMs (DeChurch & Mesmer-Magnus, 2010a). The similar, dissimilar, and complementary TMMs represent TMMs types to which I will refer in the environment-cognition fit hypothesis.

1.2. TMMs content

In regards to TMMs content, Cannon-Bowers at al. (1993) initially distinguished between four TMMs contents: equipment, task, team interaction, and team TMMs. The equipment TMM, which has not been often investigated, refers to equipment functioning, operating procedures, equipment limitations, and likely failures. The task TMM refers to task procedures, likely contingencies, task strategies, and environmental constraints. The team interaction TMM refers to roles or responsibilities, information sources, interaction patterns, communication channels, and role interdependencies. The team TMM refers to knowledge of the teammates' knowledge, skills, abilities, preferences, and tendencies relevant for the task. Later, Mathieu, Heffner, Goodwin, Salas, & Cannon-Bower (2000) recast these contents into a task mental model which consists of task and equipment related features and team mental model which consists of team interaction and team related features. Converse and Kahler (1992) further distinguish among TMM knowledge contents, declarative (facts, concepts, rules in a domain, and interrelationships among these), procedural (sequence, order of tasks, and timing of task and teamwork), and strategic (goals, priorities, action constraints, contingencies, restrictions, resources, plans or strategies to achieve the task in a given context). In line with previous literature, in this work I will focus on the following TMMs contents: task, team, team interaction, procedural, and strategic TMMs (e.g., Cooke et al., 2001; Marks et al., 2000; Banks & Millward, 2001; Randall et al., 2011).

With respect to empirical findings, diverse empirical support exists for the relevance of TMMs for team performance and effectiveness (DeChurch & Mesmer-Magnus, 2010b; Mohammed et al., 2010). The TMMs contents and TMMs characteristics of accuracy and similarity have been found to affect, directly or indirectly, independently or in statistical interaction outcomes such as communication, coordination, backup behavior, planning, performance quality and timeliness, and decision effectiveness (DeChurch & Mesmer-Magnus, 2010b).

There are few empirical studies that focus on the relationship between TMMs and team adaptive performance and their approach in treating these relationships is diverse. For instance, Marks et al. (2000) studied the relationship between TMMs similarity and accuracy and adaptive performance in novel task environments. They found that teams had higher performance when their TMMs were more similar and less accurate but similarity did not contribute much when they had accurate TMMs. Resick, Murase, Randall, and DeChurch (2010) observed how the team managed an unexpected critical event halfway through a simulated decision making task (disaster-earthquake striking city). They found that the interaction between TMM similarity and accuracy affected performance—when similarity was high, accuracy had no effect on adaptation, but when similarity was low, accuracy was strongly positively related to adaptation. Sander et al. (2015) found that task and team TMMs similarity did not relate to performance after a task change but that TMMs accuracy related to performance after the change. Other studies find a positive direct or indirect effect of TMMs on performance for teams encountering different types of changes (Ellis, 2006; Gorman, Cooke, & Amazeen, 2010; Resick et al., 2011; Stout, Cannon Bowers, Salas & Milanovic, 1999; Uitdewilligen, Waller, & Pitariu, 2013; Waller et al., 2004). In summary, the studies reviewed show that either TMMs similarity or TMMs accuracy is a relevant predictor of adaptation to changes or to novel task environments. But these investigations are also confined to a type of task environment, which precludes generalizations to other types of task environments. We do not know for instance whether these relationships hold for teams that conduct more knowledge oriented work such as project teams.

More specifically, these studies give us some insight into how cognition and adaptation are related in dynamic and structured environments. But, to truly understand the role of cognition, which encompasses TMMs and other team cognitive related constructs, for team adaptation, our purview must expand to incorporate awareness of different types of environments in which teams operate and to which they have to adapt. Further, the changes that teams may experience during an adaptive episode have been treated unsystematically, which does not enable us to determine the effect of specific changes on team cognition (Maynard et al., 2015). To provide a broader perspective and formalize these relationships, therefore in the following I take a contingency view and discuss the environment-cognition fit perspective in determining team adaptive performance.

2. The role of the task environment

The task environment will be discussed in terms of the structural contingency hypothesis.

In organizational sciences, the structural contingency refers to the relationships between the organizational structure or the organization's mode of organizing and the organization's environment. Early scholars have proposed that the best mode of organizing is represented by a top-down structure in which the management prescribes how work should be conducted. Other scholars have argued instead that the best way of organizing is decentralized in which the employees are free to take and implement initiatives. Later, the contingency approach offers a view that integrates both these modes of organizing by arguing that each of the two models is relevant for specific types of organizational environments. As such, the top down or mechanistic structure is more appropriate for organizations operating in environments with low degree of market and technological change. The bottom up or organic structure is more appropriate for organizations that operate in environments with high degree of market and technological change (Donaldson, 2001).

Thus, for early researchers, the rate of change in the organizational environment represented a contingency that determines the organization's mode of organizing and its performance. Other researchers have explored other contingencies such as organizational strategy, size, uncertainty, information processing demands, and technology. These characteristics reflect the influence of the environments in which the organization is embedded which implies that organizational effectiveness depends on the fit between the organization and its environment (e.g., Drazin & Van de Ven, 1985; Van de Ven & Drazin 1985).

Researchers have also defined a structural contingency theory at the team level, termed the structural adaptation theory. Research in this area shows that the fit between the team structure and environmental demands enhances adaptation and team performance (Beersma, Hollenbeck, Conlon, Humphrey, Moon, & Ilgen, 2009; DeRue, Hollenbeck, Johnson, Ilgen, & Jundt, 2008; Hollenbeck et al., 2011; Johnson, Hollenbeck, Humphrey, Ilgen, Jundt, & Meyer, 2006; Moon, Hollenbeck, Humphrey, Ilgen, West, Ellis, & Porter, 2004; Porter et al., 2010).

A particular type of contingency explored in organizational research is represented by the information processing contingency (Galbraith, 1973). This theory holds that higher task uncertainty will increase the information processing of the decision makers during the task to reach the optimal levels of performance. This implies that the information processing demands of the task must be matched with the information processing capabilities of the organization. The same arguments have been advanced for the individual and the team levels of analysis, where research shows that the fit between the cognitive structure and information processing capabilities and the complexity of the task environment increases individual and group performance (Schroder, Driver, & Streufert, 1967). More specifically, Schroder et al. (1967) found that groups and individuals with a higher integrative cognitive complexity (i.e., that were able to represent cognitively more dimensions of the environment in which they were working and more interactions among the dimensions) reached a higher performance in complex and dynamic environments than individuals and groups that had more simple cognitive structures.

In the TMMs literature, there have been different calls for determining the type of TMMs most appropriate for managing different types of environments, that is to develop a contingency perspective on the relationship between TMMs, the team environment, and team performance (Cannon-Bowers & Salas, 2001). While most research has focused on a type of environment where similar TMMs are likely to be necessary for team performance, the other types of TMMs on the continuum may also aid performance but it is not clear in what environments and in what situational conditions.

For example, most work focused on teams that work on standardized tasks in relatively dynamic environments where TMMs similarity has emerged as a positive predictor of diverse team outcomes. Some recent work suggests though that in work on ill-defined tasks such as project development and innovation work generally, TMMs that are more similar may not have necessarily a positive effect on team performance. This is because they provide a limited view on the task which does not aid combinatorial efforts toward creative outcomes (Schilling & Green, 2011). Other work suggests that teams composed of members with different roles may not need to hold similar TMMs but complementary TMMs such that they fill the gaps in each other's knowledge and provide an integrated view of the task (Cooke, Kiekel, Salas, Stout, Bowers, & Cannon-Bowers, 2003). The different types of TMMs on the similarity continuum have either been scarcely investigated or not investigated at all which prevents the development of an accurate view with respect to an environment-cognition contingency hypothesis.

Previous work greatly aids our understanding of the role of team cognition for diverse team processes and performance, but the limited frame within which it is conducted restricts the potential to derive more targeted and more informed predictions. Therefore, in this section, drawing on a broader literature, I will advance a model that ties different TMMs types on the continuum with different environmental configurations. I conceptualize the environment across multiple dimensions and I base the propositions derived here on work in strategic management, problem solving, and organizational adaptation. Literatures in organizational adaptation distinguish between three environmental characteristics: complexity, dynamism, and uncertainty (Aldrich, 1979; Child, 1972; Dess & Beard, 1984; Duncan, 1972; Emery & Trist, 1965; Lawrence & Lorsch, 1967; Levinthal, 1997; Terreberry, 1968; Thompson, 1967; Wholey & Brittain, 1989). Other research also emphasizes coupling (Orton & Weick, 1990). Accordingly, I characterize the environment in terms of four dimensions: the degree of complexity, the degree of coupling, the path/goal structure (i.e., environmental uncertainty), and the degree of dynamism or change. I review these in the following. Also note that starting with this section, the predictions advanced will be summarized in the form of propositions.

The framework presented in Figure 1 will guide the discussion.

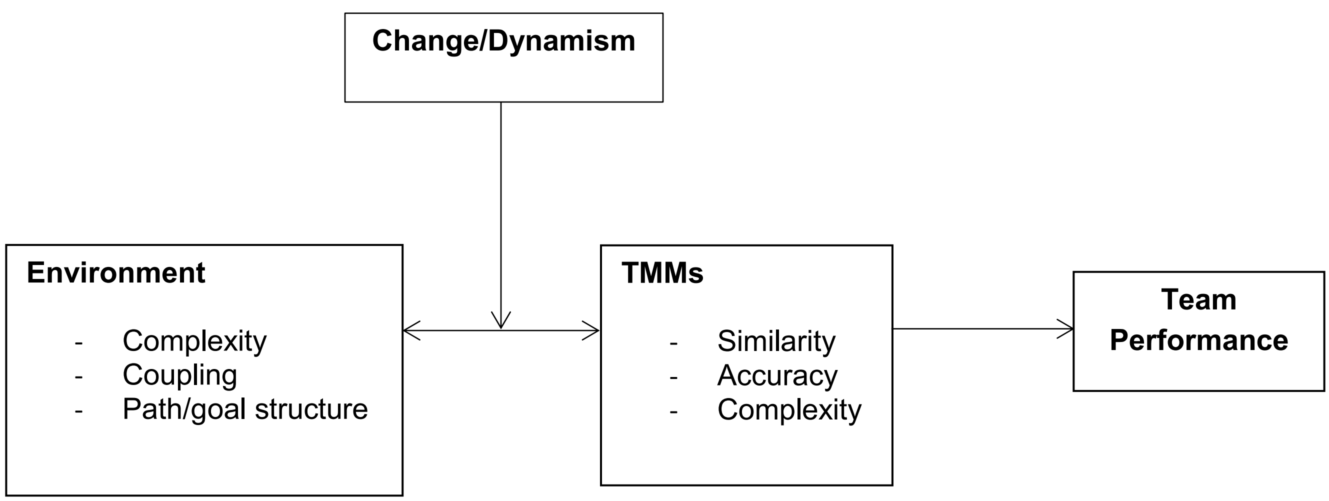

Figure 1. The relationship between the environment-cognition fit and team performance

2.1. Complexity

In the following sections, I will use the word system to describe tasks or task environments. According to Simon (1962) a complex system is "made up of a large number of parts that interact in nonsimple ways" (p. 468) where the whole is larger than the sum of the parts and cannot be recomposed by inferring the characteristics of the parts. Adopting this conceptualization, in this paper complexity refers to the number of system components and the interactions between these components. My discussion of complexity will be conducted in terms of Kauffmann's (1993) fitness landscape model. The model was developed in biology by Wright (1937) to capture the evolutionary dynamics of organisms according to the mapping of a set of genes on the phenotypes. In research on organizational adaptation, the system fitness represents the optimal match between the system configuration and the environmental demands. The model is sufficiently general to be applied across domains, and it has been used successfully for instance to explain organizational adaptation (e.g., Levinthal, 1997). I elected this model because it provides a frame within which to consider the relationship between cognition and the environmental structure (Gavetti & Levinthal, 2000).

The model describes the system as a landscape or configuration of landscapes, defined in terms of the number of environmental dimensions, N, and the interactions among those dimensions, K. The dimensions can be described in terms of whether they possess a certain characteristic or state or not, for example if the organization has decided to introduce an employee training program or not. K represents the number of interrelationships between the dimensions. These refer to the number of dimensions with which each dimension is related or on which it depends. In other words, K shows the extent to which the contribution of a dimension to the system fitness depends on the other dimensions as well. When $K = 0$ the elements are contributing independently to the system fitness and when $K = N – 1$ the contribution of each element depends on the contribution of each other element. When $K = 2$ for example, the contribution of the dimension will depend on its value and on the value of two other dimensions. For example, the decision to train or not to train individuals may depend on the values of other dimensions, such as opportunity to use skills and managerial support. In Thompson's (1967) terms, K describes the degree of interdependence among the dimensions.

Different levels of interactions among the system dimensions create different landscapes characterized by high and low peaks on the landscape. The high peaks represent optimal solutions matching the environmental demands, while the lower peaks represent suboptimal, local peaks, which match the demands of the environment only partially. When each decision contributes independently to the levels of system fitness, that is when the level of K is low, the decisions with respect to enhancing the fitness of the system are simple. That is, there is one global optimum that can be reached by changing the values of the dimensions independently. When the values of the contributions of some decisions depend on the values of other decisions or when the dimensions are interdependent, the landscape is more rugged or peaked. This implies that, according to the different values of the dimensions, different peaks may emerge, with different levels of fitness.

Adaptation on a rugged landscape becomes more difficult because organization, individual, or team may become trapped on suboptimal peaks, foregoing the exploration of the landscape in search of the optimum peak. Here cognition aids, because it allows the problem solvers to explore mentally decision configurations that cover a larger area of the space and eventually, depending on their capacities for representation, to choose the optimal one (Gavetti & Levinthal, 2000). Therefore, in this framework, a higher number of dimensions that interact (i.e., high N and high K) define a complex environment while a simple environment will be characterized by fewer dimensions and a low number of interactions among dimensions. In summary, the complexity of the environment describes the number of environmental dimensions and the interactions between these dimensions, with more complex environments being characterized by a higher number of interactive dimensions.

2.2. Coupling

As detailed in the complexity section, a system can be composed of one or more dimensions. The dimensions of a system may be more or less related with other dimensions (Weick, 1969). Dimensions that are more similar with each other may be grouped by levels of similarity in different system domains or modules. For example, a project development task may be formed of multiple dimensions but these are generally clustered into module A, project definition and module B, project implementation. These new subgroupings or modules can themselves be more or less related with each other. The degree to which the modules in which the system is organized are related, or the extent to which the modules A and B are related, is termed coupling. Systems with the same degree of interactions among the dimensions (i.e., K) may have different degrees of coupling among the modules leading to different patterns of coupling (Rivkin

& Siggelkow, 2007). The likelihood of grouping dimensions by similarity in subdomains or modules corresponds to the notion of decomposability, which states that systems have an underlying structure which makes them more or less decomposable.

Three levels of coupling can be distinguished: tightly coupled, loosely coupled, and uncoupled systems (e.g., Ethiraj, Levinthal, & Roy, 2008). In tightly coupled systems, the dimensions included in some modules share strong connections with dimensions in other modules. This makes the system as a whole less decomposable. In loosely coupled systems, dimensions in some modules share a moderate amount of connections with dimensions in other modules. Loose coupling ties with Simon's (1962) notion of near decomposability which refers to decomposing a complex system into subsystems, where the relationships within each subsystem are tighter than the relationships between subsystems (Sanchez & Mahoney, 1996). In uncoupled systems, the elements in different modules do not share common connections with elements in different modules; in other words, the functionality of the system modules is independent of other modules.

For example, consider a team working on the development of a project composed of multiple different tasks. In one structure, members divide their tasks according to how similar each task is with each other task. Then, they proceed to individually work on each module of tasks while keeping each other informed of their progress using specific rules and deadlines. This amounts to a loosely coupled system. In a second structure, the tasks are heterogeneous and interrelated, such that they cannot be decomposed into different modules to be processed separately by members. Instead, members work on the tasks simultaneously, reciprocally passing the outputs of each others' work to others. This amounts to a tightly coupled system. Third, the project can be perfectly decomposed into unrelated modules of tasks such that members need only to put the modules together when they finish the individual work to finalize the project. This amounts to an uncoupled system.

The grouping together of similar system elements and relationships and the elimination of unnecessary relationships has also been termed modularity. Modular systems contain nearly independent subsystems or modules which are connected via interfaces or specific rules (Baldwin & Clark, 2000). The objective of modularization is to simplify the underlying structure of the system by decomposing the system into similar modules based on their similarity and the relationships among them. Decomposition is necessary because as systems grow in complexity the capacities of the humans to deal with the multitude of constraints decrease which requires that they attempt to simplify the system. Modularity affords parallel problem solving, flexibility in module combination, efficiency through localized problem solving, and ensures resource availability through loose coupling (Ethiraj & Levinthal, 2004). For example, in a decomposed or modular system, a product may be upgraded—e.g., the PC components—by changing one of the components instead of the entire system.

While some systems may be decomposed into different modules based on underlying structural similarities, other systems cannot be decomposed. It becomes difficult to decompose a system characterized by a high specificity and heterogeneity of the components and their relationships. This specificity requires that the system is maintained integrated. Maintaining the system integrated or tightly coupled as opposed to decomposing it is more useful because the system elements achieve synergistically a degree of functionality which cannot be attained if the elements are treated as a combination of independent units (Schilling, 2000). System decomposition assumes that an overarching frame or mental representation has been adopted within which the module combinations will be considered (Brusoni, 2005). In tightly coupled systems, however, multiple problem spaces can be considered simultaneously. The derivation of multiple problem spaces makes possible distant search and affords recombination potential.

Some studies find positive evidence that a match between the degree of system modularity or decomposition and the underlying knowledge and labor distribution increases system performance (e.g., Baldwin & Clark, 2000; Hoetker, 2002; Kusunoki, Nonaka, & Nogata, 1998; Marengo et al., 2000; Schilling & Steensma, 2001; Zhao, 2012). In line with these, I make the assumptions that the degree of system decomposition will be related with the type of team level knowledge decomposition (e.g., Browning, 2001). Assuming a system with an underlying given structure in terms of complexity and coupling, therefore I advance that effective teams develop cognitive structures that match the true underlying structure of the system.

In summary, coupling refers to the extent to which the system can be decomposed in elements with different levels of relationships between them from unrelated through loosely coupled to tightly coupled. The degree of coupledness and the complexity dimensions determine the complexity of the system. A complex system may be loosely coupled but it would still be considered complex due to the interactions that take place within the dimensions. The most complex system would be composed of a high number of interacting dimensions and would be tightly coupled.

2.3. The path/goal structure

The goal/path structure is defined in terms of four dimensions: multiplicity of outcomes, multiplicity of paths to achieve outcomes, probabilistic linkages between paths and outcomes, and conflicting interdependence among paths to multiple outcomes (Campbell, 1988). On one hand, tasks can have single goals or multiple goals that are associated such that their attainment requires attention to only a task dimension. For example, a jury decision making task can be categorized as a task with a single goal or multiple interdependent goals because the people have to reach a common decision as to the outcome of the trial. On the other hand, tasks can have multiple goals that are not associated requiring simultaneous or sequential attention to multiple task dimensions. For example, a business decision making team may attempt to reach simultaneously cost, quality, and quantity outcomes. Goals can be achieved through one path or through multiple paths. When the paths are similar and substitutable, the problem solvers must only select the effective path for goal attainment. For example, in a personnel scheduling task, the problem solver must only select the path that provides the goal achievement potential.

When the paths are different and assume different implications for goal attainment this requires different strategies for path derivation and selection (Orasanu, 1994). For example, in a business unit the outcome of innovation may be obtained via multiple paths and all can be equally applied to reach the goal, which requires synthesis of the paths for appropriate outcomes. These characteristics of unifinality or the presence of a singular goal vs. multifinality or the presence of multiple goals and equifinality or the presence of multiple paths to achieve the goal interact with the dimensions of task environment complexity and coupling described above in determining the effectiveness of a certain type of cognition for managing the task demands. (See Kruglanski, Shah, Fischbach, Friedman, Chun, & Sleeth-Keppler (2002), goal systems theory, for an explanation of the mutifinal and equifinal character of the goals system at the individual level.) These characteristics of mulifinality and equifinality are better represented at the team level. Whereas it is taxing and conflictual for the individual to pursue multiple goals or to consider multiple paths towards goal achievement, the team has the possibility to pursue multiple goals and multiple paths, as they deem appropriate, by virtue of each member attending to different goals and paths, which should be less taxing and less conflict arousing.

2.4. Environmental dynamism

I assume that most of the tasks that teams perform currently are dynamic (Kozlwski & Bell, 2006; Mathieu, Maynard, Rapp, & Gilson, 2008). This implies that during their work teams encounter various types of changes to which they have to adapt. I distinguish two types of change: systematic and local. The changes can be systemic when they affect system level components or relationships, or local, when they affect components or relationships specific to one part of the system.

The changes may affect relationships between the dimensions included in a module, they may lead to changes of modules, they may change the relationships among the modules, or they may change both the modules and the relationships that tie them corresponding to incremental, modular, architectural, and radical change in Henderson and Clark's (1990) framework. In case the change affects module level relationships, the change has a local or isolated character. To the extent that the components are linked via standardized relationships, the changes within one module should not affect significantly the operations of another module. When changes take place at the level of the relationships between modules, when both modules and relationships among them are changed, or when central modules are changed, the change has a systemic character with larger implications for the functionality of the entire system.

In loosely coupled systems, depending on the element that changes, both local and systemic changes are possible. In tightly coupled systems, changes are more likely to have a systemic character as they affect dimensions which are tied through strong interdependencies. But some of the components or relationships may not have a central role in the system. Changes that affect these less essential components and relationships components will have a local or isolated character. Thus, both loosely coupled and tightly coupled systems may experience local and systemic changes. In summary, changes can have a local character, affecting unique relationships or modules or a global character affecting multiple central relationships or modules.

I decided to focus on the four dimensions of complexity, coupling, dynamisms, and path/goal structure in keeping with the environmental dimensions regarded in the strategic management literature. Duncan (1972) for instance defined the environment in terms of: a stable-complex dimension referring to the number and similarity of factors in the environment which corresponds to the complexity dimension here; a static-dynamic dimension referring to the extent to which the factors in the environment remain the same or change over time corresponding to the dynamism dimension noted here; and in terms of uncertainty referring to the lack of information regarding the states of the system and the inability to assign probabilities with confidence with respect to how the environmental factors will affect decision making which corresponds to the path/goal structure here.

Dess and Beard (1984) also define the environment in terms of: munificence or the degree to which the environment is favorable for organizational actions (e.g., amount of resources, constraints on actions), dynamism or rate of change which subsumes the dimension of unpredictability or uncertainty, and complexity referring to the heterogeneity or range of the organization's activities, the multiplicity of inputs and outputs, the organizational density or tight coupledness. Wholey and Brittain (1989) refer to four dimensions: amplitude or the degree of difference involved in the change, frequency of environmental change, predictability or the degree of irregularity in the overall pattern of change which can be subsumed to the dynamism and path/goal structure dimensions considered here.

The differentiation between complexity and degree of coupling introduced here was necessary to capture the complexity dimension completely. For example, a complex system in which there are numerous interactions between the system dimensions can be more easily handled when the interactions can be separated in different clusters. As another example, when the system is tightly coupled but there are few dimensions (low complexity) then it would be more easily managed then when it is tightly coupled and formed of multiple dimensions. As such, the degree of complexity of a system is determined both by the number and interaction between the dimensions and by the extent to which they can be separated in different clusters, or the degree of coupling. The following proposition summarizes the discussion concerning the environment.

Proposition 1: Team environments can be defined in terms of the following characteristics: complexity, coupling, path-goal structure, and dynamism.

3. The environment-cognition fit

In this section, I present the environment-cognition fit model. I relate the environmental structure in terms of the complexity, coupling, and path/goal structure dimensions to team level similar, dissimilar, and complementary TMMs configurations.

3.1. Loosely coupled systems

In loosely coupled systems, the system is decomposed into separate areas or modules each module being composed of a certain set of tasks in a certain domain. This requires specialization and division of labor in the team. At the cognitive level, this would translate in members forming complementary TMMs.[1] In simple systems, each area attended to by each member would be composed of a low number of dimensions with low interactions among the dimensions.
At the cognitive level, this would translate into a lower TMM complexity with fewer concepts and fewer links among the concepts represented. In complex structures, each area of the system would be represented by a higher number of dimensions and relationships among them which at the cognitive level would translate into a higher TMM complexity.

When the system is unifinal, there is one goal and one certain path toward achieving the goal. This implies that each member can pursue changes in his module and overlook developments in other members' modules as long as they maintain an understanding of the rules that standardize the relationships among the modules. Equifinal and multifinal systems assume multiple paths toward achieving the goal and the presence of multiple goals. In this case, members cannot direct their attention solely to their area of the system but they must instead hold a higher level understanding of the architecture of the system (Brusoni, 2005).

Specifically, they should maintain not only a local understanding of the module implications for performance but also a higher level understanding of the diverse outcomes and paths. This enables them to understand how modules can combine to reach the goals, what different combinations exist to reach multiple goals, and what changes afford the derivation of multiple paths toward achieving the goal. System integration relates with the concept of architectural knowledge "about the ways in which the components are integrated and linked together into a coherent whole" (Brusoni, Prencipe, & Pavitt, 2001). This would translate at the cognitive level into complementary and integrated TMMs, whereby the integration would be achieved by holding a higher level view of the system.

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[1] Throughout this exposition I assume that team members are able to represent accurately the external environment. For example, they are able to represent the number of dimensions and their interaction and the path/goal structure of the system.

Integrated TMMs refer to members holding a representation of the linkages among the different modules in addition to the linkages within the modules. This higher level view can either be developed via communication, which would be costlier, or via system integrators or certain liaison roles who would ensure the maintenance of the system (Brusoni, 2005; Brusoni et al., 2001).

Proposition 2: In loosely coupled systems with a unique path/goal structure, complementary TMMs will match better the environmental characteristics than other types of TMMs. In loosely coupled systems with an equifinal-multifinal path/goal structure complementary TMMs and a higher level view of system will match better the characteristics of the environment than the other types of TMMs.

3.2. Tightly coupled systems

In tightly coupled systems, the underlying system structure cannot be easily decomposed. The system dimensions are tied together by specific relationships that create synergistic specificity (Schilling, 2000) and cannot be mapped onto different areas or separated into modules without losing their specificity. This means that the system must be treated cognitively as an integrated whole. Depending on the path/goal structure of the space then different TMMs may be more effective for mapping the space across the complex-simple dimension. A unifinal system implies only one goal and one path towards achieving it. In this case, members would need to hold a similar view on the system as a whole to enable their coordination and work on the common aspects. This applies for both complex and simple systems with the qualification that the TMMs of teams working in tightly coupled simple systems would be less complex than those of teams working in tightly coupled complex systems. For example, a simple system would presuppose a simple reasoning type of task with a correct response such as the selection of the correct command in a simple series of operations. For complex systems, consider the operation of a nuclear plant depending on the unfolding of a clear and predetermined sequence of processes (Perrow, 1984). In terms of TMMs characteristics, in this case, similarity would be confounded with accuracy, since there is one way to reach the specified goal which all members must be aware of in order to maintain team functionality.

In multifinal and equifinal systems, there are multiple paths towards the goals and multiple goals. Therefore, a diverse understanding of the system is necessary in order to derive functional responses to the system demands. For simple systems, imagine for example an idea generation task where members must find a solution for an ill-defined problem such as finding multiple uses for an object. At the other end, for a complex task, imagine that members must develop a complex new product that addresses multiple goals, such as quality, esthetics, and efficiency. While complementary cognition would ensure ample coverage of the problem space, it would be limited to the representation of the space within one frame.

Similar TMMs would similarly represent just one of the alternative problem spaces within which the system can be represented. But when members form dissimilar TMMs they may represent the system in terms of alternative spaces, matching the underlying structure of the system which can be defined in terms of alternative structures. Dissimilar TMMs afford diverse understandings of the elements and their interactions. Members can represent and work within different system states, sequentially or in parallel, they can select one of the derived views and work only within that view, or they can derive a new representation of the space by recombining their views (Gavetti & Warglien, 2011; Reiter-Palmon & Robinson, 2009).

Proposition 3: In tightly coupled systems with a unique path/goal structure, similar TMMs will match better the environmental characteristics than other types of TMMs.

Proposition 4: In tightly coupled systems with an equifinal-multifinal path/goal structure, dissimilar TMMs will match better the environmental characteristics than other types of TMMs.

A qualification is in order. Loosely coupled systems are not structured at the outset, but they are described in terms of nondecomposed systems (Frenken et al., 1999). Therefore, members need to map the initial space and decompose it according to some rules and underlying structures. In this case, dissimilar TMMs may be helpful initially since it enables members to derive and select among one or more system decompositions. This is necessary because the initial problem space decomposition influences future task efforts (Mumford, Reiter-Palmon, & Redmond, 1994). A representative decomposition can be achieved when members consider alternative task spaces, number of modules, size of modules, and interactions among modules (Ethiraj & Levinthal, 2004).

Proposition 5: In loosely coupled systems that have not been decomposed, the dissimilar TMMs provide better representations of the environment than the other types of TMMs.

The proposed relationships between the type of environment and the structure of the teams' TMMs are described in Table 1.

Table 1. *The Fit Between Environmental Structure and Team Cognition*

System complexity and goal/path structure	Type of system coupling: Loosely coupled	Tightly coupled
Simple unifinal	Complementary TMMs+ low complexity Product assembly	Similar TMMs + low complexity Well-defined problem solving
Simple multifinal	Dissimilar TMMs + low complexity Complementary TMMs + low complexity Product assembly with multiple structures	Dissimilar TMMs + low complexity Idea generation task
Complex unifinal	Complementary TMMs + higher level view + high complexity Medical team	Similar TMMs + high complexity Military defense task
Complex multifinal	Dissimilar TMMs + high complexity Complementary TMMs + higher level view + high complexity within module New product development University decision making	Dissimilar TMMs + high complexity Organizational strategy definition

4. The effect of changes

Having described the likely relationships between a specific system structure and the TMMs configuration effective for managing the demands of the system, I turn to a discussion of the TMMs types on the continuum effective for managing systemic and local system changes, in relation with the types of environments in which teams operate.

4.1. Local changes

Local changes assume modifications to only a part of the system. In loosely coupled systems, across degrees of complexity, a local change assumes incremental modifications within a module. Since modules are only weakly connected, the modifications made to one module are not consequential for the functionality of the other modules. In this case, complementary TMMs would enable members to deal with the changes as each can address independently the changes arising in their assigned areas of the system. In tightly coupled systems, a local change would affect only one part of the integrated system. When this part is not central to the functionality of the entire system, then the members may direct their attention only to that part of the system affected by the change. When the path/goal structure is unifinal, then the system is constrained in its capacity to deal with the change to a specified course of action aimed at reestablishing the equilibrium that existed before the change. This requires that members develop a similar understanding or similar TMMs of the implications of the change for that part of the system affected. In simple systems, this understanding would be more simple, while in complex systems the understanding would be more complex. When the change is local but it affects a system with equifinal-multifinal structure, then members must form a diverse understanding of the area of the problem space affected by the change, or dissimilar TMMs.

This is required because the equivocality of the system extends to any of its interconnected parts which can only be addressed by using the adequate representational mechanisms. Conflicting constraints imply that an incremental improvement of one dimension will imply a loss for another dimension (Fleming & Sorenson, 2001). A diverse understanding of the change would ensure that members would be able to derive alternative courses of action to address the change and reestablish functionality of that part of the system affected. For the first case, imagine a team of nuclear plant operators encountering a problem with a leak in the steam generator tube requiring a plant shutdown (Waller et al., 2004). To successfully manage the problem, the team must represent and understand the event similarly in order to take the appropriate action, which is singular. For the dissimilar case, imagine a top management team striving to derive a new strategy for addressing the problems in one area of the company. In this case, it is likely that a diverse understanding of the company problems will lead to better strategy derivation than a limited focus on one way to achieve the goal (e.g., Kilduff, Angelmar, & Mehra, 2000). This is because multiple goals may exist such as quality and efficiency goals, and multiple means towards their achievement, such as product innovation or personnel demoting, which may bear differently on the solution. When different goals and achievement strategies are considered by virtue of dissimilar TMMs, then the company can make more comprehensive decisions and implement integral actions.

Proposition 6: Local changes in loosely coupled systems can be best managed by representing the local change complementarily.

Proposition 7: Local changes in tightly coupled system with a unifinal path/goal structure can be best managed by representing the local change similarly.

Proposition 8: Local changes in tightly coupled systems with a multifinal-equifinal path/goal structure can be best managed by representing the local change dissimilarly.

4.2. Systemic change

In a loosely coupled system, systemic changes affect the links between the modules, the entire modules, or both the links between the modules and the entire modules. In this case, holding a complementary view is not sufficient to derive an appropriate response to the change. A change of the module may assume changes in other modules since it may affect the linkages among them. A change in the architecture or the links among the modules assumes a new structure of the system which cannot be managed within the existing system representation. It requires instead a diverse higher level understanding of the system capable of constructing alternative representations. This would enable members to derive novel module combinations and architectures which would radically change the system.

Complementary cognition affords only a limited view within the existing representations while complementary cognition complemented by higher level understandings of the architectures affords only a view confined to the current system architecture (e.g., Brusoni, Marengo, Prencipe, & Valente, 2007). In this case, it is required that members construct a diverse view of the system that would enable them to derive alternative module configurations and system architectures. This necessitates that they change their cognitive mode from complementary to dissimilar. Just as at the beginning of the system decomposition effort, the systemic change affects the fundamental relationships among system modules, which requires a new partitioning of the space. Adopting a dissimilar form of cognition would enable members to derive new system configurations and to repartition the system based on new rules and modules. So long as the change is systemic, this dissimilar view is required independent of the degree of system complexity and the system path/goal structure.

Proposition 9: In loosely coupled system affected by systemic changes, the change can be best managed when members form a dissimilar TMM of the entire system.

In tightly coupled systems, the systemic change affects central elements or central relationships among elements. To manage the change members should form an integrated representation of the whole system. In systems with a unifinal goal/path structure there is only one response to the systemic change that should be enacted by members to reestablish functionality. This requires that they develop similar TMMs of the system and address the change using this unique representation. This holds across degrees of system complexity and it would be confounded with the TMMs characteristic of accuracy. In systems with multiple goal/path structures, the change cannot be interpreted unidimensionally because the structure of the system admits multiple types of connections among modules and dimensions with different implications for system functionality.

This requires that members develop an integrated dissimilar representation of the change. Since there are multiple ways to work within the system, the dissimilar TMMs would enable members to construct these alternative views and by selection or combination to derive one or multiple effective ways to deal with the change. For example, in the similar case imagine a system-wide accident in a nuclear power plant where delays in processing are not possible, the sequences of operations are invariant, there are no substitutions possible, and there is little slack in supplies and personnel (Perrow, 1984). The members would need to know optimally the operations, processes, and system rules in order to ensure adequate adaptation (Perrow, 1984). In the dissimilar case, imagine that the organization as a whole is on the verge of bankruptcy due to external changes with a systemic character. In this case, a diverse representation of the strategies that the organization can implement to establish functionality are likely to aid organizational survival.

Proposition 10: In tightly coupled systems with a unique path/goal structure, the systemic changes can be best managed when members form a similar TMM of the entire system.

Proposition 11: In tightly coupled systems with an equifinal-multifinal path/goal structure the systemic change can be best managed when members form a dissimilar TMM of the entire system.

5. Match and mismatch—system decomposition

The relationship between level of system decomposition and unit capabilities has been studied in a number of domains (Campagnolo & Camuffo, 2010) but close to our intent, there is a burgeoning of interest in this topic in the organizational learning and adaptation literature (e.g., Henderson & Clark, 1992; Schilling, 2000; Ulrich, 1995). Most of this evidence is based on agent based simulations that investigated the effect of system decomposition into modules on organizational performance in systems with different underlying structures (e.g., Ethiraj & Levinthal, 2004; Levinthal, 1997; Marengo & Dosi, 2005; Rivkin & Siggelkow, 2007). These studies find that mismatches between the optimal level of decomposition and the enacted level of decomposition decrease performance. Specifically, assuming an optimal decomposition of the system into modules, modes of decomposition that do not match the optimum decomposition tend to underperform (Brusoni, 2005; Frenken et al., 1999; Marengo et al., 2000; Levinthal & Warglien, 1999; Zhang & Gao, 2010).

In loosely coupled systems, researchers find that decomposing the problem into finer modules than the optimal number of modules is not effective in the long term because it locks the problem solver quickly into suboptimal solutions or local peaks. Decomposing the system into coarser modules on the other hand seems more effective although it takes a longer time to reach the optimal solution (Ethiraj & Levinthal, 2004; Frenken et al., 1999; Geisendorf, 2010). In addition to the optimal degree of modularity, in loosely coupled systems, there seem to be benefits from holding a higher level view of the system (Brusoni et al., 2001). Maintaining a higher level view of the system means that the members that are assigned different modules are able to understand the rules that tie the components together, the role of each module in the system, and the potential for module combination and recombination. This higher level view enables them to modify the system configurations amounting to changing the system modules or module combinations and to improve their activities (Brusoni et al., 2001; Brusoni, 2005; Marengo et al., 2000; Warglien & Levinthal, 1999).

In tightly coupled systems, the optimum module size is equal to the size of the system which implies that the system is treated as a whole instead of being decomposed. Decomposing a tightly coupled system amount to ignoring interactions among the system dimensions and partitioning the system based on artificial similarities and rules. Since the dimensions are characterized by a degree of specificity that enables the system to obtain synergistic functionality, decomposing the system is not an effective performance strategy. Decomposition in tightly coupled systems may lead to local improvements but at the expense of global performance (Brusoni et al., 2007). In decomposing the system, the members may also find it difficult thereafter to reconstruct the original system space. The reason for this is that tightly coupled systems may be represented through a number of alternative structures and when decomposing the system members adopt one of these structures within which to conduct their work. Therefore, recomposition would amount to addressing one of the system structures but not alternative structures. When the system is formed of components that are tightly interconnected then changes in any one component can affect changes in others, which requires a distant search for the simultaneous modification of multiple elements which may bear on the final solution (Gavetti & Levinthal, 2000; Gavetti et al., 2005; Fang & Levinthal, 2009). Integrated cognition as represented by similar or dissimilar TMMs avoids thus suboptimal parsing of the system and enables by mental exploration the discovery of the optimum.

With respect to the environment characteristics, a number of authors find that treating the system as tightly coupled is beneficial in volatile environments (Brusoni et al., 2007). Turbulence or changes make it more likely that a different system representation is needed to solve the obstacle. While modular search enables local improvement or problem solving within modules it does not address higher level system problems. Tightly coupled search can search distant areas of the system and create multiple alternative search spaces. This enables the team to move off local or suboptimal peak and to find optimal performance peaks (Brusoni, 2005; Frenken & Mendritzki, 2012; Levinthal, 1997; Marengo & Dosi, 2005; Rivkin, 2000; Sorenson, 2003).

There may be also an evolutionary aspect to achieving the match between cognition and the environment. As organizations learn and become aware of the true interdependencies between knowledge elements, their coupling patterns should change to reflect this new knowledge (Yayavaram & Ahuja, 2008). In this context, in loosely coupled systems, the effectiveness of decomposition of the original system will determine future performance efforts. Therefore, initially treating the system as tightly coupled may aid the development of a higher level view and the exploration of potential system configurations (Geisendorf, 2010; Siggelkow & Levinthal, 2003).

Extending the notion of asymmetry in structural adaptation (Hollenbeck et al., 2011) it may be also more difficult to transition from loosely coupled types of TMMs to tightly coupled, when the situation requires it. For instance, when a task is cognitively decomposed into units, it may be more difficult for a team with complementary TMMs to form dissimilar or similar TMMs when transitioning to a more integrated task structure than for a team with dissimilar or similar TMMs to form complementary TMMs. This is because the system structure in loosely coupled systems assumes different norms for collaboration and information sharing than the system structure in tightly coupled systems. In loosely coupled systems, members may work on their own modules without the need to share much information beyond the information required with other members.

This should make it more difficult for them to transition to a mode that requires that they actively collaborate and share information with others to develop integrated system representations (Hollenbeck et al., 2011; Moon et al., 2004). Members that have worked in a system which required active collaboration and information sharing should instead find it easier to transition to a system that requires that they work independently on modules and develop module level representations. There may be also cross-sectional asymmetries in that according to the cited literature (e.g., Frenken et al., 1999; Marengo et al., 2000) treating a loosely coupled system as tightly coupled seems to be more effective than over-decomposing the system. This is because the over-decomposition of the system can lead to entrapment on local peaks that although they reach some level of performance in the short term, in the long term they score lower due to not being able to move of local optima. The tightly coupled decomposition on the other hand enables the derivation of the optimal peaks, even if it does so more slowly, gaining advantages in the long term (Frenken et al., 1999). This would suggest that members that approach the loosely coupled systems with integrated cognitive strategies (i.e., similar or dissimilar TMMs) may attain a better performance than the ones that try to decompose the nondecomposable systems which amounts to forming complementary TMMs in a tightly coupled system.

With respect to the goal/path structure mismatch, treating a system with multiple goals and paths as a unifinal system may lead to lower performance because it omits the consideration of the alternative path goal structures which may be effective in handling the system requirements. With respect to the complexity of the environment, I assume also in line with previous research that the development of more complex TMMs structures is not necessarily beneficial for performance in simple environments (Schroder et al., 1967). It tends to be more effortful and at best will not yield performance differences from the more simplified TMMs.

Although the contingency hypothesis predicts that matches will yield optimum performance, these may still be difficult to reach in a team. Members may find it difficult to attain the optimum level of decomposition, they may find it difficult to represent alternative spaces when working in an integrated system (Frenken et al., 1999), or they may limitedly focus on only one area of the system despite the requirement for broad system exploration (Sayama, Farrell, & Dionne, 2011). Although the group has larger capacity than the individuals for adequately representing the system, they may still be bounded by their cognitive capacities (Ethiraj & Levinthal, 2009). I will return to these points in the final section on factors that enable the development of the environment-cognition match.

6. Evidence

Empirical evidence with respect to environment-cognition fit propositions does not abound but there are some studies in diverse literatures that confirm their validity. There seems to be more support for the role of similar and dissimilar TMMs and less evidence for the relevance of complementary TMMs.

In the team literature, the role of TMMs for managing tightly coupled and unifinal task environments is especially addressed (e.g., Cooke et al., 2003; Ellis, 2006; Gurtner, Tschan, Semmer, & Nagele, 2007; Lim & Klein, 2006; Marks et al., 2000; Mathieu, et al., 2000; Randall et al., 2011; Smith-Jentsch, Campbell, Milanovich, & Reynolds, 2001; Stout et al., 1999; Webber, Chen, Payne, Marsh, & Zaccaro, 2000). Most research finds that similar TMMs in these types of task environments afford greater coordination and team management capacities which prove beneficial for performance (DeChurch & Mesmer-Magnus, 2010a).

The role of dissimilar TMMs is emphasized for work on complex and tightly coupled tasks with multiple goals and paths towards goal achievement (Badke-Schaub et al., 2007). A larger literature in creative and complex problem solving suggest that knowledge and task relevant perspectives diversity enable teams to develop performance strategies and problem solutions enhancing outcomes such as adaptation and innovation (e.g., West, 2002; Williams & O'Reilly, 1998). Empirical support is available in the innovation literature, with studies showing that diverse teams with respect to functional and educational backgrounds reach a higher performance on knowledge oriented complex tasks which require innovative outputs (Bell, Villado, Lukasik, Belau, & Briggs, 2011; Carpenter & Friedriksen, 2001; Jehn, Northcraft, & Neale, 1999; Kaplan, Brooks, Shesler, King, and Zaccaro, 2009; Ford & Sullivan, 2004).

The role of TMMs dissimilarity for the management of changes is sustained in strategic management literature which holds that organizational and top management team diversity is necessary to deal with the demands of complex and dynamic environments (Dess & Origer, 1987;

Dess & Priem, 1995; Priem, 1990) with some studies supporting these assertions (Bourgeois , 1980; Bourgeois, 1985; Carpenter & Friedriksen, 2001; Cannella, Jong-Hun, & Ho-Uk, 2008; Dess, 1987; Ensley & Pearce, 2001; Judge & Miller, 1991; Walsh, Henderson, & Deighton, 1988; Kilduff et al., 2000). In the team effectiveness literature, there is very little research on the types of environments represented by dissimilar TMMs but the scarce evidence that exists suggests that members will develop dissimilar TMMs in complex and tightly coupled environments (Badke-Schaub et al., 2007; Levesque, Wilson, & Wholey, 2001; Zajac, Bedwell, Kramer, & Salas, 2014).

The few studies that focused on capturing members' complementary representations find that teams that are able to represent their portion of the space effectively and then to derive integrated courses of action attain high quality outcomes (Banks & Millward, 2001; Cooke et al., 2003). With respect to the information processing enacted by teams (Schroder et al., 1967), there is evidence that teams that are able to form more complex cognitive structures when they face complex environments achieve higher performance. When dealing with simple tasks however there is no advantage to being in a team with a higher cognitive complexity, confirming the arguments made here regarding the optimal level of match.

Thus, overall, there is some empirical support for the propositions advanced here but research could greatly benefit from further empirical attention, especially with respect to the role of different TMMs types other than similar TMMs, which requires the investigation of different environments, and with respect to the transitions among these types of TMMs which requires temporal assessments.

7. The relationship between change characteristics, cognition, and behavior

In this section, I describe the effect on cognition and behavior of specific types of changes. Changes can have different characteristics which may impact the development of TMMs. Therefore, following previous frameworks (Gersick & Hackman, 1990), I consider in addition to the magnitude of the change, which refers to whether the change has a systemic versus a local character, the frequency of the change. Frequency describes the rate at which the team experiences an event in a given interval of time, with higher frequency changes unfolding at a faster rate and lower frequency changes at a lower rate.

Generally, across degrees of magnitude, high frequency changes are expected to require more stability in the members' TMMs. This assumes that, indifferent of the environment in which they are operating, teams that meet frequent changes should form either more similar TMMs or that they should retain a base of similar elements on which to base their actions. The explanation for this is that the frequency of the change devalues the gains obtained from adding further knowledge through exploration, which implies that gathering new knowledge would add little benefit to adaptation attempts beyond exploiting the current knowledge (Gavetti & Levinthal, 2000; Gavetti, Levinthal, & Rivkin, 2005; Levinthal, 1997; Levinthal & Posen, 2012). The changes in cognition and behavior described are expected to occur in all the systems configurations. Some types of changes should make it more difficult to achieve the match between the system demands and the TMMs types. For example, high magnitude and high frequency changes will lower the possibility of forming similar TMMs which are required in unifinal tightly coupled systems.

In deriving these effects, I relied on literature on team and organizational adaptation, which addresses the effects of task and environmental changes on behavior and cognition (e.g., Brown & Eisenhardt, 1997; Gavetti & Levinthal, 2000). Changes in cognition emerge following a cognitive assessment of the new situation experienced by the team (Burke et al., 2006). Second, they should result from the feedback on the effectiveness of certain adaptation strategies received from the environment during the adaptation process. Feedback permits the creation or readjustment of cognitive action-outcome linkages. Behavioral modification should follow cognitive change or, when the frequency and magnitude of the changes are very high, it should be a direct response to the change. Table 2 describes these changes in cognition and behavior for changes with different degrees of magnitude and frequency.

Table 2. *The Effect of Change Characteristics on Team Mental Models and Behavior*

Type of change	Effect on cognition:	Effect on behavior:
Low frequency-low magnitude	Stability; incremental adjustments; adjustments based on the results of behavioral exploration	Stability; inertia of routines; potential for incremental proactive changes—experimentation which may lead to the creation of new routines or the refinement and improvement of the existent routines
High frequency-low magnitude	Incremental adjustments; add knowledge contents or relationships among knowledge contents; subtract contents or relationships among contents; change the strength of the relationships among contents; maintain sequencing, form, and direction of the relationships; build and maintain a stable base of unchanged knowledge on which to build new knowledge; retain the redefined relationships for future use; permanent process of refinement according to feedback on a solid base of knowledge; forgetting of old TMMs; Effective—TMM incremental adjustment, TMM enrichment, increasing TMM complexity	Periodic patterns of behavior—display behavioral shifts that correspond to the shifts in the situations periodically; since the situations are repetitive and known, most likely rely on stored routines for managing the changed situations; ordered, sequential, linear, organized activity; detailed, highly analytical routines that precisely specify steps; subdivide activities among individuals; potential for incremental adaptation of routines as further experiencing the same situation may shed new light on relationships; add novel elements due to idiosyncratic and improvisational learning; proactive modification of routine; extension of routines based on varied practice; Effective—incremental routine adjustment, improvisation
Low frequency-high magnitude	Reorganization of mental models; discard mental models; create new mental models; adding or subtracting elements; paradoxical changes—modifying relationships among contents: direction (e.g., from positively related to negatively related); strength (from unrelated to strongly related, changes in element centrality—peripheral elements may become central and central elements may become peripheral); sequencing (e.g., reorganization of the causal chains, reversal of cause and effects), form (e.g., from linear to nonlinear relationships); potential for different update and modification of mental models among	Less predictable behavior; short term exploration—chaotic behavior—unpredictable in the short term, predictable in the long term; discarding routines; combine previous routines; create new routines; interim formalization of new routines complemented by refinement as the adaptation process progresses; persistence in using previous strategies, based on positive feedback on previous performance levels; undue exploitation of old routines; Effective—exploration and convergence on behavioral strategy

	team members, with potential to reach similar structure with increasing temporal distance from the change; Effective—mental models change; mental models divergence and mental models convergence to create new mental models	
High frequency-high magnitude	Multiple mental models may operate simultaneously; the mental models operating simultaneously may be in contradiction; cognition update lags behavior; knowledge becomes rapidly outdated, difficult to keep up with the changes in the environment; events and actions unfold before feedback is obtained preventing the updating or the formation of action-outcome linkages; because knowledge becomes outdated fast, no new knowledge accumulation and no possibility to use old knowledge—change alters the value of old knowledge and alters efforts to accumulate new knowledge; fast updating may not be efficient because there is no time to exploit the new knowledge accumulated; at the extreme, rely more on situational knowledge than on stable knowledge structure; create partial mental model as the change unfolds and use it as a working model for understanding and managing the situation; idiosyncratic change of internal structures, likely different among team members; mental models are divergent but there is no particular endorsement of one mental models over another; Effective— selectively discard old mental models to enable the accumulation of new knowledge—forgetting to enable learning; mental models divergence; mental models enrichment-mental models complexity; mental models centralization	Less predictable behavior; contradictory patterns: excessive exploration-randomness vs. excessive stability; no memory of previous behavior, constant spontaneous behavior; exploit existing knowledge and opportunities, greater inertia; refine existent routines—strategy persistence (potentially more adaptive); increased action bias when the environment is munificence-reducing but decreased when it is munificence enhancing; unstable processes; interim installation of loosely defined behavior patterns; Effective—experimentation, work organization around priorities, semistructures; sequenced simple routines—few rules that specify boundary conditions on the actions of members or indicate priorities; nonlinear, iterative process—recycling through earlier steps; learning by doing; experimentation followed by highly rationalized implementation of the chosen option
Key References	Bourgeois & Eisenhardt, 1988; Eisenhardt & Brown, 1995; Eisenhardt & Martin, 2000; Gersick & Hackman, 1990; Gavetti & Levinthal, 2000; Posen & Levinthal, 2012	

The timing of change may determine the extent to which the changes will disrupt the team activity and result in dysfunctional adaptation. Team and task familiarity is likely to moderate the disruptive effects of some types of changes. Teams where members have worked together before the change are more likely to have developed capabilities such as expectations, norms, goals, and strategies that enable them to handle multiple types of changes. When members have little familiarity with each other and with the task, the changes are expected to have a more detrimental effect. Members' actions are expected to be less coordinated and more in situ, because they face the double task of countering the situation and developing representations of their task, team, team interaction, and environment.

Behaviors will be characterized by more spontaneity as norms have not been reinforced to dictate a certain pattern of action, or norms may emerge spontaneously according to the situation demands and persist without explicit agreement. For instance, if they meet challenges when they are still in the phase of development of dyadic exchanges, in which they dyadically learn more about the role of others, according to Kozlowski, Gully, Nason, and Smith's (1999) theory of team development, integration of behaviors across the group will be less attuned to each members' needs and skills, and behavioral repetitions as well as improper coordination are more likely. Although most research to date has examined a specific change introduced sometime in the midterm of the group work (e.g., Randall et al., 2011), in field settings different combinations and influences are possible which demands more attention to the temporal aspects of the threat. In such diverse contexts, even minor changes may have a deleterious effect on groups that have not established effective cognitive and behavioral patterns to deal with emergencies.

Proposition 12: The timing of change relative to the likelihood that members have developed TMMs and behavioral patterns will add to the magnitude of the change such that teams with less experience will be more affected across degrees of change than team with more experience.

8. Change content

To complete my characterization of the changes and their effects, in this section I discuss the content of the changes that teams are likely to experience. Thus far research has taken a more unspecific approach to studying the relationship between different types of changes and TMMs. This limits our understanding of which types of changes are relevant in influencing which types of TMMs. Further, this limitation means that we cannot predict accurately how the team will be affected by the changes, that we cannot build better predictive models, and that we cannot design more useful interventions to address team adaptation. Therefore, I consider that the detailing of the relationships between the changes content and TMMs is a worthwile task.

In determining the changes content, I examined the types of changes manipulated or assessed in the studies identified in the team adaptation reviews by Maynard et al. (2015) and Baard, Rench, and Kozlowski (2013). Additionally, I examined the types of changes embedded in the research on the relationship between team adaptation and team mental models (e.g., Marks et al., 2000; Resick et al., 2014; Randall et al., 2011; Sander et al., 2015; Uidewilligen et al., 2013). Further, I considered theoretical models by Gersick and Hackman (1990) and by Louis and Sutton (1991) which addressed types of changes that have not been explored in the studies identified. Finally, I perused work on activity interruptions (Zellmer-Bruhn, 2003) and critical events (Morgeson, 2005) to identify other change contents.

Based on this review, a number of change contents emerged, which I organized into the following categories, according to content similarity: task design, task events, team events, and environmental events. These contents are represented in Figure 2 in relation with the TMMs contents responsive to the changes content. Generally, changes in task design such as structural changes are likely to lead to changes in procedural TMMs, task events such as work problems, tools added, additional requirements are likely to lead to changes in the task TMMs, environmental changes such as novel situations are likely to lead to changes in the strategic TMMs, and team events such as member turnover or removal are likely to lead to changes in team and team interaction TMMs.

Proposition 13: There will be a positive relationship between the content of the change and the content of the TMMs to which the change refers.

This broader tripartite classification (i.e., task, team, and environmental) is in line with an open systems approach to teamwork, which considers teams at the juncture between individual, organizational, and environmental boundaries (Kozlowski & Bell, 2003). By this approach, teams are influenced by and influence a number of different levels of their performance environment. Some teams, such as managerial and project teams may be closer to the environmental boundary and thus more affected by changes in the larger organizational environment, while other teams such as production and technical teams may deal with changes primarily at the team and task levels and experience environmental changes only indirectly (Thompson, 1967).

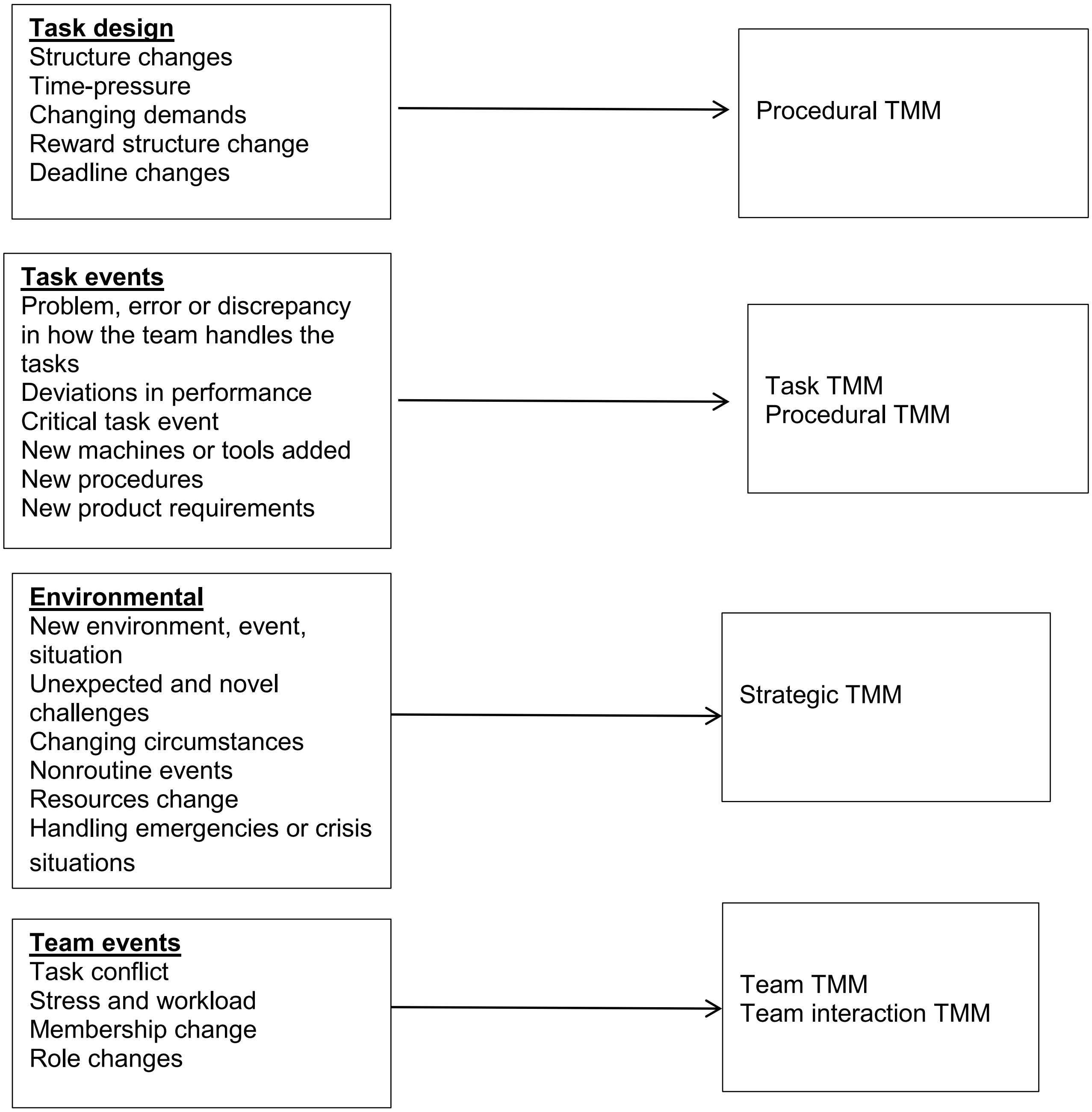

Figure 2. The relationship between change content and team mental models content

8.1.Multiplicity of changes

Most of the empirical research studies the effect of one type of change on team adaptation. When studies consider multiple types of changes, there is no attention paid to understanding their independent or interactive effect. Multiplicity of changes describes whether the team experiences a change in one content domain or multiple content domains. Changes in multiple content domains may operate independently or in interaction and they may have similar or different degrees of magnitude and frequency (McArthy, Lawrence, Wixted, & Gordon, 2010). The consideration of multiple changes adds a layer of complexity to the treatment of team adaptation. Real teams may operate under different environmental and task conditions, implying changes in different content domains, with potentially different characteristics. For instance, they may experience frequent schedule changes with low to moderate impact on the activity coupled with large magnitude less frequent changes pertaining to resource availability. The team may manage a change at the same time that another change emerges.

New changes can be unrelated with previous changes or related, needing active readjustment of previous adaptation strategies in different domains. Singly, these changes may have a lower overall impact but cumulatively or in interaction, they may lead to a different impact. The requirements for response change and the operational abilities of the team may also be unpredictably affected by the accumulation of such multiple content changes. To properly estimate the effects of multiple changes, turbulent environments should be sought out in the field and examined or environments created in artificial lab settings. Research in strategic management can serve as an example for studying environmental turbulence under multiple aspects (Barr & Bogner, 2002; Nadkarni & Naryanan, 2007; Wholey & Brittain, 1989). These designs should be complemented by clear conceptual models relating types of changes with expected changes in behavior and cognition to be truly informative.

Finally, these different change components presented in this framework should not be viewed in isolation but as integrated components of the model. For instance, a systemic change in a tightly coupled environment with multiple goals and paths may lead to different outcomes according to its content and its characteristics in terms of frequency and magnitude and on whether it ties to other changes in the system. A change with similar characteristics and content may have may lead to different outcomes in a loosely coupled system with a unifinal goal/path structure compared with a multifinal system. The aim is to provide a framework to guide future research areas in the area of team adaptation and team cognition and team adaptation in general. It is additionally hoped that this framework will also serve researchers interested in investigating adaptation with a multiple lens, from experimental to field to simulation research and across levels broadening the view to the organizational level.

9. Factors influencing the development of the environment-cognition fit

Different factors may affect the extent to which the teams are able to integrate their TMMs and form more comprehensive understanding, such as team norms, team leadership, and team learning processes. Furthermore, differences in information processing, learning, and representation formation among the team members are likely to create inconsistent development if they are not attended to and corrected (Dahlin, Weingart, & Hinds, 2005; Hinsz, Tindale, & Vollrath, 1997; Hutchins, 1991; Cronin & Weingart, 2007). I briefly review some methods useful in developing the environment-cognition fit. I rely on previous research on TMMs and on research on representation formation in different domains such as ill-defined problem solving.

With respect to developing TMMs complementarity, members could be assigned responsibility for different modules that compose the system. In order to ensure effective collaboration, they could be imparted the rules that tie the modules together and the higher level view of the system. Without adequate separation of the modules among the members, role ambiguities and conflicts may arise, with negative effects on the team functioning. Higher level views and rules are necessary to maintain coordination among modules and collaboration and effective communication among the members. Rules would guide for instance the extent and scope of communication, ensuring that members share contents relevant to others timely and appropriately. To develop an understanding of the others' responsibilities and roles, team members could be cross-trained through different methods (e.g., behavioral observation, actual work on the task of others, e.g., Blickensderfer, Cannon-Bower, & Salas, 1998). To develop an understanding of the rules that guide the system and of the system as a whole they could engage in initial comprehensive meetings and then maintain periodic meetings and discussions.

With respect to creating TMMs dissimilarity, creative problem solving techniques such as problem restatement and critical thinking training could be employed (Cohen, Freeman, & Thompson, 1998; Scott, Leritz, & Mumford, 2004). Alternatively, teams could be exposed to variation training which assumes the experience of different novel events during task practice (Schmidt & Bjork, 1992; Hesketh, 1997). Team research has used for instance related variation practice (Schilling, Vidal, Ployhart, & Marangoni, 2003), perturbation training (Gorman et al., 2010), and event based training (Fowlkes, Dwyer, Oser, & Salas, 1998) to train team flexibility. With respect to leveraging dissimilarity, appropriate information processing mechanisms should be put into place. Dissimilar perspectives need to be combined and recombined in different ways to reach optimum environment fit levels. Therefore, members would benefit the sharing, elaboration, and integration of their knowledge (Homan, Van Knippenberg, & Van Kleef, 2007). This also requires that motivational attitudes such as learning orientation are cultivated (Bunderson & Sutcliff, 2003), with a view to both exploration and exploitation of knowledge. For teams with dissimilar TMMs, the most relevant aspect would be to maintain a balance between exploration and exploitation of their dissimilar views (Gupta, Smith, & Shalley, 2006).

With respect to creating similarity, team intervention strategies such as team dimensional training (Smith-Jentsch, Zeisig, Acton, & McPherson, 1998), team interaction training (Marks et al., 2000), and task schema training (Rentsch, Delise, Mello, & Staniewicz, 2014) could be employed. With respect to leveraging similarity, teams' motivational attitudes should be addressed such that the members are all motivated to work toward the same goal (DeShon, Kozlowski, Schmidt, Milner, & Wiechmann, 2004), to share their views (Homan et al., 2007), to cooperate, and to coordinate their actions. With respect to training the teams' capacities to deal with different changes, it must be ensured that the changes experienced during the learning or training experiences match the characteristics of the changes likely to be encountered in the real work environments.

10. Application domain

The framework is aimed to organize research efforts in the area of team adaptation and team cognition, but it can also serve researchers interested in other levels of analysis or generally in the role of the environment in the effort to adapt. It has been constructed following a long tradition focusing on the role of the environment for organizational adaptation and it is hoped that its core elements will bear fruit in future adaptation models and research. With respect to the particular area of team adaptation, the framework can provide researchers a starting point for classifying their designs according to the environmental characteristics and predict the type of cognitive and behavior changes teams in specific environments are likely to undergo.

It is aimed to systemize the research around more general, higher level factors. Whereas previous research has tended to take a more limited focus, the relationships described here enable the exploration of a larger number of environments and environmental characteristics with more clear expectations for the role of TMMs. An important note is that the level to which this relationship bear out depends on the study design. For instance, dissimilarity may be favorable at early moments of encountering novelty or change, but later on convergence may be necessary. Therefore, researchers that examine the level of TMMS similarity at the end of a task as opposed to at landmarks may not confirm these relationships. Therefore, the proposition should be tested with a consideration to the role of time, as another contingency dimension. This model addresses the team level but it may be possible for teams in the same organization to meet different environments, therefore to develop different types of cognition, for example production and research and development teams (Thompson, 1967). When the analysis is extended to the inter-team relationships, the contingencies are likely to be different. So far, there is no theory of adaptation at the interteam level although this would be a useful addition to the current models. Multiteam systems (Marks, DeChurch, Mathieu, Panzer, & Alonso, 2005) are becoming prevalent in different industries and sectors so the mechanisms that address their adaptation are also relevant.

In summary, this chapter addressed the following areas of the relationship between team adaptation and TMMs: a contingency perspective on the relationship between the team environment and TMMs; the effect of changes on team behavior and TMMs; the content of changes and its relationship with TMMs; and factors relevant in achieving the environment-cognition fit. The major contribution of the chapter is that it organizes previous work on the relationship between team adaptation and TMMs around a set of common factors. Previous reviews have not regarded the role of the environment which is an important omission because addressing the environment permits the development of better predictive models. Further, there has been little regard for the types of changes that the teams face and their relationship with team behavior and TMMs.

This limits the possibilities for both deriving more informed predictions and for the development better interventions for team adaptation. Therefore, by developing a comprehensive model of environment-cognition fit and by addressing the role of changes for the relationship between TMMs and team adaptation, this chapter has contributed to literature on team adaptation and TMMs. In the following chapters, I will undertake the task of testing some of the propositions advanced in this chapter. It is hoped that future research will empirically test some of these propositions and that the proposed framework will be useful in designing and implementing future studies.

Chapter 2 - The Role of Team Mental Models Dissimilarity for Team Project Performance During Changes

In this study, I undertake the exploration of the environment-fit contingency hypothesis by studying the moderating role of situational changes on the relationship between TMMs and adaptive performance. As noted in the introduction, cognition plays a fundamental role for team adaptation but most of the work that addresses the relationship between team cognition and team adaptation is theoretical. We need therefore direct tests of these relationships to determine in what contexts and to what extent team cognition contributes to higher adaptive outcomes. In deriving the hypotheses, I draw on process based models of team adaptation and on individual problem solving research. The theoretical model of team adaptation of Burke et al. (2006) describes team adaptation as a process unfolding through four stages: situation assessment, plan formulation, plan execution, and team learning. When teams meet changes, first they orient their attention to the change and try to construct a meaning for the novel situation. This initial phase of adaptation is termed situation assessment. Then based on the information gleaned from the environment and on the cognitive representations of the changed situations the teams develop a plan to address the changes. In a third phase, the teams execute their derived plans. The final phase is learning which addresses the teams' emergent understanding from the situations experienced and the actions taken to address them. In this work, I will focus on the situation assessment and plan execution stages.

Situation assessment, which represents the first stage of adaptation, is triggered by cues in the environment suggesting a discrepancy between the current and past situation elements or between current and future levels of performance. These cues activate mental models, which represent meaningful patterns or organized knowledge structures that are stored in long-term memory. Mental models are used to understand and integrate the cues by relating them with past knowledge and experiences (Mumford et al., 1994). Cues may trigger the activation of one or multiple mental models that can be used to explain the current situation. The interpretation of the cues using mental models influences how teams construct the situation cognitively and it influences the actions they take further with respect to altering or redefining goals, plans, and action strategies. Therefore, the role of mental models is crucial at the early adaptation stages. If members do not interpret the cues appropriately or if they develop a less comprehensive view of the environment this may lead the team on the wrong path, it may lead to the development of incomplete or inaccurate action plans and subsequently impair actions and performance. Therefore, the mental models constructed during the situation assessment phase of team adaptation should bear highly on future team adaptation and performance.

Research on problem solving states that in order to effectively solve complex and ill-defined problems, the problem solver must spend deliberately time on the problem construction stage (e.g., Baer, 1988; Chi, Feltovich, & Glaser, 1981; Reiter-Palmon, Mumford, O'Connor Boes & Runco, 1997; Scott, Leritz & Mumford, 2004), which represents the stage when the problem solver defines the problem and its elements (Reiter-Palmon, Herman, & Yammarino, 2009; Reiter-Palmon, Mumford & Threlfall, 1998). This research emphasizes the relevance of deriving multiple perspectives and the activation of multiple problem representations which are then used to understand the problem elements and their relationships (Simon, 1977; Jonassen, 2000). Recall that the environment that the team faces can be defined in terms of its path/goal structure. Focusing on environments with a multiplicity of goals and paths, in this work I expound the arguments for the relevance of dissimilar mental models for team adaptation.

I suggest that teams that are able to derive a multitude of representations to characterize the changed situations may be at an advantage compared with teams that are able to derive only similar types of interpretations of the changed situation. Forming similar representations may restrict the scope of adaptation, the comprehensiveness of the problem solving approaches derived, and ultimately the adaptation outcomes (Gavetti & Levinthal, 2000). Teams with different mental models may be able to derive different interpretations and apply them to the changed situation (Kellermanns, Floyd, Pearson, & Spencer, 2008; Levesque et al., 2001). This expanded view provides the potential for complex problem solving, the derivation of multiple action strategies, and the creation of more comprehensive plans on which to base future actions.

However, I move away from a static view on the influence of TMMs on performance and propose a temporal mechanism via which TMMs influence performance. I submit that a TMMs convergence-divergence mechanisms may be more effective in deriving proper solutions for dealing with changing situations than TMMs divergence alone. The diversity of representations is not sufficient for enhancing adaptive outcomes (e.g., Fiol, 1994; Simsek, Veiga, Lubatkin, & Di, 2005). Members may need to derive an integrated understanding that will guide their actions steps (e.g., Crossan, Lane & White, 1999). Diverse representations at the situation assessment phase of adaptation ensure that the teams will derive comprehensive views of the changed situations. But only a diversity of views is not sufficient to respond to these situations.

This is because in the next steps the teams must derive an integrated action response plan and they must implement this plan. In other words, the team must select among the multiple representations derived or the members must combine these representations into a novel representation that fits the new context (Gavetti & Warglien, 2011; Reiter-Palmon et al., 2008). Therefore, I submit that in order to adapt to changes the teams must critically use their cognitive resources, drawing on their diversity in initial stages and then pooling their perspectives and converging on a new view in subsequent adaptation stages.

In summary, this study addresses the following gaps in the literature on the relationship between TMMs and adaptive performance: it assesses the role of TMMs for the theoretically derived first (situation assessment) and last (plan execution) stages of the Burke et al. (2006) theoretical team adaptation model. This focus is important because while there is some literature on the relationship between team adaptation and TMMs, the relationships stated have not been investigated empirically. We need to know how these theoretically defined relationships play out in actual empirical studies in order to move the literature forward. Only by assessing the relationship between team adaptation and TMMs empirically in real samples we can determine which steps of the adaptive process relate in which way with TMMs. This will enable us to build better models of adaptation and TMMs and to qualify current models.

Second, TMMs have been regarded as dynamic constructs that are changeable over time as a function of the team's performance environment, but with few exceptions (e.g., Mathieu et al., 2000), most of the studies have treated the construct as stable, assessing only cross-sectional relationships. Considering that the models of team adaptation address longitudinal, dynamic relationships, this study aims to fill this gap by assessing the TMM construct and its relationship with adaptive performance longitudinally. Third, there have been recent calls (Badke-Schaub et al., 2007; Mohammed et al., 2010) to assess the relationship between TMMs and performance criteria such as innovation and creativity but so far there have been no attempts to capture these relationships—this is the third area that this study aims to cover.

With respect to the linkages with the theoretical framework outlined in the previous chapter, this work tests Proposition 4 and Proposition 8. To be more specific, the tasks on which the teams worked in this study can be described as complex, tightly coupled, and with a equifinal-multifinal goal structure. This corresponds to the definition of creative project development tasks as ill-defined, which refers to the lack of a clear problem representation at work onset, and ill-structured, which refers to the lack of a clear structure at the onset of the task. Thus, Proposition 4 proposes that in such environments team performance is enhanced when members develop dissimilar TMMs. Proposition 8 proposes that local changes in complex, tightly coupled environments, and with an equifinal-multifinal goal structure can be best managed by developing dissimilar TMMs. Since the teams in this study faced a local change midway through their task performance, this study directly tests this proposition. Further qualifying the theoretical arguments advanced in the theoretical chapter, I include a temporal component by testing not only the relationship between TMMs and performance in certain environments at one time point but tracking the development of TMMs across different adaptation episodes and their relationship with performance. In the following, I review the role of TMMs for performance during changes emphasizing both the role of divergence and the role of TMMs convergence.

1. **Situational changes, TMMs dissimilarity, and performance**

A situational change refers to a challenge for which the team does not have preexisting resources, developed strategies, solutions, or means to deal with (Gersick & Hackman, 1990). A change can be represented for example through team structural changes, stressful events, problems or errors, new task procedures, new task requirements, membership changes, unexpected and challenging events, or resource changes. Previous studies have examined the effect of different types of nonroutine events or changes on team adaptation (e.g., Ellis, 2006; Kanki et al., 1991; LePine, 2005; Stachowski et al., 2009; Waller, 1999; Waller et al., 2004) or more specific types of changes such as structural changes (e.g., Beersma et al., 2009; DeRue et al., 2008; Hollenbeck et al., 2011; Johnson et al., 2006; Moon et al., 2004).

In essence a change means the alteration of the values of a previous state that demands attention and active intervention in order to reestablish the equilibrium existent before the change or to establish a new equilibrium. During the initial moments of a change, there are no clear definitions of the situation—the states of the world have changed—and no clear ways to approach its resolution. At the most, the team has to rely on redefining the meaning of the task and taking actions within a new frame. But the changed situation may admit one or multiple redefinitions of the task such that limiting attention to only one of the possible alternative definitions may constrain the team's capacity to adapt (Gavetti & Levinthal, 2000; Hutchins, 1991; Klahr & Dunbar, 1988; Sayama et al., 2011; Schwenk, 1986; Skilton & Dooley, 2010; Staw, Sandelands, & Dutton, 1981).

In this case, members forming similar TMMs will tend to attend to similar change related cues and thus create similar new mental models of the situation or generally of their team, task, and team interaction (Hutchins, 1991). The amount of external information available to the team will be restricted by the frames they impose on the situation, such that even if more information can be available for adaptation the members will likely not attend to it (Gavetti & Levinthal, 2000). This limits the inclusiveness of goals and strategies the team derives and further leads to a restriction in the range of behavioral responses. Mental models that overlap to a great extent may reduce the likelihood that members will engage in novel behaviors or express dissenting opinions and disagreements, which further reduces the likelihood of novel behavior (Gersick & Hackman, 1990).

Thus, to enable a comprehensive assessment of the changed situation, team members may need to form dissimilar mental models of the new task conditions (Hutchins, 1991; Gavetti & Warglien, 2007). In this regard, members may attend to different information and their joint representation may provide a more complete view of the environment. Or members may attend to the same information, but tie the elements via different relationships or assign them different meanings (Hutchins, 1991). In the first case, they may consider different goals for the changed situation; in the second case, they may consider the same goals but relate the goals and the goals achievement strategies differently. Assuming that two distinct representations provide a more complete view of the changed environment (Mumford et al., 1994), their sharing and integration will offer members a new more comprehensive representation, different than their individual previous representations, thus carrying larger potential for their collective adaptation (Crossan et al., 1999; Fiol, 1994; Weick & Meader, 1993). This requirement for dissimilarity applies both to task TMMs, which refer to knowledge of the team's task requirements, procedures, and strategies, and team TMMs which refer to knowledge of the team's interaction, roles, and responsibilities.

For example, a project team is required to suggest new strategies to address the teacher selection problems of a school. Members have available certain resources, certain knowledge related to the goals and priorities of the school, and a palette of strategies that may be effective in addressing the problems. In a team, two members may view the project budget as highly related with the strategies that can be developed to address the problems. In another team, one of the members may view the budget unrelated while another highly related with the potential strategies. In the first team, members will be able to derive a coherent plan for solving the problems based on common agreement. In the second, members may not agree on the overall plan but they have a more diverse view on the potential actions. One of the members will pay attention to the resource constraints, while the second will derive different strategies that do not account for the resource constraints.

Together, they are able to derive more potential actions and strategies emerging from their different approaches and perspectives. This assumes that teams that are able to form dissimilar TMMs of their tasks are better able to manage the task requirements when these call for different understandings and approaches. Therefore, the teams that are able to relate their goals, strategies, and resources in different ways may derive different definitions of the task and by working within each definition or by combining these definitions they may derive more comprehensive problem solving approaches (e.g., Hutchins, 1991; Gavetti & Warglien, 2007; Sayama et al., 2011).

Similarly, the team may find itself in an impasse with respect to the effective team interaction strategies (Brown & Eisenhardt, 1997; Moorman & Miner, 1998). In some teams, members may tie the situation change with an awareness of the team goals, which assumes that the team must work together to overcome the changes and meet the goals. In other teams, there may be an awareness of the immediate task requirements, which means that the team must develop a shortsighted view and address the immediate problems. In yet other teams, one member may be aware of the goals and another of the task requirements, which affords them to address the changes keeping in sight both the short and the long-term requirements. This latter strategy is more effective because it accounts for a proper distribution of labor and affords comprehensive action and interaction potential. Therefore, in an adaptation framework, members may be better able to manage the changes that they encounter when they hold both a diverse view of their task requirements and of their team.

There is support generally in the strategic management literature that top management teams that have a variety of cognitive frames deal better with the demands of changing environments. Carpenter and Fredricksen (2001) found that educational diversity had a positive relationship with global strategic posture under high environmental uncertainty. Cannella et al.,

(2008) found that intrapersonal functional diversity had a stronger relationship with firm performance as environmental uncertainty increased. Dess and Origer (1987), Dess and Priem (1995), and Priem (1990) also argued that in more complex and dynamic environments, more heterogeneity in the top management team will be associated with higher firm performance. More close to this investigation, Marta, Leritz, and Mumford (2005) found that heterogeneous teams working on the resolution of organizational case studies had a higher performance when they met changes in the form of changed task requirements than teams that had homogeneous views. This leads to my first hypothesis, with respect to the role of dissimilar TMMs for team adaptation during changes:

Hypothesis 1: Situational changes will moderate the effect of task and team TMMs similarity on performance such that teams with more similar task and team TMMs will have a lower performance than teams with more dissimilar TMMs.

2. **The role of TMMs convergence**

I argued that the benefits of holding dissimilar TMMs may be enhanced when teams are facing situational changes to which they have to respond by deriving complex and comprehensive responses. In this section, I qualify these assumptions by considering the role of time. During the situation assessment phase of adaptation, members need to derive diverse mental models of the new task requirements and the possibilities for their implementation in order to obtain a comprehensive representation of the situation (Hutchins, 1991; Mumford et al., 1994). But so much diversity in understandings may ultimately hurt team performance when members are not able to also converge on some interpretation, either by selecting among the members' proposed interpretations or by combining their views and creating a new team specific representation (e.g., Fiol, 1994; Ford & Sullivan, 2004; Gavetti & Warglien, 2007; Hutchins, 1991; Kaplan, Brooks-Shesler, King, & Zaccaro, 2009; Kilduff et al., 2000; Mannix, Neale, & Goncalo, 2009; Pearce & Ensley, 2004). In problem solving, this corresponds to the selection and implementation of some of the solutions proposed. There is much support in the creative problem solving literature that both divergence and convergence of mental representations are necessary for successful problem solving, albeit at different stages of the problem solving process. Since I argued that adaptation is a form of problem solving process, I submit that this team and task TMM divergence-convergence mechanism applies for team adaptation.

Ford and Sullivan (2004) advance a model of creativity based on the punctuated equilibrium model of group development of Gersick (1988). They argue that novel contributions are beneficial to project team performance especially early during the team development when the team's goals are to learn more about the problem, search for information, and derive potential solutions. After the midpoint transition however, when the team must execute the plan, additional novel contributions may hurt performance. Therefore, what is required is early diversity but later convergence in order to derive and implement creative solutions to problems. Kaplan et al. (2009) in addressing the creative problem solving stages, similarly argue that the generation of ideas requires divergent thinking from team members. However, idea implementation depends on the opposite of divergence, that is team conformity. In their model, team conformity at the implementation stage contributes to effective coordination, information exchange, conflict management, and collective efficacy. On a similar note, Walsh et al. (1988) discuss that high diversity of perspectives and low consensus is necessary at early stages in the decision making process to ensure that the group has a diverse outlook on the situation but at later stages higher consensus is necessary for decision implementation. Some empirical support already exists for these assertions.

Kilduff et al. (2000) found that high performing diverse top management teams had a diversity of interpretations at the beginning of their work on a simulated organization but had more convergent interpretations towards the end of their performance. Fiol (1994) describes the consensus building process of a project team around the interpretation or framing of issues. At the beginning of the project, members held diverse interpretation contents and framed issues differently but towards the end of their performance they framed issues related to the definition of the project and its potential contribution to the business similarly. Utterback and Abernathy (1975) found that more flexible or unstructured approaches were more appropriate for the initial stage of idea development during new product development but that during the implementation stage mechanistic structures were more favorable.

Agent based simulation work also sustains the relevance of this divergence-convergence mechanism. Hutchins (1991) showed that a high level diversity in the members' cognitive frames can hurt decision making and performance. Members that depart too much in their interpretation from others and when there are no mechanisms in place to support their convergence may fail to agree on one representation. Essentially, the individuals pursue their own different interpretations in the problem space without regard for the other members which ultimately hurts their cohesion and performance. More recently, Gavetti and Warglien (2007) showed in a simulation that diversity of interpretations is valuable to problem recognition in strategic decision making only when the mechanisms are put into place to help members converge on a shared interpretation.

Consistent with this evidence, I submit that at later stages of problem solving, more TMMs convergence is needed. Without convergence, members may flounder at implementation, unable to select among one of their representations that defines the course of action or they may select too many representations on which to act, which is ineffective (e.g., Hutchins, 1991). Therefore, the extent to which they are able to diverge but later to converge on a representation of the problem should determine the effectiveness with which they are able to adapt to a changing situation. Therefore, I advance:

Hypothesis 2: Task and team TMMs convergence will have a positive effect on project team performance.

3. Cognitive content vs. cognitive structure

Research in strategic management proposes that teams that are heterogeneous on aspects such as functional and educational background will reap the benefits of diversity by deriving novel, effective, and efficient products and by overcoming changes in their performance environment (Dess, 1987; Hambrick & Mason, 1984; Priem, 1990). Functional and educational background should provide the diverse cognitive content required to manage diverse environments. But while content may be useful in the derivation of novel strategies and task approaches, research consistently shows that the organization of knowledge as reflected in TMMs is most predictive of outcomes (DeChurch & Mesmer-Magnus, 2010b). Consistently, I advance that at early stages of situational changes dissimilar TMMs should influence team outcomes more than proxies of cognitive diversity such as functional and educational background. To directly test this hypothesis, I formed interdisciplinary teams and assigned them to work on a project development task on which they faced unexpected changes. The extent to which TMMs dissimilarity will explain more variance in outcomes as opposed to educational background diversity will determine whether the organization of knowledge (Walsh et al., 1988) or its content (Hambrick & Mason, 1984) matters more for team outcomes. Therefore, I also advance that:

Hypothesis 3: Initial TMMs similarity will explain variance in team performance over and above educational diversity.

I take a temporal approach and assess the TMM construct both midway through the team's work, when the teams receive a change, and at the end of the task to determine whether the effect of TMMs on performance is different at different stages of performance, as the study hypotheses suggest. The relationships proposed are depicted in Figure 1.

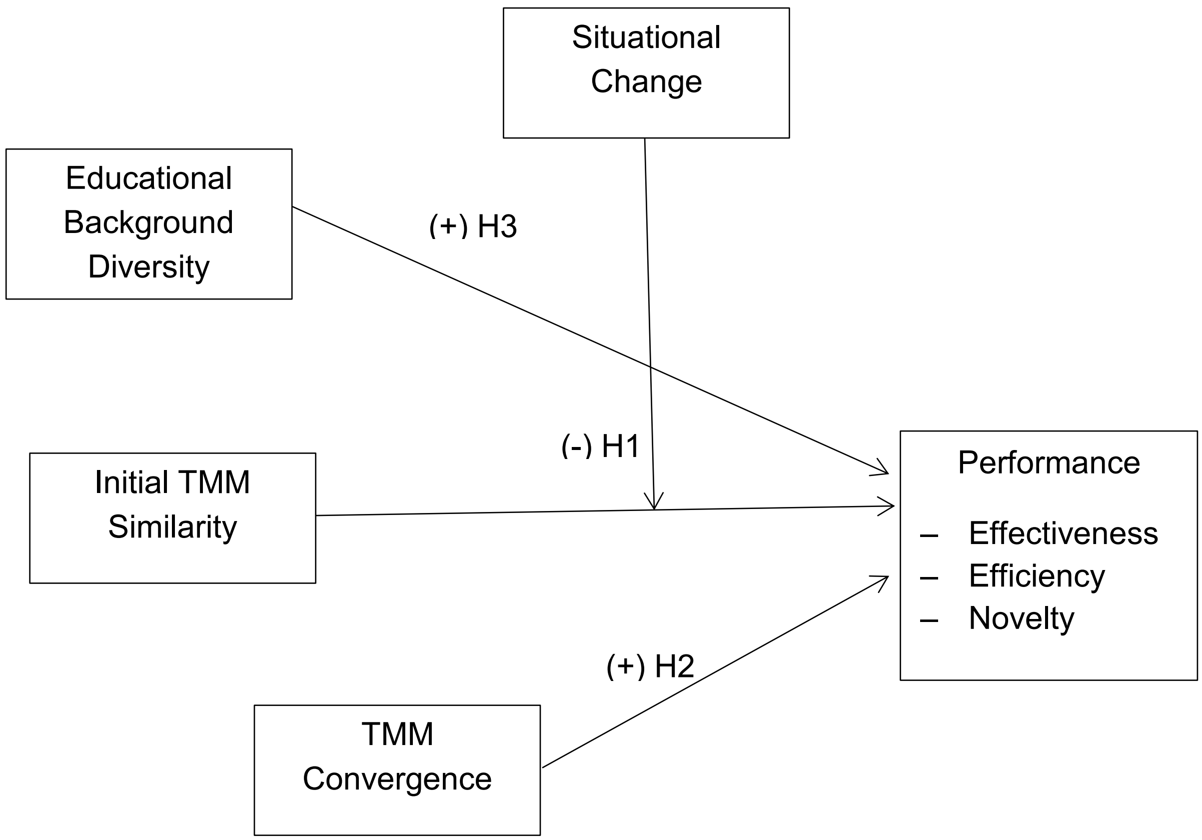

Figure 1. The effect of initial TMMs similarity and TMMs convergence on performance in relations with the changes experimental condition

TMM = Team mental model.

4. Performance

I also aimed to expand the scope of the study by including a set of outcomes that have not been considered in previous work on TMMs. Specifically, I studied project teams which can be described as teams that develop one-time products or services, working on non-repetitive task that require the application of knowledge, judgment, and expertise (Cohen & Bailey, 1997). Project outcomes are typically defined in terms of the effectiveness and efficiency of the derived solutions (e.g., Pinto & Prescott, 1990). Effectiveness refers to how relevant and valuable the solutions proposed are from a customer point of view, here the fictional organization. Efficiency refers to how much the solutions include an awareness of time, resources, and budget constraints. In addition to these two dimensions, the novelty of the project solutions is a criterion that emerges as particularly relevant in work on creative problem solving. Since I draw on the creative problem solving research (e.g., Mumford, Supinski, Baughman, Constanza, & Threlfall, 1997) and the study task is constructed with a multidimensional outcome view in mind, I also assess the novelty of the teams' project. Novelty refers to how original the solutions proposed are, how many new elements that are specific to the group they introduce, how well the team managed to combine diverse elements to reach novel solutions, and the magnitude or level of impact of the solutions proposed for the customers. I assessed these dimensions using multidimensional scales for a comprehensive representation. In deriving these measures, I drew on exemplary work in project management that refers to project success criteria (Lipovetsky, Tishler, Dvir, Aaron, & Shenhar, 1997) and on work in creative problem solving (e.g., Mumford et al., 1997).

5. Method

5.1. Sample

To test the study hypotheses, a 2 (similar/diverse group educational background composition) x 2 (situation change/no situation change) experimental study was conducted. Participants (N = 117) were undergraduate and graduate students enrolled in psychology, business administration, and economics courses at a public university in Eastern Germany. Fifty-eight percent of the participants were female and their age ranged from 18 to 36 years (M = 24; SD = 2.56). Participants were randomly assigned to 39 three-person teams based on their educational specialization, forming 21 diverse teams (psychology, business administration, and teaching studies, one member from each specialization per team) and 18 similar teams (three members with the same specialization in each team). Teams were then randomly assigned to a change (10 similar teams and 11 diverse teams) or no change (8 similar teams and 10 diverse teams) condition. For their participations, members received a compensation of 24 euro.

5.2. Task

Participants were assigned the role of process improvement consultants working within a team to help a school, Eastwood School, improve its teacher recruitment and selection strategies.

They were required to complete a plan template describing: the strategies the school would need to take to address its organizational problems, the resources (material, personnel, and budget) required for implementing the strategies, the timeframe of implementation, the potential implementation risks, and outcomes of strategies implementation. The information package contained a three-pages case study, an additional three pages describing school material and personnel resources, and the school schedule of events, and a two-pages project plan template for the group work.

The case study was designed based on human resource management case studies used in academic courses to train students' practical skills, and it is consistent with previous work that has explored the relevance of different contexts for the development of team cognitive representations (e.g., Marta et al., 2005; Mohammed & Ringseis, 2001). It described the general background of a secondary public school (e.g., size, workforce composition), the school's teacher attraction and selection strategies, and an assessment of these strategies, noting weaknesses and areas requiring improvement. Weaknesses referred to the school's limited teacher attraction strategies, inappropriate job applicant screening, limited selection strategies, and inappropriate job applicants interviewing strategies. The requirements specified that members had to work as a team using the information available to address the recruitment system and selection system issues. In addition to the materials, they had available a fictional budget of 5000 Euro for the task, among which 3500 Euro were assigned for improving the recruitment system and the rest for improving the selection system. Teams in the study thus represent project teams, which can be described as teams that develop one-time products or services, working on non-repetitive task that require the application of knowledge, judgment, and expertise (Cohen & Bailey, 1997).

5.3. Procedure and experimental manipulation

The experiment was conducted within a laboratory consisting of eight adjacent rooms each with a three-person working space. Each experimental session lasted for two hours and forty minutes on average. Upon arrival at the study setting, participants were directed to their group work rooms, according to assignment to the diverse or similar experimental condition, where they read and signed informed consent, read individually the study information pack, completed a background questionnaire, and then started working on the task with their group members.

After 35 minutes of work, teams were assigned to the second experimental condition (change/no change). At this point, members of teams assigned to the change condition received individual sheets consisting of one paragraph of information specifying a change related to the task requirements requested by school management. The change information stated that the school received complaints from former job applicants regarding the fairness of its selection practices (i.e., unequal employment opportunities, discriminatory questions during interview). Based on these complaints and governmental equal employment regulations, they were required to specify strategies addressing these problems by focusing on the school selection system as an improvement priority, and redistributing their budget (1500 Euro for improving the recruitment system and 3500 Euro to improve the selection system), and their resources to reflect this change.

After reviewing the change information individually, members completed the task and team TMMs questionnaires, and thereafter resumed their work for another 35 minutes. Teams assigned to the no change condition completed the TMM questionnaires at the same time with the teams in the change condition. The analysis of the video data showed that most teams took the new challenge seriously and they tried to incorporate the new information about the change in their work. When the task was over, participants completed the second set of mental models measures, and were rewarded, debriefed, and dismissed. Mental model assessment will be referred to as Time 1 (35 minutes into the task) and at Time 2 (at task completion).

5.4. Measurement

Item translation

The study questionnaire items were translated independently from English to German by two research assistants with a background in psychology following the procedures recommended by Brislin (1980). The translators met to clarify disagreements and select optimum translated content. Additionally, the appropriateness of the translation was checked by two native German speakers, doctoral students with a background in psychology.

5.4.1. Team mental models

Task mental models. Mental model similarity was operationalized using the Pathfinder (PF) network algorithm (Schvaneveldt, 1990) which derives network representations of each individual's knowledge in the form of PF networks representing connections among mental model concepts (Cooke et al., 2004). The task mental model content was identified by a documentation analysis and by consulting a project management expert to further clarify item content and improve item representativeness. Nine items were identified via the task analysis which were organized into 8 x 9 association matrices. Team members rated how similar the concepts were using a 7-point scale ranging from 1 (*not related*) to 7 (*highly related*) for a total of 36 ratings. The following items were derived: “recruitment sources diversification”, “project constraints”, “school goals and priorities”, “recruitment methods improvement”, “selection methods diversification”, “selection methods improvement”, “school internal practices”, “causes of the school problems”, “plan effectiveness”.

The ratings were submitted to Pathfinder and pairwise TMMs similarity was assessed using the metric of closeness (C) which calculates the similarity between two members’ PF networks. The index ranges from 0 to 1, higher values indicating higher similarity. The team level TMMs similarity was then derived by aggregating the three resulting similarity indices at the team level. Similarity scores per team ranged from .14 to .45 for Time 1 and from .13 to .56 for Time 2.

Team mental models. The content of the team TMMs was derived based on a literature review of the important team interaction skills required for working on project and problem solving tasks, adapted to the content of the task (Cannon-Bowers, Tannenbaum, Salas, & Volpe, 1995; Mumford, Schultz, & Van Doorn, 2001; Taggar & Brown, 2001). The following items were derived: “define problems”, “priority setting”, “development of an action plan”, “focus on the task”, “strategy or plan changes”, “reaching an agreement”, “focus on the goal”, and “task awareness”. The eight concepts were organized into 8 x 7 association matrices which were rated by team members on a 7-point scale ranging from 1 (*not related*) to 7 (*highly related*), for a total of 28 ratings per team member. As with the task mental models, the individual ratings were submitted to PF to derive individual knowledge networks which were subsequently compared pairwise within each team. The team mental model similarity score was derived by averaging the three pairwise similarity indices. Similarity scores per team ranged from .17 to .61 for Time 1 and from .14 to .62 for Time 2.

5.4.2. Performance

The assessment of team performance was based on a rating scale that I developed drawing on the relevant literature on team innovation and project planning (e.g., Besemer & Quin, 1999; Cropley, Kaufman, & Cropley, 2011; Lipovetsky et al., 1997; Marta et al., 2005; Mumford et al., 2001; Pinto & Prescott, 1990; West, 2002). Specifically, each team’s plan was rated on nine subdimensions represented by between 2 and 9 items on a 7-point scale (45 items in total), ranging from 1 (*does not apply to the actions described in the plan*) to 7 (*applies to all actions in* *the plan*). The subdimensions represented were: plan efficiency—6 items (e.g., “There is a detailed budget for the project.”, α = .85), plan action relevance—5 items (e.g., “Actions serve the purposes described in the plan statement and case description.”, α = .87), implementability—3 items (e.g., ”The actions, as they are specified in the plan, can be translated into realized actions, put into practical effect.”, α = .81), value-added—4 items (e.g., “The extent to which actions add value more than if they were not implemented or beyond other actions.”, α = .84), impact—9 items (e.g., “The implementation of the actions proposed will place much demand on the organization.”, α = .81), originality—2 items (e.g., “The extent to which the actions proposed are unique and elicit surprise on the part of the evaluator.”, α = .96), novelty—8 items (e.g., “The group approached the problem in a novel, imaginative, unpredictable, or innovative manner.”, α = .95), outcomes—4 items (e.g., “The outcomes described in sufficient detail for the stakeholders to have a clear perspective on the areas that will be improved, how, and how much.”, α = .96), and risks—4 items (e.g., “The risks for the actions suggested in terms of specific causes, constraints, restrictions on actions are described in the plan.”, α = .97).

These dimensions were derived such that they map onto the areas covered in the teams' plan development, specifically the strategies developed (elaboration, implementability, relevance, value, originality, novelty, impact) and the resources estimated (plan efficiency, risks, and outcomes). These dimensions are consistent with previous research on creativity that assesses the quality and the originality of the products (e.g., Besemer & Quinn, 1999; Mumford et al., 1997), where quality is defined in terms of completeness, coherence, and usefulness of the solution, and originality in terms of newness and unexpectedness of the solution. I added efficiency outcomes since they are relevant for work on project development tasks such as the one used in this study (e.g., Lipovetsky et al., 1997).

The author and a second rater, that received a theoretical and applied five-hour training, rated the study teams' plans on these dimensions. All team identifying information was removed from the materials before rating. The intraclass correlations ICC(1) and ICC(2) values for interrater reliability were in general above the recommended thresholds, thus: outcomes – ICC(1) = .78, ICC(2) = .86; risks – ICC(1) = .71; ICC(2) = .83; novelty – ICC(1) = .77, ICC(2) = .87; originality – ICC(1) = .68, ICC(2) - .81; impact – ICC(1) = .69, ICC(2) = .82; value – ICC(1) = .66; ICC(2) = .80; implementability – ICC(1) = .71; ICC(2) = .83; relevance – ICC(1) = .80; ICC(2) = .89; efficiency – ICC(1) = .82; ICC(2) = .90. Considering this positive evidence regarding interrater reliability I averaged the scores offered by each rater per subdimension to form a unique subdimension score (e.g., the score of rater one for relevance and of rater two for relevance were aggregated to form a new score).

A principal component factor analysis with varimax rotation was performed on the aggregated subdimensions scores. Results showed that the subdimensions loaded onto three distinct factors, explaining 73.23 % of the scale variance. The first factor labeled performance effectiveness consisted of the following subdimensions: value, relevance, and implementability (12 items), explaining 26.51 % of the scale variance ($\alpha = .71$); the second factor labeled performance efficiency consisted of the following subdimensions (8 items): outcomes and risks, explaining 14.72 % of the scale variance ($\alpha = .55$); the third factor labeled performance novelty consisted of the following subdimensions (19 items): impact, originality, and novelty explaining 31.99 % of the scale variance ($\alpha = .86$). The subdimension efficiency was removed due to cross-loading more than .40 on the factors novelty and effectiveness. The factor dimensions were in general not correlated. These dimensions are also consistent with the ones derived in previous work on individual and team creativity outcomes (e.g., Marta et al., 2005).

5.4.3. Control variables

Since task experience may determine the task mental models that individuals form, the following variables were measured and controlled in the analysis: experience in project management, number of project management projects in which they participated, average length of project, experience in the human resources domain (academic or work), team experience (academic or work). I also controlled for age, gender, academic grade, number of years of employment, and academic specialization. Since these controls did not relate to the study variables, they were not included in the analysis.

5.4.4. Manipulation check

To check whether the change manipulation was effective, participants answered, at Time 2, items regarding the perceived task workload and their perceptions of change. Task workload was measured using the NASA task workload index (TLX, Hart & Staveland, 1988) ($\alpha = .79$; $r(wg) = .78$; ICC(1) = .24). The perceptions of change were measured using two items ($r = .53$, $p < .001$; $r(wg) = .57$; ICC(1) = .07): “Our task requirements changed many times during our performance” and “I experienced major changes in the task requirements”, assessed on a 7-point scale from 1 (*does not apply*) to 7 (*applies to a large extent*). Although the means were in the expected direction, results showed that groups in the changes condition did not experience higher task workload ($t(37) = 1.08$, $p = .29$, $M_{changes} = 4.56$ vs. $M_{control} = 4.31$) or higher perceptions of change ($t(37) = 1.46$, $p = .15$, $M_{changes} = 3.34$ vs. $M_{control} = 2.95$) than groups in the control condition. With respect to the perceptions of change, this may reflect that participants experienced a unique change that was of moderate magnitude and not major multiple changes.

Additionally, to control for possible effects of team familiarity, participants were asked how acquainted they were with their group members prior to the study. Ninety-four percent of the participants indicated that they never met their group members prior to the experiment, five participants indicated that they have met some of their group members but are not formally acquainted, and two participants indicated that they were close friends with some of their group members.

Analysis Strategy

To test the study hypotheses, a series of univariate and multivariate analysis of variance, and regression analyses were conducted. To account for the limited power, significant results are reported at $p < .10$.

6. Results

Table 1 summarizes descriptive statistics and zero-order correlations among the main study variables.

Table 1. *Means, Standard Deviations, and Correlations Among the Study Variables*

	M	*SD*	1	2	3	4	5	6	7
Efficiency	4.24	1.05	1						
Effectiveness	5.81	0.61	.18	1					
Novelty	5.08	0.78	.23	-.19	1				
Task TMM T1	0.29	0.07	.15	.28	-.09	1			
Task TMM T2	0.32	0.09	.19	.14	-.15	.47**	1		
Team TMM T1	0.36	0.12	.13	.27	-.33†	.40*	.38*	1	
Team TMM T2	0.36	0.12	.17	.01	.05	.24	.24	.56**	1

Note. $N = 39$. TMM = team mental model. T1 = Time 1. T2 = Time 2.

† $p < .10$. * $p < .05$. ** $p < .01$

6.1.Hypothesis 1

Hypothesis 1 predicted that the relationship between TMMs similarity and performance will be moderated by whether teams are exposed to change or not. To test this hypothesis, the product terms computed between the task and team TMMs and the experimental condition (change/no change) were added at step two of the each of the regression models for the separate performance dimensions, after including the experimental conditions and the task and team TMMs variables. All variables were centered prior analysis (Aiken & West, 1991). Change was coded 0 for the teams in the no change condition and 1 for the teams in the change condition. These relationships are represented in Table 2.

Table 2. *The Direct and Moderated Effect of Time 1 Team Mental Model Similarity on Performance*

Predictor	Effectiveness		Efficiency		Novelty	
	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2
Change[a]	-.26	-.26	-.2.39**	-3.08**	0.04	-.10
Diversity[b]	.65†	.73†	-.91	-1.04*	-.42	-.63
Diversity x Change	.17	.08	2.83**	4.10**	.32	.78
Task TMM T1	-.11	-1.18	2.52	5.24†	1.62	4.74
Team TMM T1	.30	.77	-2.50	-.82	-2.41	-3.22
Task TMM T1 x change		4.10		-11.36†		-12.22*
Team TMM T1 x change		-1.66		-5.96		2.84
R^2	.35	.38	.41	.60	.17	.32
F	2.28†	.49	3.03*	4.80*	.88	2.25

Note. $N = 39$. TMM = team mental model. T1 = Time 1. Values reported are unstandardized betas.

[a]Change = 0 for groups in the no change condition and 1 for groups in the change condition.
[b]Diversity = 0 for the groups with similar composition and 1 for groups with diverse composition.
† $p < .10$. * $p < .05$. ** $p < .01$.

For performance effectiveness, the experimental conditions, diversity and change, the interaction between the experimental conditions, and the task and team TMMs variables explained .35 of the variance at the first step of the analysis ($F(5,21) = 2.28$, $p < .10$). The addition of the interaction between the Time 1 task and team TMM variables explained an additional .03 of the variance ($F(2,19) = .49$, $p = .62$). None of the interactions between the TMMs variables and the experimental condition were significant.

For performance efficiency, the experimental condition, the interaction experimental conditions, and the team and task TMMs variables explained .41 of the variance ($F(5,22) = 3.03$, $p < .05$). The addition of the interactions between the Time 1 task and team TMMs similarity variables explained an additional .19 of the variance ($F(2,20) = 4.80$, $p < .05$). The interaction between Time 1 task TMM similarity and the change experimental condition was marginally significant ($b = -11.36$, $SE = 5.91$, $p = .07$). To expound the nature of this interaction, we performed simple slopes tests according to the indications of Aiken and West (1991). The results showed that teams in the no changes condition had a higher performance efficiency when their Time 1 task TMMs were more similar ($b = 5.24$, $t(20) = 1.76$, $p = .09$) and that teams in the changes condition had a lower efficiency when their Time 1 task TMMs were more similar ($b = -6.11$, $t(20) = 1.20$, $p = .25$) although the later effect was not significant. These interactions are represented in Figure 2.

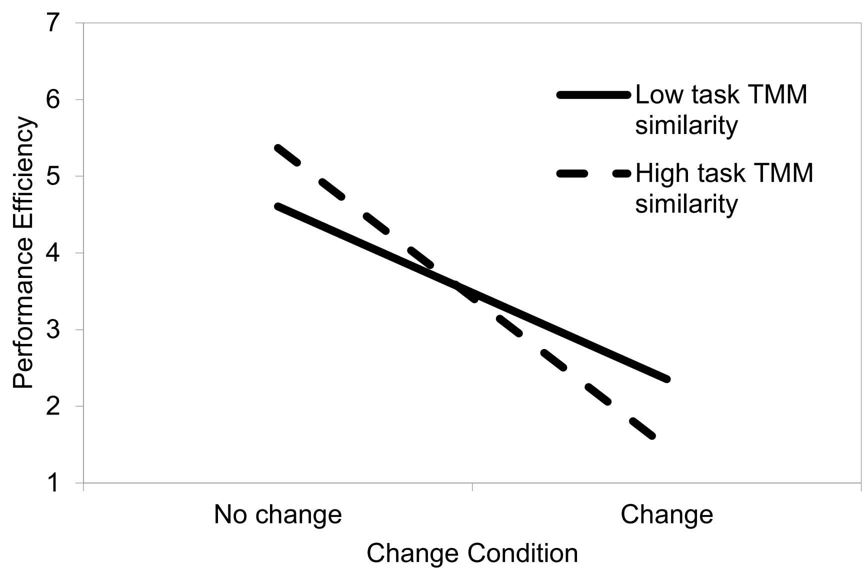

Figure 2. The effects of Time 1 task TMM similarity on team performance efficiency for teams in the change and no change condition

For performance novelty, the experimental condition, the interaction between the experimental conditions, and the team and task TMMs variables explained .17 of the variance ($F(5,22) = .88$, $p = .51$). The addition of the interactions between the Time 1 task and team TMMs similarity variables explained an additional .15 of the variance ($F(2,20) = 2.25$, $p = .13$). The interaction between Time 1 task TMMs similarity and the change experimental condition was significant ($b = -12.22$, $SE = 5.76$, $p < .05$). To determine the nature of this interaction, simple slopes analyses were conducted. Results showed that Time 1 task TMMs similarity had a positive effect on the performance novelty of teams in the no changes condition ($b = 4.74$, $t(20) = 1.63$, $p = .11$) but that it had a negative on the performance novelty of teams in the change condition ($b = -7.48$, $t(20) = 1.50$, $p = .14$). These interactions are represented in Figure 3. These findings partially support Hypothesis 1—only the interaction between Time 1 task TMMs similarity and the change condition affected performance efficiency and performance novelty in the predicted direction, but the interaction between Time 1 team TMMs similarity and the experimental condition did not show the predicted pattern of relationships.

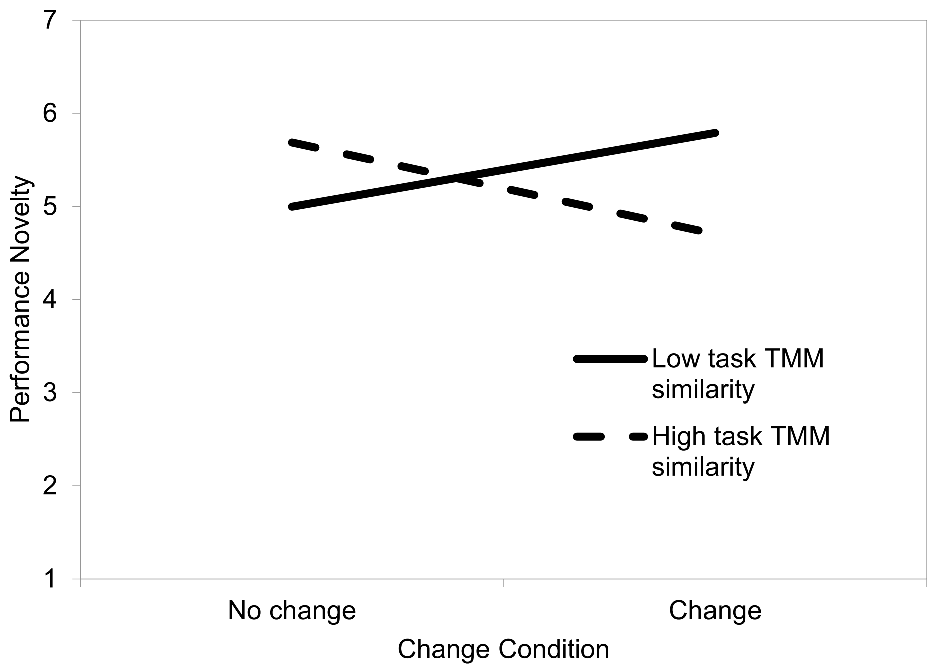

Figure 3. The effects of Time 1 task TMM similarity on team performance novelty for teams in the change and no change condition

6.2.Hypothesis 2

Hypothesis 2 stated that teams that increase their TMMs similarity from Time 1 to Time 2 will achieve higher performance. Before testing this prediction, I checked whether TMMs changed significantly across the two measurement occasions. MANOVA results showed that across study conditions task TMMs similarity increased ($F(1,39) = 5.08$, $p < .05$), while team team TMMs similarity did not change significantly ($F(1,39) = .001$, $p = .84$) from Time 1 to Time 2.

To test Hypothesis 2, the performance dimensions were regressed on TMMs convergence, controlling for the effects of the experimental conditions—diversity and situational change and their interaction. TMMs convergence was represented through difference scores between the Time 2 and Time 1 measurements. The results of this analysis are displayed in Table 3. For performance efficiency, TMMs convergence explained an amount of variance of $R^2 = .08$ at step two of the analysis, above the effects of diversity, the experimental change condition, and their interaction ($F(2,20) = 1.45$, $p = .26$). Neither the effect of task TMMs convergence ($b = 2.91$, *SE*

= 2.28, *p* = .27) nor the effect of team TMMs convergence (*b* = 2.23, *SE* = 1.56, *p* = .17) was significant.

For performance effectiveness, the TMMs convergence variables entered at step two explained an amount of variance of R^2 = .03 (F(2,19) = .56, *p* = .58). Neither the effect of task TMMs convergence (*b* = -.18, *SE* = 161, *p* = .91) nor the effect of team TMMs convergence (*b* = -1.04, *SE* = .99, *p* = .31) were significant. For performance novelty, the TMMs variables explained an amount of variance of R^2 = .22 (F(2.20) = 3.05, *p* = .07) at step two of the analysis. Only the coefficient of the team TMMs convergence was significant (*b* = 2.89, *SE* = 1.18, *p* < .05). Overall, these findings do not support for Hypothesis 2.

Table 3. *The Effect of Team Mental Models Convergence, Diversity, and Situational Change on Performance*

Predictor	Effectiveness		Efficiency		Novelty	
	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2
Diversity[a]	.58†	.57	-.51	-.17	-.03	.06
Change[b]	-.33	- .27	-1.83**	-1.70*	.50	.40
Diversity x Change	.27	.20	2.22**	2.11*	-.33	-.17
Task TMM convergence[c]		-.18		2.91		1.15
Team TMM convergence[d]		-1.04		2.23		2.89*
R^2	.33	.36	.34	.42	.06	.28
F	3.37*	.56	3.75*	1.45	.50	3.05†

Note. *N* = 39. TMM = team mental model. Values reported are unstandardized betas.

[a]Diversity = 0 for the groups with similar composition and 1 for groups with diverse composition.

[b]Change = 0 for groups in the no change condition and 1 for groups in the change condition.

[c,d]Task and team TMM changes were represented through difference scores between the Time 2 and Time 1 scores.

† $p < .10$. * $p < .05$. ** $p < .01$.

6.3.Hypothesis 3

To determine whether the effect of TMMs similarity at the initial stages of performance will explain additional variance in performance (Hypothesis 3), above the effect of team diversity, we reran the analysis for Hypothesis 1 in three steps. At step one we entered the diversity and change experimental condition variables and their interaction. At step two we entered Time 1 team and task TMMs similarity and at step three we entered the interaction between task and team TMMs similarity and the change experimental condition. Evidence that team and task TMMs similarity explain additional variance in performance above the effects of team diversity would be obtained at step two.

We found in analysis not shown here that: For performance efficiency, the TMMs variables did not explain additional variance at step two of the analysis ($R^2 = .05$, $F(2,22) = .91$, $p = .42$). However, the coefficient of diversity experimental condition at step two was not significant ($b = -.91$, $SE = .53$, $p = .10$). For performance effectiveness, the TMMs variables explained $R^2 = .002$ of the variance at step two of the analysis ($F(2,21) = .03$, $p = .97$). The coefficient of the diversity experimental condition was significant at step two ($b = .65$, $SE = .33$, $p = .07$). For performance novelty, the TMMs variables explained .08 of the variance at step two which was not significant ($F(2,22) = .99$, $p = .39$). The coefficient of the diversity experimental condition variable at step two was not significant ($b = -.42$, $SE = .47$, $p = .37$). These results make it difficult to draw definite conclusions with respect to the role of TMMs over and above team diversity for team performance. Neither diversity nor the TMMs variables contributed significantly to performance. Thus, the hypothesis was not sustained in this data and future explorations are needed to determine the differential role of team knowledge content (i.e., as determined by team diversity) and team knowledge structure (i.e., as represented in TMMs) for different performance criteria.

7. Discussion

In this work, I examined at the phenomenon of team adaptation to better understand it as a process of overcoming changes. Drawing on the adaptation model of Burke et al. (2006), I examined the role of TMMs for different stages of team adaptation, specifically for the situation assessment and solution implementation stages. Bridging with research on problem solving at the individual level, I proposed that teams that are able to derive dissimilar TMMs of the changed situations in the stage of situation assessment reach higher performance. Further, convergence on a mental model at later adaptation stages was also proposed to be related with performance. I thus proposed a TMMs divergence-convergence mechanism to explain the role of TMMs for adaptation regarded as a process of adapting to changes. This study thus addressed the two gaps outlined in the introduction, that of building better predictive models of the role of TMMs for team adaptation and exploring the longitudinal effects of TMMs on performance.

I found partial support for the advanced hypotheses. With respect to the role of TMMs dissimilarity for early stages of adaptation, I found that more dissimilar task TMMs led to higher performance novelty and performance efficiency for teams that faced changes. This suggests that a higher coverage and a more diverse view provided by dissimilar task TMMs enables members to address the multilateral sides of changes and develop products that have unique and original features. Dissimilar task TMMs may provide the diversity necessary to view the multiple definitions of the changed situations and to create effective strategies within each definition, thereby increasing the novelty of the overall project. Second, it suggests that dissimilar TMMs are a valuable source for attending to multiple constraints and contingencies that may bear on the efficiency of the project development during changes. Dissimilar task TMMs may enhance awareness of multiple elements that define project efficiency and thus contribute to performance on this dimension.

The results concerning the role of TMMs convergence for performance outcomes are less clear-cut. Although I hypothesized that convergence on a task and team TMMs during the period of work after teams encounter a change would be positively related to the performance dimensions of efficiency, effectiveness, and novelty, I found less support for this assertion in the current model. Only team TMMs convergence had a positive effect on the performance dimension of novelty. It appears that in order to achieve high novelty of their products teams must agree timely on a plan of work and a set of strategies to implement the derived actions.

Without this level of agreement, the teams' products may be diverse but lack the internal coherence required to create impactful, original, and novel projects. This conforms to the literature cited which suggests that a higher diversity during idea generation and a higher convergence or consensus during idea implementation are complementary and necessary stages for obtaining novel products or processes. This finding is also in line with the proposed effect of TMMs on the performance of product design teams. Badke-Schaub et al. (2007) proposed that the convergence on a task TMMs may be less relevant for teams that work on the creation of novel products but that convergence on a team TMM may be more relevant to enable members to integrate their ideas on the product.

The TMMs convergence did not affect the performance dimensions of efficiency and effectiveness. An explanation for this finding is that the time for convergence may have been too short, preventing the emergence of a TMM that would guide team activity in these areas. A good definition of risks and outcomes (performance efficiency) and of valuable, implementable, and relevant project strategies (performance effectiveness) may require a longer time to converge which has not been captured in this study because the assessment of TMMs has been conducted at short time intervals. In such a case, observing convergence over a longer timeframe may help predict the extent to which the teams' projects are efficient and effective. In other words, agreement or convergence on a task definition and team working processes may be valuable but their effects may be realized only over a longer time frame.

Levesque et al. (2001) for example found that team interaction TMMs diverged over a longer period of team interaction but they did not relate this divergence with team performance. McComb (2007) found that TMMs converged over time and that TMMs convergence was positivelz related with team performance. The timeframe in her study was considerably higher than in this study ranging from a few weeks to a few months. Thus, I encourage researchers to examine the effect of convergence over a longer period of time. Only doing so we may determine whether convergence or divergence is required for the development of products that are both effective and efficient.

Conversely, it may be possible that creating products that are effective and efficient depends less on the convergence on a task and team TMM. Members may take a more distributive approach in deriving these outcomes, which means that they are able to accomplish their project work without the need to agree too much on the exact meanings. Future research should explore these different explanations, for a more integrative understanding of the role of TMMs for project team performance. Adaptation is a dynamic process. Thus, to truly capture accurate relationships between concepts these should be studied with a consideration to the role of time. If I would have looked only at the later effect of TMMs dissimilarity on performance, the positive effects of early exploration would have not emerged (Kilduff et al., 2000). These omissions may impact our capacity to intervene and support teams' effective management of critical events and novel situations. Early focus on a limited set of similar ideas may limit adaptive potential and subsequently team's capacity to deal with external demands (e.g., Hutchins, 1991).

This study contributes to the literature on TMMs and adaptation in several ways. First, I propose a mechanism by which TMMs may affect adaptation at different stages of the adaptation cycle. I suggested here and found some support that a TMMs divergence-convergence mechanism supports the overcoming of critical events and the derivation of coherent and comprehensive plans. Future studies could further this model by expanding on understandings of the role of TMMs at different stages of the adaptation model. Additional tests of this model to determine its validity are also needed, perhaps with a view to expand this in field settings, where the demands and constraints on adaptation may be more salient than in the teams studied here.

Second, I advance the literature by including a set of outcomes that are typical for project development work. There have been recent calls in the literature to expand the TMMs criteria with a view to incorporating outcomes as creativity and innovation. I answered this call here by considering in addition to traditional outcomes as effectiveness and efficiency of work, novelty of work and how this related to TMMs in different stages of the problem solving process. The study provides support for the relevance of both divergence and convergence of mental representations for innovation work, a hypothesis often stated but rarely tested.

Third, in line with upper echelons theory (Hambrick & Mason, 1984) I tried to determine whether cognitive content, as represented in members' different educational backgrounds, or cognitive structure, as represented in teams' TMMs are more effective in determining performance. Although clear results on this debate are still wanting, in this study I did not find support for either of the assertions (West & Schwenk, 1996). I found that while TMMs did not contribute variance above educational diversity, the latter in itself did not prove effective in increasing performance. I offer as an explanation the limited time frame of the study. Perhaps in contexts where both the effects of diversity and TMMs can be realized over time, more clear results on the differential influence can emerge.

Overall, these results suggest that at least for innovative work, it is necessary that teams are supported in forming diverse mental models of the situation they face. This can be ensured for example by presenting different nonroutine situations and creating the opportunity to discuss the meaning of these situations in the team. Secondly, the results also suggest that is necessary that mechanisms are put into place to ensure the integration of the diverse views that may derive from these exercises. There may be less value in diversity for achieving novel projects or products if this does not also contribute to the implementation of plans and solutions which can only be achieved through TMMs convergence. On the other hand, achieving more effective and efficient projects seems to be less affected by TMMs convergence. This suggests either that more distributed forms of cognition may be relevant for these outcomes, or that a longer time frame of TMMs convergence should be assessed, both paths that can be explored by future research.

Limitations

This study suffers from a number of limitations. First, the study setting and study sample make generalizations to organizational teams difficult. The task and task requirements, however, resembled those performed by real organizational teams, that is, ill-defined project tasks where members must jointly derive strategies and make tradeoffs among courses of action to develop implementable plans. Further, project teams are often exposed to unforeseen scope changes that demand fast and adapted responses which indicates that the change introduced in the study represents adequately the organizational environments (e.g., Pich, Loch, & Meyer, 2002).

Second, the study offers limited insight to the processes underlying the TMMs developmental processes. This prevents accurate inferences regarding the mechanisms underlying the different effects found. Although I theoretically based the study predictions on process based models of adaptation (Burke et al., 2006), I have not assessed the actual processes on which these predictions rely. Thus, future studies should focus on assessing these mechanisms to enable accurate inferences.

Third, the study included only two measurement occasions of the TMM construct. Although this enabled me to test the predicted relationships, it did not allow me to explore specific predictions referring to the rate of construct change across the team and potential turning points in TMM development (Bliese & Ployhart, 2002). A task for future research, thus, is to reinitiate the longitudinal assessment of TMMs (e.g., Mathieu et al., 2000) potentially in field settings for a more accurate account of its influence. Fourth, the team composition in terms of educational background may misrepresent the reality of organizational teams. Although diverse composition is a hallmark of project based teams such as the ones represented in our study, members may not be uniquely specialized as they were in these teams.

In summary, this chapter showed that task TMMs dissimilarity affects positively the performance novelty and performance efficiency of teams that face changes. Team TMMs convergence affected positively the performance novelty of teams. This study contributed to the literature by testing the relationships between TMMs in different adaptation stages and team performance. Future studies could continue the longitudinal investigation of the TMM construct in a context of adaptation to changes. This chapter was based on the definition of team adaptation as adaptation to a punctuated event during the team's work. In the next chapter I will examine another perspective on team adaptation, that of long term adaptive performance and I will examine the role of TMMs for long term adaptive performance.

Chapter 3 - Enhancing Adaptive Performance Transfer: Task Variation and Team Mental Models Flexibility

In this study, I further the understanding of the role of TMMs as dynamic constructs for team adaptation emphasized in the first study. The previous study emphasized the role of TMMs as dynamic constructs that affect team outcomes over time as opposed to constructs that exert a stable influence on outcomes. In this paper, I take this view of TMMs as dynamic constructs one step further and instead of considering their role for performance in a specific team context I consider their role over multiple team contexts or tasks performed. To be more specific, the literature on team adaptive performance suggests that there are two perspectives on team adaptation: a short term and a long term perspective. The short term perspective tries to determine how the team adapts to a punctuated change during its work. For instance, in the previous study, the teams received a change halfway during their task performance and they had to think about strategies to deal with this change. The long term perspective tries to determine what makes teams able to cope with new demands and changes when transitioning from one task to another. This means that researchers investigate the conditions and practices that enable a team to deal with novel demands and changes on new tasks, instead of focusing on their ability to deal with changes when working on a unique task.

This second perspective is also referred to as adaptive performance transfer, because performance on a practice task during which the team experiences certain interventions, aids performance on novel tasks. In this paper, I aim to explore the second perspective on adaptation by examining a mechanism that has been advanced in the individual literature as enhancing long term adaptive performance, task variation, and by exploring the role that team mental models play for team long term adaptive performance. Specifically, I look at the role of the TMMs developed during tasks on which members experience variations or varied tasks for work on novel tasks.

Varied tasks are tasks during which the team encounters different types of variations such as novel task demands or changing task conditions. Research advances that individuals and teams that work on more varied tasks are driven to explore the task more which leads them to better understand the principles of the task and to develop better processing mechanisms. This enhanced processing aids their work on future tasks which leads to high adaptive performance transfer. Research also suggests that adaptive performance transfer hinges on the representations or mental models that the team or individual has managed to form during the work on the varied task. Here the role of TMMs should be considered. When the team works on a varied task but does not manage to develop understandings of this task which correspond to developing specific TMMs, then they may be less able to grasp the meaning of a new task. This is because simple exploration of the space of a varied task is not sufficient to enable the development of new capacities but what is required is a deep understanding corresponding with the development of TMMs which affords the mapping of the new task space. Consistently, in this study I look at the moderating role of the TMMs developed during the work on a varied task on the relationship between task variation and novel task performance.

In summary, this study addresses the following gaps in the literature between TMMs and team adaptation: it assesses the role of TMMs for long term adaptive performance. So far research has treated only the relationship between TMMs and adaptation to a punctuated work change, also termed the short term perspective or the performance change perspective on adaptation. But adaptation is a long term process, that unfolds over multiple and different performance episodes. Since TMMs have been placed at the core of team adaptation (Burke et al., 2006), it is important to know their role for long term adaptation as well as short term adaptation. If we know only the relationships between one type of team adaptation and TMMs we may not be able to generalize to other types of adaptation which limits our knowledge and understanding of both TMMs and team adaptation. Second, this study addresses an important gap in the TMMs literature, that of determining the degree to which TMMs develop over time and how their development ties with team adaptive performance. Despite repeated calls to assess the construct longitudinally (e.g., Mohammed et al., 2010) there have been few studies that addressed this research need (e.g., Marks et al., 2000).

It is important to know whether TMMs can be regarded as stable constructs or whether they are adjustable to the conditions of the task environment in order to better plan team management and team development activities and to make better predictions regarding their role for performance. In this study I address this omission in the previous literature by assessing the TMM construct longitudinally and exploring the relationship between TMMs development and team performance. Third, following the path opened by the previous study, I apply this model of the relationship between team adaptation and TMMs to a context where teams must attain innovative performance. Innovative performance has not been addressed by previous research and it is important to know whether TMMs are related to these outcomes in order to expand TMMs theorizing and provide better starting points for future studies that investigate multiple outcomes.

With respect to the linkages between the predictions of this study and the theoretical framework, this study tests Proposition 4, Proposition 11, and Proposition 13. Proposition 4 proposes that in tightly coupled systems with an equifinal-multifinal path/goal structure, dissimilar TMMs will match better the environment characteristics and lead to a higher performance. The tasks used in this study represented case studies which dealt with multiple, interconnected issues that were tightly coupled and could be solved using a variety of strategies and responses. Therefore, they correspond to the type of environment described in Proposition 4. Considering these, then dissimilar TMMs should represent the type of TMMs that can best manage such environments.

Second, Proposition 11 stated that in complex, tightly coupled systems with an equifinal-multifinal path/goal structure, systemic changes can be best managed when teams form a dissimilar TMM of the entire system. In this study, the teams received during their work on a first task three changes which had a systemic character. The changes referred to aspects that required attention to multiple dimensions of the task that were interconnected such that the problem could not be separated into areas that could be solved separately. In other words, the changes did not have a local character. This, according to the framework advanced, means that the changes could be best managed by forming dissimilar TMMs. Third, Proposition 13 proposes that there will be a positive relationship between the content of the change and the content of the TMMs to which the change refers. In this study, the teams received changes related to their task requirements and correspondingly their task TMMs were assessed and demonstrated to change according to changes in the task.

1. **Task variation**

Task variation represents an intervention by which the learner is exposed to variations during a practice task. Task variation is instantiated through interventions such as task sequence variation (i.e., changing the order in which certain activities are performed), stimuli or task content variation (i.e., introducing novel stimuli such as changes in task requirements during performance), task context variation (i.e., changing the time or the environment in which the task is performed), task changes (i.e., transitioning from one task to another for example from a task that requires noncreative problem solving to a task that requires creative problem solving), and variation in the nature and scheduling of feedback (i.e., changing the timing and the type of feedback received related to task performance) (e.g., Hesketh, 1997; Ivancic & Hesketh, 2000, Schmidt & Bjork, 1992).

Other exploration inducing learning techniques are represented by discovery learning (i.e., encouraging the learner to explore the task in order to derive meaningful relationships and novel understandings) (e.g., McDaniel & Schlager, 1990), guided exploration (i.e., encouraging the learner to explore the task but guiding his exploration by drawing attention to certain aspects of the task) (Bell & Kozlowski, 2008), error management training (i.e., encouraging the learner to make mistakes during the learning of a new task such that he can learn from the mistakes) (e.g., Frese, Brodbeck, Heinbokel, Mooser, Schleiffenbaum, & Thiemann, 1991), and mastery training (i.e., inducing an orientation to view the task as a challenge and to put effort into learning and understanding the task) (Bell & Kozlowski, 2008). In the team literature, task variation is represented by embedding events into the training experience (Fowlkes et al., 1998, introducing different events such as weather changes during an episode of simulated flight performance), related variation practice (Schilling et al., 2003, practicing on tasks that are related), and perturbation training (Gorman et al., 2010, introducing roadblocks during the performance of a task).

The role of task variation is to create an exploratory mindset that drives the learner to discover alternative task configurations and to test alternative problem solutions, assuming an active approach to learning (Baldwin & Ford, 1988; Hesketh, 1997; Paas & Van Merriënboer, 1994; Schmidt & Bjork, 1992). It is assumed that these varied explorations of the task should make the learner understand the task better and to develop processing strategies and rules useful in the work on novel tasks. The effectiveness of task variation for enhancing novel task performance has been demonstrated in varied domains, from psychomotor work to cognitive based work on tasks ranging from device functioning diagnosis (Kamouri, Kamouri, & Smith, 1986), luggage screening (Gonzalez & Madhavan, 2011), basic transformation tasks (McDaniel & Schlager, 1990), physical education (Wrisberg, 1991), statistical skills acquisition (Paas & Van Merriënboer, 1994; Van Merriënboer, Jelsma, & Paas, 1992), management problem solving (Gary et al., 2012), driving simulator tasks (Ivancic & Hesketh, 2000), and military tasks

(Holladay & Quinones, 2003). Cumulating this evidence that shows that varied tasks lead to higher performance on novel task, I derive the first hypothesis:

Hypothesis 1: Task variation will influence performance on a novel task positively.

Despite positive evidence that task variation affects novel task performance there is no guarantee that exposing learners to variations will enhance adaptive outcomes (Vollmeyer, Burns, & Holyoak, 1996). I draw on the individual expertise literature in advancing that the cognitive representations developed during the work on the varied task are particularly relevant for leveraging the benefits of varied task exploration.

2. The role of flexible mental models

Research on individual expertise states that varied tasks will be effective in determining higher transfer performance only to the extent that learners develop a deep and comprehensive understanding of the space of the varied task (Gentner & Gentner, 1983; Gick & Holyoak, 1983). In other words, learners that are exposed to the same varied task can develop different understandings of the varied tasks and it is these understandings that determine their future performance on complex tasks. This literature differentiates between two types of expertise—adaptive expertise and routine expertise (Hatano & Inagaki, 1986; Salomon & Perkins, 1989; Schwartz, Bransford, & Sears, 2005; Smith, Ford, & Kozlowski, 1997). Routine experts are oriented toward problem solving in stable and predictable domains where they can apply a set of known procedures to reach a set of well-defined goals.

Adaptive experts are oriented towards solving problems in ill-defined domains, characterized by shifting problem solving rules, ambiguous goals and means for their achievement, and the existence of multiple problem configurations and frames within which they can define their problem solving strategies. Since the aim of varied tasks is to develop adaptive experts (Schwartz & Bransford, 1998; Spiro et al., 1987), I focus on their cognitive characteristics. The individual expertise literature places at the core of the adaptive experts' effectiveness in managing novel and unpredictable situations the quality of their mental representations or their mental models (e.g., Gentner et al., 2003; Goldwater & Gentner, 2015; Loewenstein, Thompson, & Gentner, 1999; Spiro et al., 1987; Spiro, Feltovich, Coulson, & Anderson, 1988). The characteristic of mental model flexibility in particular seems to confer adaptive experts their advantage in managing complex, diverse, and novel environments.

Mental model flexibility refers to a set of characteristics that can be defined on three levels: the complexity or the richness of the mental models, the number of alternative mental models available, and the ability to switch between mental models when the situation requires it (Goldwater & Gentner, 2015; Jacobson & Spiro, 1995; Collins & Gentner, 1987; Ainsworth, 2006; Van Merriënboer et al., 1992). Summarizing these characteristics, research shows that adaptive experts have mental models that are more complex, diverse, and adjustable. I review these characteristics of flexible mental models in the following.

2.1. Mental model complexity

Mental model complexity refers to the number of task dimensions and relationships among the dimensions represented in the mental model (e.g., Nadkarni & Narayanan, 2005). Studying the differences between expert and novice mental models, Chi, Feltovich, and Glaser (1981) noted that experts possess mental models that represent a higher number of chunks in memory, with more relationships among each chunk and more efficient methods for retrieving and applying the knowledge in the situation. Similarly, Cellier, Eyrolle, and Mariné (1997) note that experts as opposed to novices possess mental models that are organized in a higher numbers of patterns with more variables and more links among the variables in the patterns. Complexity is also revealed in features as the presence of higher level interactions, dynamic patterns of relationships and feedback loops, a higher number of categories of knowledge, and storage of knowledge related to both efficient and inefficient strategies (e.g., Collins & Gentner, 1987; Spiro et al., 1988). In this study, I operationalize mental model complexity as the number of dimensions and the number of relationships between the dimensions included in the mental models.

Research supports the relevance of complex mental models for complex problem solving. Nadkarni and Naranayan (2005) and Carley (1997) found that mental model complexity of students was related with their academic performance. Carley (1997) also found that team mental models became more complex over time as project teams developed their web of knowledge concerning the relevant concepts in the domain. Van Boven and Thompson (2003) found that participants at a negotiation exercise obtained a higher judgment accuracy score when their mental models were more complex and showed integrative features. Schroder et al. (1967) found that groups in which members had a higher integrative complexity were better able to address the demands of complex and dynamic environments.

Integrative complexity was conceptualized as the perception of multiple dimensions of the environment and the integration of these dimensions in that more integrative structures have more connections between the rules tying the dimensions. Higher integrative complexity was found to be related with greater flexibility and adaptive orientation to stress and to different environmental demands (Schroder et al., 1967). Related research on adaptive expertise suggests that experts that develop more complex knowledge structures are better able to draw on this knowledge or to reorganize their internal knowledge contents when new situation demands it (Smith et al., 1997; Hatano & Inagaki, 1986). The instructional literature on cognitive flexibility also suggests that multiple frames to describe different aspects of the task are useful to the extent that the learners are able to connect across these frames to create comprehensive understandings which amounts to increasing their cognitive complexity (Schwartz & Bransford, 1998; Spiro et al., 1987).

2.2. Alternative mental models

Spiro et al. (1987) in their cognitive flexibility theory maintain that cognitive flexibility depends on the development of multiple frames, mental models, or analogies applicable to the same situation or aspect of the task and the ability to shift these frames flexibly. These multiple mental models help illuminate different aspects of a complex system that cannot be captured by a single mental model, however complex and organized. Consider a team that works on the derivation of strategies to help a firm avoid bankruptcy. The team may be considering one aspect of the company failure and may do so complexly (i.e., they may regard multiple dimensions and may consider multiple interactions among the dimensions). But however complex this understanding, it still refers to only one aspect of reality, one way of looking at the problem. If, however, the team is able to represent the problems faced by the company from multiple perspectives, that is they are able to form multiple mental models of the problem, then they develop a more multifaceted view of reality which may help them in designing solutions to the problem.

Therefore, developing multiple mental models of a task may be more effective than developing a unique mental model, even if this is complex. Comparing, contrasting, and selecting elements across the mental models should provide the learner flexibility in making future inferences. The interconnectedness of alternative frames affords flexibility by enabling: categorization of concepts and cases based on the situation, creating multiple access routes to relevant prior knowledge in memory, and the development of a base of analogies for developing current understandings (Spiro et al., 1987). Similarly, it is posited that problem restatement at the problem construction stage, which corresponds to deriving multiple definitions of the original problem space, is positively related to solution originality and quality (Mumford et al., 1994; Reiter-Palmon et al., 1998).

This capacity to derive alternative mental models of a problem therefore serves especially in ill-defined problem solving where the problem may be represented through different structures which cannot be accounted by a unique mental model. In this case, people will partition the domain into multiple component models, which can be mapped from different source domains (e.g., Collins & Gentner, 1987; Spiro et al., 1988). Multiple representations provide additional information when each representation describes different aspects of the environment. Piecing together these different representations then would create a complete mental model of the domain (Van Merriënboer et al., 1992).

Finally, the ability to switch between mental models implies that the problem solvers are able not only to develop more complex and more diverse mental models but also that they are able to change the mental models or the rules tying the mental models with each other when the situation changes. This assumes that they are able to use their knowledge in constructive ways (Spiro et al., 1987).

3. Team level relationships

In line with the previous argumentation, the development of diverse, complex, and adjustable mental models should be particularly valuable to manage complex new situations. Diverse mental models offer multiple perspectives on reality which may be necessary when the problem is multifaceted, complex mental models ensure that the view created grasps multiple meaningful dimensions of reality, and adjustable mental models imply that the mental models can change over time to deal with novel relationships and changes in the task dimensions. This means that in the context of a varied task, individuals that are able to create mental models with these characteristics will be better able to grasp fully and adequately the complexity of the problem domain in support of their problem solving efforts**.** In this research, I argue for a mapping of these characteristics at the team level. I expect that teams that are able to form certain forms of mental models when they are confronted with a varied task should increase the effectiveness with which they map the space and comprehend essential relationships. This ability to develop complete understandings and a variety of frames among which they can switch should provide the learners an analytical apparatus that they can use to better process more complex future tasks.

At the team level, task representations are expressed through team mental models (TMMs). TMMs represent organized knowledge structures of task, team, and team interaction that enable the members to describe, explain, and predict team and task events (Cannon-Bowers et al., 1993). In line with the stated conceptualization, I consider here the extent to which the characteristics of expert mental models effective for mapping varied tasks could be generalized to the team level (Chi et al., 1981; Collins & Gentner, 1987; Gentner & Gentner, 1983; Gick & Holyoak, 1983; Glaser, 1989; Spiro et al., 1988). I assume that teams that develop flexible TMMs are better able to grasp the principles underlying the varied task which should sustain their work on a novel task.

In generalizing, first I make the following assumptions regarding the mental models of effective groups working on an initial varied task: (1) their mental models will be more complex (e.g., Carley, 1997); (2) they will have available diverse mental models to represent and interpret the problem space (e.g., Zaccaro, Banks, Kiechel-Koles, Kemp, & Bader, 2009); and (3) they will possess the ability to modify their TMMs or to shift among representations when the situation requires it (Kozlowski, 1998; Burke et al., 2006; Marks et al., 2000; Zaccaro et al., 2009). By this conceptualization, I extend the previous literature which has addressed empirically only the characteristics of TMM similarity and accuracy (e.g., exceptions—Carley, 1997; Van Boven & Thompson, 2003), aiming to provide a more complete characterization of the TMM construct.

The equivalent of complex mental models is represented by a higher TMMs complexity reflected in the number of task dimensions and the number of relationships among dimensions represented in the TMMs. The equivalent of diverse mental models at the individual level is represented by diverse mental models at the team level, yielding the characteristic of TMMs divergence or dissimilarity. Dissimilar TMMs refers to members representing differently the same aspects of the task, team interaction, and environment or to considering different task aspects than the other members (Badke-Schaub et al., 2007). In this case, for instance, two members may envision different strategies to reach the same goal, they may consider different resources as effective for accomplishing the task, or they may regard different procedures to accomplish a task. In terms of the ability to alter relationships among the concepts or to shift frames, I expect teams' TMMs to change significantly across the practice interval on the varied task as teams meet new demands for their work.

The capacity to shift TMMs when the situation demands it is the main characteristic of flexible TMMs emphasized in the literature (e.g., Burke et al., 2006; Marks et al., 2000; Zaccaro et al., 2009). I add to this TMMs complexity, because only a complex view of the task should enable the development of deep insights about the task and action potential. I further add TMMs divergence. I assume, in accordance with the information processing contingency view (Morris, Bransford, & Franks, 1977; Schroder et al., 1967), that a higher TMMs dissimilarity should be more effective for managing the requirements of multiply defined tasks for which no one mental model can map the space, but multiple alternative representations are required (Simon, 1977; Campbell, 1988). Comparing, contrasting, and selecting elements across dissimilar mental models should in turn provide the team members flexibility in comprehensively mapping the alternative task configurations (Collins & Gentner, 1987; Jacobson & Spiro, 1995). The capacity to form divergent TMMs should thus mitigate the tendency to focus on a narrow area of the problem space and to derive local suboptimal solution observed in individuals and groups (e.g., Sayama et al., 2011; Stasser & Titus, 1985).

Previous literature tended to focus on the TMMs characteristic of similarity (e.g., Cooke et al., 2003; Ellis, 2006; Gurtner et al., 2007; Lim & Klein, 2006; Marks et al., 2000; Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers, 2000; Stout et al., 1999). In the work of action-oriented teams such as investigated in previous research a higher similarity affords coordination and thus enables effective performance management strategies. I focus instead on teams working in knowledge oriented domains, such as project design and project development, that work on ill-defined tasks. These teams benefit from a variety of perspectives, strategies, or problem solving approaches for effective task management (Campbell, 1988; De Meyer, Loch, & Pich, 2002). In these domains, the flexibility of members' TMMs is revealed in a higher number of alternative frames as represented by members' dissimilar views (e.g., Drach-Zachavy & Somech, 2001; Hoever, Van Knippenberg, van Ginkel, & Barkema, 2012; Phillips & Loyd, 2003).

Supported by previous work on expertise development, I expect that TMMs that become more complex during the work on the varied task will yield higher performance transfer. I secondly expect that TMMs that become more dissimilar will lead to higher performance transfer. Third, I expect that the development of more complex TMMs will moderate the effect of developing more dissimilar TMMs in the context of task variation on transfer performance. This is in line with the cited individual level literature which advances that the development of more complex and the increasing availability of alternative frames indicate the development of adaptive expertise. The literature on adaptive expertise suggests that in order to be flexible, mental models must be complex, diverse, and adjustable at the same time.

Some empirical support exists in the literature for the effectiveness of the identified TMM characteristics in determining performance outcomes. For example, agent based simulation work shows that in certain circumstances, such as high mutual self-interest of members, incomplete access to information, and timely and moderate levels of communication, dissimilar TMMs afford a more effective problem space exploration (Dionne, Sayama, Hao, & Bush, 2011; Hutchins, 1991; Gavetti & Warglien, 2007; Sayama et al., 2011). Research on actual teams also shows that in certain contexts, such as different role and task distribution, a higher TMMs dissimilarity may be more effective for performance (e.g. Banks & Millward, 2007; Cooke, Kiekel, & Helm, 2001; McComb, Kennedy, Perryman, Warner, & Letsky, 2010). There is also evidence that TMM characteristics such as complexity (Carley, 1997; Nadkarni & Narayanan, 2005; Schroder et al., 1967) or deep structure (complexity and dynamic relationships, Gary & Wood, 2011) have a positive effect on long-term performance. In line with the argumentation so far, I expect that teams that are able to develop flexible TMMs should make better use of the varied practice experience endowing them with an ability to learn how to learn, to map the task space, and to process the essential relationships on a novel transfer task.

Hypothesis 2: Complex TMMs will moderate the relationship between task variation and transfer task performance.

Hypothesis 3: Divergent TMMs will moderate the relationship between practice task variation and transfer task performance.

Hypothesis 4: Complex TMMs will moderate the moderated effect of divergent TMMs on the relationship between practice task variation and transfer task performance.

The relationships posited are represented in Figure 1.

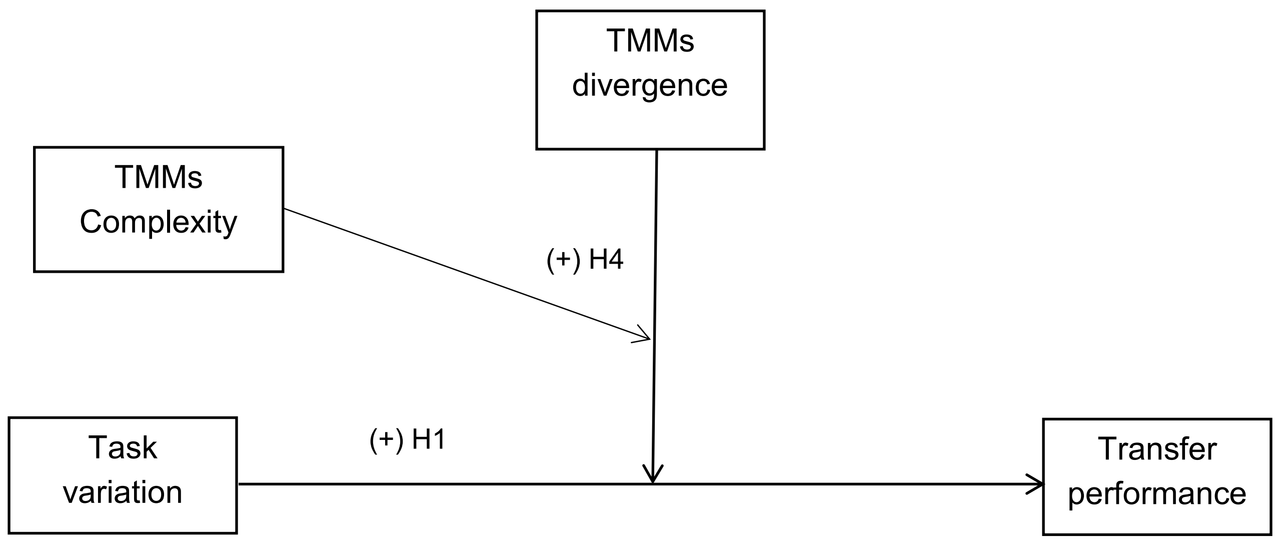

Figure 1. The indirect effect of task variation on transfer performance moderated by TMMs divergence and TMMs complexity.
TMMs = Team mental models.

4. Performance

The literature on task variation has looked at different criteria for effective transfer such as problem solving, strategy derivation, learning performance, and device operation (e.g., Kamouri et al., 1986; McDaniel & Schlager, 1990; Van Merriënboer et al., 1992; Gary et al., 2012). I extend these with a set of criteria relevant for teams that work on project development tasks (Lipovetsky et al., 1997; Pinto & Prescott, 1990). Specifically, in this study I look at effectiveness, efficiency, and novelty transfer performance criteria that can be enhanced by task variation. Effectiveness refers to the extent to which the solutions proposed by the team address the problems encountered, to the extent to which their solutions are relevant, valuable, and implementable. Efficiency refers to the extent to which the solutions proposed can be realized within given time and budget constraints. Novelty refers to the extent to which the solutions proposed are original and introduce elements that have not been considered thus far in the given problem related information (e.g., Cropley & Kaufman, 2012).

This set of criteria has been emphasized in the work on project development tasks. Lipovetsky et al. (1997) in their analysis of project success dimensions emphasized the dimensions of efficiency or meeting schedule and budget goals and the dimensions of relevance or the value of the project to the customer and the organization. Pinto and Prescott (1990) also emphasize as measures of project planning success efficiency measures and external success measures defined as perceived value of the project and customer satisfaction. I draw thus on the literature on project planning success and define a set of factors that reflect efficiency and effectiveness. The tasks that I used in the study are project development tasks such that these performance criteria should be relevant in this context.

A project is defined not only in terms of efficiency and relevance but also in terms of its perceived novelty which refers to the introduction of novel processes, products of procedures that are important for the customers and that are created with the purpose of benefitting the group, individual, or society (West & Farr, 1990). Novelty is defined in terms of the magnitude, radicalness, and innovativeness of the ideas introduced (West & Anderson, 1996). Innovation is an important criterion for project development because it indicates the capacity of the groups to change and adapt to different demands of their work. Therefore, I look at these three performance criteria: efficiency, effectiveness, and novelty.

To give an example, during the work on a project development tasks, the team may have a certain budget and certain resources as well as a timeframe available to develop the project. When they are able to meet the budget and time requirements then they have developed an efficient project. They may also meet certain demands for project success such as the extent to which the project satisfies the requirements of the customer. If they are able to create a valuable project that meets the demands of the customer, then their project is effective. Finally, the solutions and strategies that they propose can be specific to the group and not encountered before which means that the group has used its imagination to create something that goes beyond what is known and that brings instead a new perspective on things. This third criterion means that the project satisfies the requirement for novelty. Both the initial varied task and the transfer task can be defined in terms of these performance criteria. I assume thus that the hypotheses stated will hold for these performance dimensions.

5. Task

In defining the task, I drew on the instructional literature on cognitive flexibility and expertise development. The practice task that the teams had to work on initially was varied such that the teams received different changes regarding their task requirements throughout their work. This corresponds to definitions of variation in the transfer of training literatures where variation is defined as changing the task stimuli or the task content. According to Salomon and Perkins (1996) the learning situations that lead to the development of adaptive skills and knowledge should have the following characteristics: active engagement of the learner, complex thinking activities (gather and select information, connect items of knowledge, generate and test hypotheses, generate inferences), opportunity to explore semantic relationships among items of knowledge, and contextualized learning.

Spiro et al. (1987) also advance that the presentation of multiple cases and examples and the introduction of complexity in the learning situation presupposes a varied experience that enables the learner to decompose cases into multiple relevant elements and combine across the decomposed elements. Therefore, in this study the task consisted of different organizational studies. The participants in the task variation condition received different task requirements changes throughout their task, meeting the requirement for variation. These tasks are in line with other studies that focused on the effect of variation by employing multiple case studies (Jacobson & Spiro, 1995; Schwartz & Bransford, 1998; Paas & Van Merriënboer, 1994). The tasks are described in the Methods section.

6. Method

6.1.Sample

To test the study hypotheses, I conducted a 2 (task variation/control, between subjects) x 2 (phase 1/phase 2, within subjects) longitudinal experiment. The study sample consisted of undergraduate and graduate students with a social sciences background of a public university in Eastern Germany (N = 69, 56 % male, mean age = 24.45, mean academic semester = 5, 96% German nationality). Participants were randomly assigned to two (N = 9) or to three person teams (N = 17), according to availability, and teams were randomly assigned to experimental conditions, forming 13 teams (N = 34, five two-person teams and eight three-person teams) in the task variation condition and 13 teams (N = 35, four two-person teams and nine three-person teams) in the control condition. Participants were rewarded 25 euro for their participation in the study. Results of the multivariate analysis of variance conducted on the study variables with the number of team members as a between subjects factor showed no significant differences between two-person and three-person teams on any of the study related variables.

6.2. Procedure

The study was advertised through messages in campus posting areas or in internet-based discussion groups. Students registered by sending an email to the experimenter with their preferred participation time and dates, selected from a list of available terms. The study consisted of two phases, scheduled to take place at three days apart. Group composition remained constant across phase. All teams in a study session were assigned to the same experimental condition. The experiment was completed in two hours and thirty minutes for Phase 1 and one hour and thirty minutes for Phase 2. After 20 minutes of reading the information individually, team members completed a background questionnaire and the TMMs measurement (Time 1 TMMs).

6.3. Task

The study tasks consisted of organizational case studies describing two different companies and the problems that they faced. The case studies were selected and adjusted based on ratings of relevance and appropriateness for the research purpose from a list of case studies used in management courses to train students' applied skills.

6.3.1. Initial practice task

For Phase 1, the participants received a two and a half pages case study describing the structure, history, culture, products, market, competition, and problems of a company operating in the soft drinks industry. The noted problems referred to reduced product innovation, increasing competition, declining profits, and rigid organizational culture and structure. Each team was provided with a plan template, in which they had to complete the following solution related information: improvement strategies, timeframe for strategy implementation, budget required to implement each strategy, and expected outcomes of implementing the strategies proposed. Teams had available a fictional budget of 100.000 euro and a timeframe of two years for defining their solutions. Participants had to split the budget among their strategies and to schedule their actions such as to fit the given time intervals and resources. In addition to the case study, each team member received role specific information consisting of sales graphs and charts, personnel and customer surveys, and product information. The additional materials, which were equally split among the team members, consisted of two thirds unique information and one third common information, distribution which was aimed at enhancing communication and participation in the task (Stasser, & Titus, 1985).

6.3.2. Novel transfer task

The Phase 2 case study had similar structure and requirements as the Phase 1 case study, but referred to an organization operating in the hospitality industry (i.e., a hotel chain). This required the application of different strategies to solve the company problems and the taking into consideration of more complex interrelationships among the given information items (different causes, different implications, different consequences). For example, in the first case study low company innovation referred to low product innovation while in the second case study low innovation referred to low service innovation. These types of innovation have different causes and correlates which requires the application of different strategies for the attainment of innovation. The company problems related to low service innovation, increasing competition, insufficiently trained work force, changing market demands, and decreasing profits. As for the first case, the teams had to specify their solutions in a plan template. They had available a fictional budget of 1000.000 euro and a timeframe of two and a half years to define their solutions. Common and unique role specific information was equally split among the members.

With respect to the focus on adaptive performance transfer, the two case studies referred to similar information processing requirements—the team had to read the information, explore the task to discover the meaning of the company problems, and derive strategies and solutions to deal with the problems. After the team has worked on the first task, considering the conditions of the study (i.e., variation vs. the lack of variation), they should have more easily mapped the space of the new task, in that they should have found it more easy to explore the task information, the meaning of the problems, and to derive strategies for the problems.

6.4.Experimental manipulation

Teams in the task variation condition received additional information at three equally spaced 15-minutes intervals throughout their work on the first task, starting 20 minutes after work onset. The information consisted of text paragraphs describing changes in the organizational environment (i.e., competitor threat, downsizing threat, and employee turnover) to which they had to respond and incorporate into their plan. The order of the three changes was counterbalanced. Members had three minutes to read the changes individually. They completed the second, third, and fourth TMMs assessment after reviewing the first and second change, and at the end of the task, respectively (Time 2, Time 3, and Time 4 TMMs). Teams assigned to the control condition did not receive additional task information but they completed the TMMs questionnaires at the same times as teams in the experimental condition.

6.5. Measurement

The study questionnaire items were translated independently from English to German by one research assistant with a background in psychology following the procedures recommended by Brislin (1980).

6.5.1. TMMs similarity

I was interested in how members develop a better understanding of their task during their work with potential to influence future task performance. Therefore, I assessed task TMMs (Cannon-Bowers et al., 1993; Mathieu et al., 2000). I measured task TMMs using structural representations. The TMMs instrument consisted of 11 task-related items organized in 10 x 11 association matrices, identified following a comprehensive task and domain analysis (Tesluk, Zaccaro, Marks, & Mathieu, 1997) and a survey of subject matter experts. The following items were used: “Extend product distribution opportunities”, “Product improvement and innovation”, “Improve product marketing”, “Employee training and development”, “Changing the company structure and culture”, “Extend customer segment”, “Increase customer loyalty”, “Close down product lines”, “Financial problems-stagnant profit”, “Competitive business environment”, and “Company downsizing”.

Participants rated the relationship between each item and all the other items on a 1 (*unrelated*) to 7 (*completely related*) scale for a total of 55 ratings. Participants’ mental models were analyzed using UCINET software (Borgatti, Everett, & Freeman, 2002) a network analysis program which provides an index of convergence between two matrices—the quadratic assignment procedure (QAP) correlation. The correlation between members’ mental models at each measurement occasion was calculated using the QAP, yielding three correlations indices per each of the four measurement occasions per team. QAP correlations represent zero-order correlations between the identical elements of two matrices and therefore the index ranges from -1, indicating no similarity, to +1, indicating complete similarity (Mathieu et al., 2000). The three correlations indices were aggregated to form coefficients of TMMs similarity, for each measurement occasion, resulting in four TMMs scores per team. Similarity scores ranged from

.06 to .61 (Time 1), from -.03 to .67 (Time 2), from -.21 to .56 (Time 3), and from -.13 to .55 (Time 4).

6.5.2. TMMs complexity

To calculate TMMs complexity I used a measure of network cohesion used in social network analysis and employed in the UCINET software (Borgatti et al., 2002). Specifically, I used average degree which represents the degree or number of ties for each node in a network divided by the number of nodes in the network: Average degree = 2T/n, where T = number of ties of a concept and n = number of nodes in the network (Borgatti, Everett, & Johnson, 2013). It is equivalent with another measure of network complexity used in previous work on mental models (e.g., Nadkarni & Narayanan, 2005), density, which equals the total number of ties in a network divided by the total number of possible ties: Density = 2T/n(n-1), rendering Average degree = Density * (n-1) (Borgatti et al., 2013). I computed the mental model complexity scores for each team member for each measurement occasion and then averaged the three complexity scores within teams within occasions obtaining four TMMs complexity scores. The TMMs complexity scores ranged from 3.17 to 5.29 (Time 1), from 3.12 to 5.36 (Time 2), from 3.51 to 5.39 (Time 3), and from 3.55 to 5.49 (Time 4).

6.5.3. Performance

The assessment of team performance was based on a rating scale that I developed drawing on the relevant literature on team innovation and project planning (e.g., Besemer & Quin, 1999; Cropley & Kaufman, 2012; Marta et al., 2005; Mumford et al., 2001; Pinto & Prescott, 1990; West, 2002). Specifically, each team‘s Phase 2 plan was rated on eight subdimensions represented by between 2 and 9 items on a 7-point scale (38 items in total), ranging from 1 (*does not apply to the actions described in the plan*) to 7 (*applies to all actions in the plan*). The subdimensions represented were: efficiency—4 items (e.g., "There is a detailed budget for the project.", α = .82), relevance—5 items (e.g., "Actions serve the purposes described in the plan statement and case description.", α = .97), implementability—3 items (e.g., "The actions, as they are specified in the plan, can be translated into realized actions, put into practical effect.", α = .92), value—4 items (e.g., "The extent to which actions add value more than if they were not implemented or beyond other actions.", α = .91), impact—8 items (e.g., "The implementation of the actions proposed will place much demand on the organization.", α = .92), originality—2 items (e.g., "The extent to which the actions proposed are unique and elicit surprise on the part of the evaluator.", α = .97), novelty—8 items (e.g., "The group approached the problem in a novel, imaginative, unpredictable, or innovative manner.", α = .95), and outcomes—4 items (e.g., "The outcomes described in sufficient detail for the stakeholders to have a clear perspective on the areas that will be improved, how, and how much.", α = .88).

Teams' plans were rated separately by the author and by a trained rater, a graduate student in Psychology, on each of the subdimensions described above. The second rater received a five-hour theoretical and applied training in which she was familiarized with the definitions of the performance subdimensions and in which she applied the learning content by rating a set of sample performance plans available from the study pretest. The consistency of the ratings between the two raters was assessed using the intraclass correlation coefficient ICC(1) and ICC(2), which yielded the following interrater reliabilities: efficiency—ICC(1) = .88, ICC(2) = .94, relevance—.ICC(1) = .56, ICC(2) = .72, implementability—ICC(1) = .46, ICC(2) = .63, value—ICC(1) =.76, ICC(2) = .86, impact—ICC(1) = .73, ICC(2) =.84, originality—ICC(1) = .71, ICC(2) = .83, novelty—ICC(1) = .68, ICC(2) = .81, outcomes—ICC(1) = .61, ICC(2) = .75. Raters met to discuss disagreements which lead to the following ICC for dimensions which had more disagreement: relevance—ICC(1) = .78, ICC(2) = .87, implementability—ICC(1) = .67, ICC(2) = .80, and outcomes—ICC(1) = .63, ICC(2) = .77.

The ratings assigned by each rater to each subdimension were combined to form aggregate subdimensions (e.g., average efficiency based on rater 1 and rater 2 ratings). The aggregate subdimensions were submitted to exploratory principal component factor analysis with varimax rotation to determine performance dimensionality. Three factors emerged explaining 80.75 % of the scale variance. The first factor, labeled performance novelty explained 30.57 % of the scale variance and was loaded by the novelty, originality, and impact subdimensions (α = .77); the second factor, labeled performance effectiveness, explained 29.95 % of the scale variance and was loaded by the value, implementability, and relevance subdimensions (α = .79); the third factor, labeled performance efficiency, explained 20.23 % of the scale variance and was loaded by the outcomes and efficiency subdimensions (α = .76). These factors represented the performance dimensions used in testing and analyzing the study hypotheses.

To control for effects of past performance on future performance, I also measured Phase 1 performance using the same performance rating scale and obtained similar results. Specifically, the exploratory factor analysis revealed three dimension explaining a total of 80.19 % of the scale variance. The first dimension explained 36.00 % of the scale variance and was loaded by the novelty, impact, and originality subdimensions ($\alpha = .84$), the second dimension explained 27.15 % of the scale variance and was loaded by the value, implementability, and relevance subdimensions ($\alpha = .85$), and the third dimension explained 17.03 % of the scale variance and was loaded by the outcomes and efficiency subdimensions ($\alpha = .60$).

6.5.4. Background variables

Since performance on the task could be influenced by participants' previous background and experiences, I controlled for the following variables: task domain relevant experience (1 item with 13 categories), task domain relevant knowledge (1 item with 9 categories), applied experience (7 items, $\alpha = .82$), interest in the case study related domains (6 items, $\alpha = .76$, M = 3.71, SD = 1.19 on a 1 (*does not apply*) to 7 (*applies to a large extent*) rating scale), teamwork experience in applied or academic settings (7 items, $\alpha = .75$, M = 2.40, SD = 1.13, on a 1 (*no experience*) to 7 (*a lot of experience*) rating scale), high-school GPA (M = 2.00, SD = .45, on a 1 (*very good*) to 6 (*insufficient*) scale), precedent academic semester grade (M = 1.99, SD = .40), number of jobs held to date (M = 2.14 years, SD = 1.11 years) , number of case studies similar to the research's case studies that participants solved individually (M = .29, SD = .61) or in a team (M = .37, SD = .42) as a course requirement . Since no significant differences emerged between analyses performed with and without these variables, I report the analysis without these controls.

6.5.5. Manipulation checks

To determine whether the task manipulations were perceived as intended, team members were asked at the end of the study Phase 1 questions related to their level of perceived task complexity and perceived task uncertainty. Task complexity was assessed using a four item scale adapted from Maynard and Hakel (1997) answered on a 1 (*totally disagree*) to 7 (*totally agree*) Likert scale. Sample items are: "This task required a lot of thought and problem-solving", "I found this to be a challenging task" ($\alpha = .92$; r(wg) = .76, ICC(1) = .35). Perceived task uncertainty was assessed using three items constructed for this study, measured on a 1 (*does not apply*) to 7 (*applies to a large extent*) rating scale: "Our task requirements changed many times during our performance", "I experienced major changes in the task requirements", "I expected our task requirements to change while I were working" ($\alpha = .74$; r(wg) = .68; ICC(1) = .38). The results of an independent samples t test showed that participants in the task variation condition did not perceive a higher task complexity than participants in the control condition ($t(23) = .82$, p

= .42, *M* task variation = 5.06 vs. *M* control = 4.75) but that they perceived a higher task uncertainty than the participants in the control condition ($t(22) = 4.28$, $p < .001$, *M* task variation = 4.72 vs. *M* control = 3.31). These results confirm that the manipulation was effective.

7. Results

Means, standard deviations, and correlations among the variables are represented in Table 1.

Table 1. *Means, Standard Deviations, and Correlations Among the Study Variables*

Variables	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Effectiveness 2	4.82	0.68	1.00													
Novelty 2	4.33	0.65	0.04	1.00												
Efficiency 2	4.09	1.04	.54**	0.13	1.00											
Efficiency 1	9.08	2.00	0.29	0.26	.90**	1.00										
Effectiveness 1	15.67	1.58	.73**	-0.01	-0.05	-0.06	1.00									
Novelty 1	13.70	2.08	0.19	.87**	0.08	0.10	0.07	1.00								
TMM1	0.30	0.12	-0.03	-0.32	-0.30	-0.31	0.20	-0.28	1.00							
TMM2	0.31	0.15	0.15	-0.23	-0.06	0.06	0.08	-0.08	0.30	1.00						
TMM3	0.27	0.17	0.05	-.40*	0.03	0.12	0.21	-0.29	0.12	.52**	1.00					
TMM4	0.22	0.17	0.18	-0.17	-0.06	-0.04	0.21	-0.17	0.23	.65**	.69**	1.00				
Complexity 1	4.37	0.37	-0.10	0.30	-0.22	-0.25	-0.28	0.03	-0.12	-0.15	-.52**	-0.09	1.00			
Complexity 2	4.53	0.47	0.05	0.19	-0.13	-0.34	-0.26	0.10	-0.11	0.02	-.47*	-0.20	.75**	1.00		
Complexity 3	4.55	0.49	0.22	0.20	0.04	-0.21	-0.26	0.17	-0.28	0.12	-0.21	0.01	.65**	.85**	1.00	
Complexity 4	4.52	0.49	0.29	0.27	0.10	-0.11	-0.14	0.19	-0.12	0.07	-0.26	-0.04	.69**	.84**	.91**	1.00

Note. $N = 26$. Performance dimension with a subscript 1 assessed for Phase 1 task. Performance dimensions with a subscript 2 assessed for Phase 2 task. Subscripts 1 to 4 for TMMs and Complexity refer to Time 1, Time 2, Time 3, and Time 4 assessments during the work on the phase one task.

* $p < .05$. ** $p < .01$.

7.1. Exploratory analysis: TMMs similarity and TMMs complexity will change significantly during the work on the varied task.

I used random coefficient modeling (RCM) to test for changes in TMMs complexity and TMMs similarity using version 3.1.1 of the nonlinear and mixed effects (NLME) program for S-PLUS and R (Pinheiro & Bates, 2000). In step one, I estimated the unconditional means model, to assess whether there are significant differences between groups in the outcome variables not accounting for time. I found positive support for TMMs similarity (ICC(1)=.57; $F(1,77)=139.63$, $p < .001$) and for TMMs complexity (ICC(1) = .23, $F(1,78) = 2985.80$, $p < .001$). In step two, I estimated the unconditional growth model by adding time to the first model as a level 1 change predictor. The random intercept and random slope model showed increased fit compared with the unconditional means model (TMMs similarity: $\chi2(3) = 7.32$, $p = 0.06$; TMMs complexity: $\chi2(3)$

= 9.14, $p < .05$). In step three, I added a quadratic time function with fixed effects to each model which yielded an improvement in fit for TMMs similarity ($\chi 2(4) = 5.86$, $p < .01$ but not for TMMs complexity ($\chi 2(4) = 0.19$, $p = .67$).

The introduction of the experimental condition as a level 2 change predictor further improved model fit (TMMs similarity: $\chi 2(1) = 5.37$, $p < .05$; TMMs complexity ($\chi 2(1) = 3.32$, $p = .06$). Finally, introducing the interaction between the time linear and quadratic factors and the experimental condition yielded an improvement in fit (TMMs similarity: $\chi 2(2) = 6.17$, $p < .05$; TMMs complexity ($\chi 2(2) = 10.04$, $p < .001$). The interaction between the linear ($b = .02$, $SE = .01$, $p = .09$) and quadratic ($b = -.02$, $SE = .01$, $p < .01$) time term and the changes factor was significant for TMMs similarity. Tests of simple slopes (Aiken & West, 1991) showed that the TMMs similarity of teams in the experimental condition followed a negatively accelerating trajectory, increasing over the first measurement occasions and decreasing at later stages ($t(73) = 2.61$, $p < .01$) but no significant curvilinear growth was observed in the control teams that appeared to follow a linearly decreasing trend ($t(73) = .80$, $p = .43$). The growth plot is represented in Figure 2. There was no significant moderation of the effect of time by the experimental condition for the TMMs complexity scores. The linear ($b = .05$, $p < .05$) and quadratic ($b = -.04$, $p < .01$) effect of time on TMMs complexity were both significant overall in the sample.

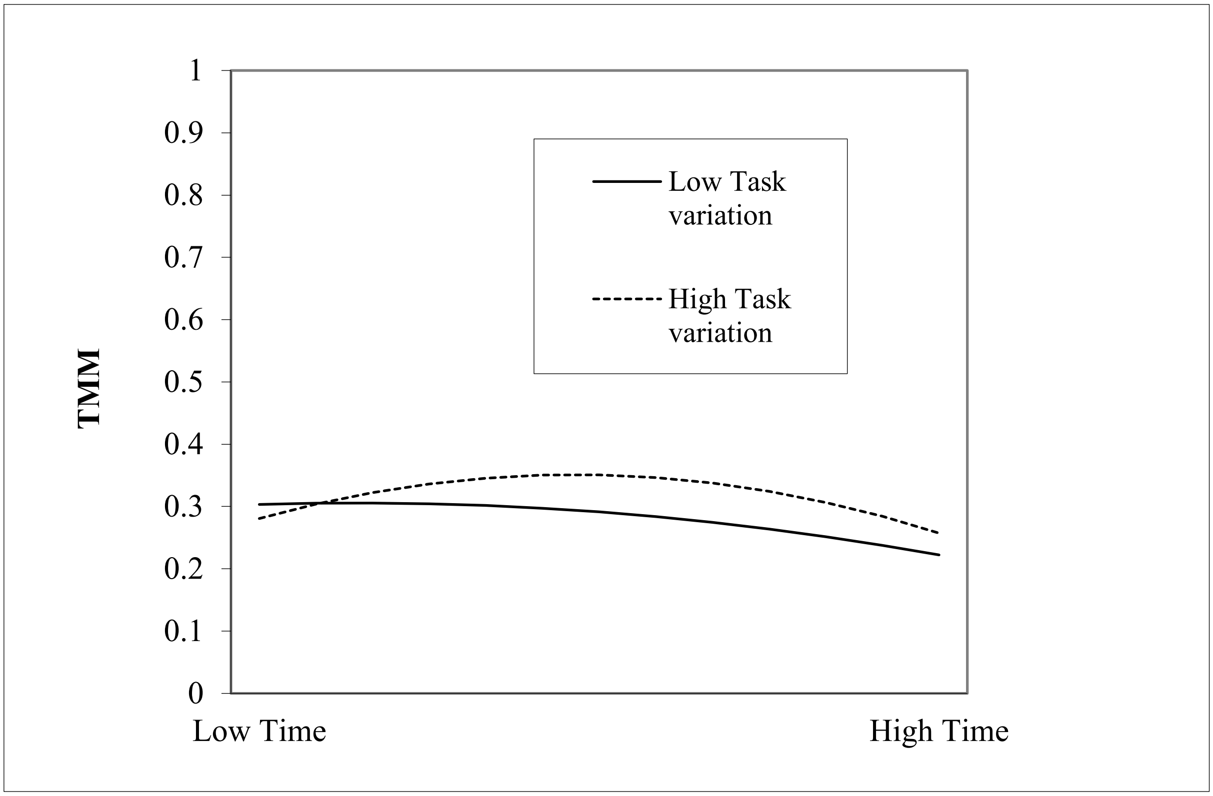

Figure 2. TMMs similarity change over four measurement occasions for teams in the task variation and control conditions.

Low Time = Time 1 of four measurement occasions. High Time = Time 4 of four measurement occasions. Low task variation = groups in the control condition. High task variation = groups in the experimental condition. TMM = Team mental model.

Examining the means confirmed that groups in the control condition decreased their TMMs similarity linearly over time ($M_{\text{Time 1}}$ = .33, $M_{\text{Time 2}}$ = .26, $M_{\text{Time 3}}$ = .21, $M_{\text{Time 4}}$ = .19) while groups in the task variation condition first increased and then decreased their TMMs similarity ($M_{\text{Time 1}}$ = .27, $M_{\text{Time 2}}$ = .36, $M_{\text{Time 3}}$ = .32, $M_{\text{Time 4}}$ = .26). Across the four measurement occasions, the mean of TMMs similarity of teams in the task variation condition was higher than that of teams in the control condition. The TMMs complexity scores changed nonlinearly in the whole sample ($F(1,67) = 14.6$, $p < .01$), increasing from Time 1 ($M = 4.37$) to Time 2 ($M = 4.53$) and from Time 2 to Time 3 ($M = 4.55$) and then decreasing from Time 3 to Time 4 ($M = 4.52$).

After verifying that TMMs similarity and TMMs complexity changed significantly over time, I followed a procedure employed by Chen, Ployhart, Thomas, Anderson, and Bliese (2011) and I retained the linear time growth empirical Bayes estimates as TMMs change predictors. The empirical Bayes estimates are weighted by the overall sample information in addition to the group level information and yield more precise estimates than the ordinary least squares (OLS) estimates obtained from the regression of each group's outcome on the predictors (Cohen, Cohen, West, & Aiken, 2003). These coefficients represent changes in TMMs that are allowed to vary across groups and can thus be used in ordinary correlation or regression analysis conducted at the group level.

7.2. Hypothesis 1: Task variation will influence performance on a novel task positively.

An independent samples *t* test on the Phase 2 performance scores was used to tests Hypothesis 1. Although the means differences are in the expected direction for two performance dimensions, the test showed that teams in the task variation condition did not achieve significantly higher performance novelty scores ($t(24) = -.56$, $p = .58$, $M_{\text{task variation}} = 4.38$ vs. $M_{\text{control}} = 4.25$), did not achieve significantly higher performance efficiency scores ($t(24) = 1.51$, $p = .14$, $M_{\text{task variation}} = 4.39$ vs. $M_{\text{control}} = 3.78$) and did not achieve higher performance relevance than teams in the control condition ($t(24) = .08$, $p = .94$, $M_{\text{task variation}} = 4.81$ vs. $M_{\text{control}} = 4.83$). These results thus do not support for Hypothesis 1.

7.3. Hypothesis 4: TMMs complexity will moderate the moderated relationships between task variation and transfer task performance by TMMs divergence.

To determine whether the three way interaction between TMMs complexity, TMMs divergence, and task variation affects future task performance I conducted a series of moderated regression analyses for each of the effectiveness, efficiency, and novelty performance dimensions. In a first step, I regressed each performance dimension on the experimental condition, on TMMs divergence, on TMMs complexity, and on the two way interactions between the experimental condition, TMMs divergence, and TMMs complexity. In a second step, I added the three way interaction between TMMs divergence, TMMs complexity, and the experimental condition and verified the significance of this last step of the analysis for evidence that the hypothesis can be sustained. In all analyses, the performance scores obtained for Phase 1 were controlled for. To account for the limited power, significant results are reported at $p < .10$.

Table 2. *The Indirect Effect of Task Variation on Novel Task Performance as Moderated by TMMs Complexity and TMMs Divergence*

Predictor	Novelty		Effectiveness		Efficiency	
	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2
Performance 1	.80**	.80**	.88**	.89**	.86**	.92**
Changes	.22	.19	.08	.11	.04	-.07
TMMs similarity	-7.96	-9.71	-6.52	-4.90	1.53	-1.49
TMMs complexity	.49	1.13	4.11*	3.48	.21	1.67
TMMs similarity x Variation	8.60*	10.66*	4.25	2.26	-.18	3.47
TMMs complexity x Variation	-.40	-.69	-1.18	-.87	5.36*	4.53†
TMMs similarity x TMMs complexity	17.55	-40.42	24.03	80.76	64.82	-66.76
TMMs similarity x TMMs complexity x Variation		95.07		-93.43		203.26†
R^2	.86	.88	.73	.74	.90	.93
F	10.39**	1.34	4.93**	.72	16.84**	4.69*

Note. $N = 26$. Values represent unstandardized betas. Performance 1 = Phase 1 Performance. TMMs = Team mental models.

† $p < .10$; * $p < .05$; ** $p < .005$.

For performance effectiveness, the variables explained a significant .73 of the variance at the first step of the analysis ($F(7,13) = 4.93$). The coefficient of Phase 1 performance effectiveness was significant ($b = .88$, $SE = .19$, $p < .001$). The second step of the analysis led to an increase of .01 of explained variance which was not significant ($F(1,12) = .72$, $p = .41$). None of the two way interactions nor the three way interaction was significant.

For performance efficiency, the first step of the analysis explained .90 of the variance ($F(7,13) = 16.84$). The coefficient of the practice task performance efficiency variable was significant ($b = .86$, $SE = .09$, $p < .001$) and the coefficient of the interaction between TMMs complexity and the experimental condition was significant (*b* = 5.36, *SE* = 2.53. *p* < .05). Adding the three way interaction between TMMs complexity, TMMs divergence, and the experimental condition at step two yielded an increase of .03 of explained variance, which was significant ($F(1,12) = 4.69$, $p < .05$). The coefficient of the three-way interaction was significant (*b* = 203.26, *SE* = 93.81, *p* = .051). I conducted simple slopes analyses at high and low levels of TMMs complexity to determine the nature of this interaction. Results showed that groups in the varied task condition obtained a higher performance efficiency on the second task when their TMMs were more complex and more similar (*b* = .70, *SE* = .31, $t(17) = 2.24$, $p < .01$, 95% CI [.02; 1.38]), but there were no significant differences between the groups for all other combinations of complexity and TMMs similarity. Specifically, for high levels of TMMs complexity and low values of TMMs similarity the task variation groups had a lower performance than the control groups ($t(17) = .55$, $p = .59$); for low levels of TMMs complexity and high values of similarity, the task variation groups had a lower performance than the control groups ($t(17) = 2.11$, $p = .06$); for low values of TMMs complexity and low values of TMMs similarity, the task variation groups had a lower performance efficiency than the control groups ($t(17) = .57$, $p = .58$).

These interactions are depicted in Figure 3.

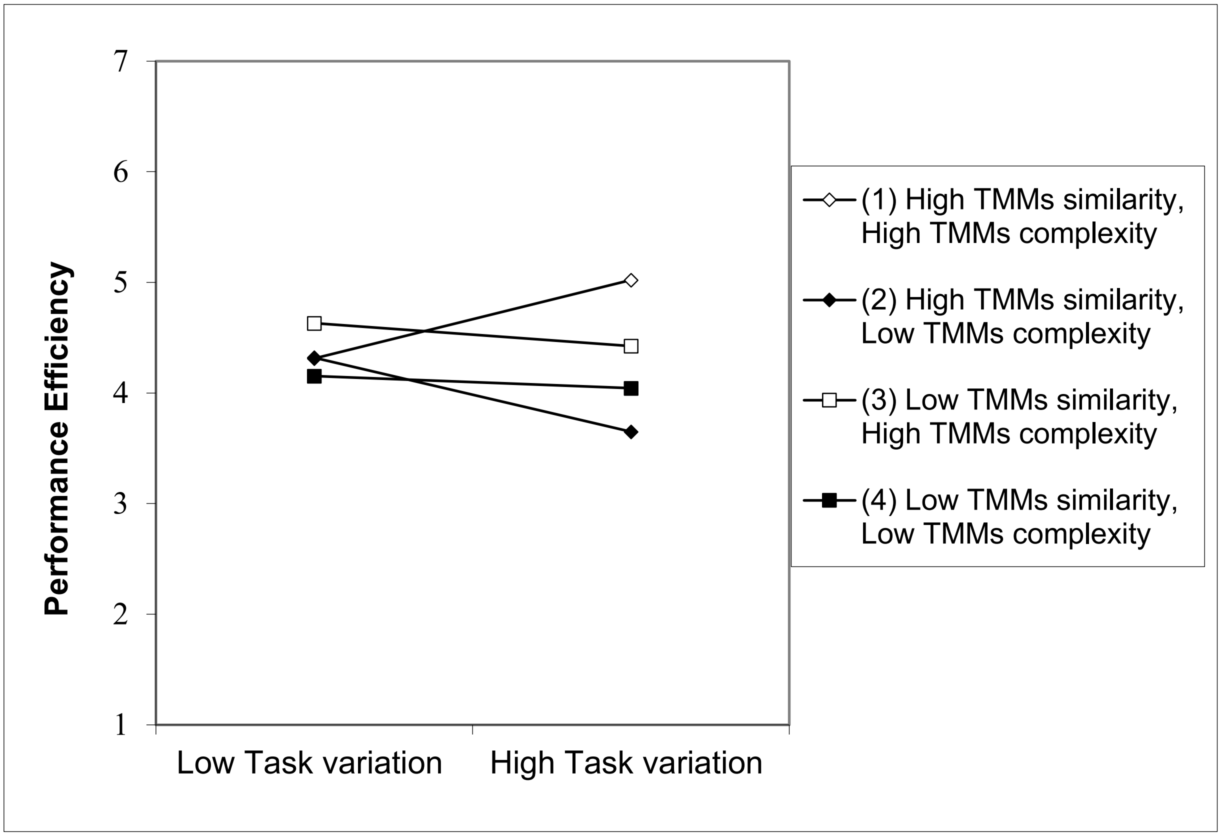

Figure 3. The effect of task variation on novel task performance efficiency moderated by TMMs divergence and TMMs complexity.

TMM = Team mental model. Low task variation = groups in the control condition. High task variation = groups in the experimental condition. Low TMM similarity = TMM that developed less similar over four measurement occasions. High TMM similarity = TMM that developed more similar over four measurement occasions. Low TMM complexity = TMM that developed less complex over four measurement occasions. High TMM complexity = TMM that developed more complex over four measurement occasions.

For performance novelty, the variables explained a significant .86 of variance at the first step of the analysis ($F(7,13) = 10.39$, $p < .001$). The coefficient of the practice task performance novelty was significant ($b = .80$, $SE = .12$, $p < .001$). Adding the three way interaction between TMMs complexity, TMMs divergence explained an additional .02 of the variance ($F(1,12) = 1.34$, $p = .27$). The coefficient of the three way interaction was not significant ($b = 95.07$, SE =

82.08, p = .27). Among the two-way interactions, the coefficient of the interaction between TMMs similarity and the experimental condition was significant (b = 10.66, SE = 3.91, p < .05). To expound the nature of this interaction I conducted simple slopes analyses at high and low levels of TMMs similarity. Results showed that groups in the task variation condition had a higher performance novelty on the novel task than groups in the control condition when their mental models were more similar (b = .37, SE = .17, t(17) = 2.18 p < .05, 95% CI [.01; .73]). There were no differences between the experimental and control conditions for moderate or low levels of TMMs similarity. These interactions are depicted in Figure 4.

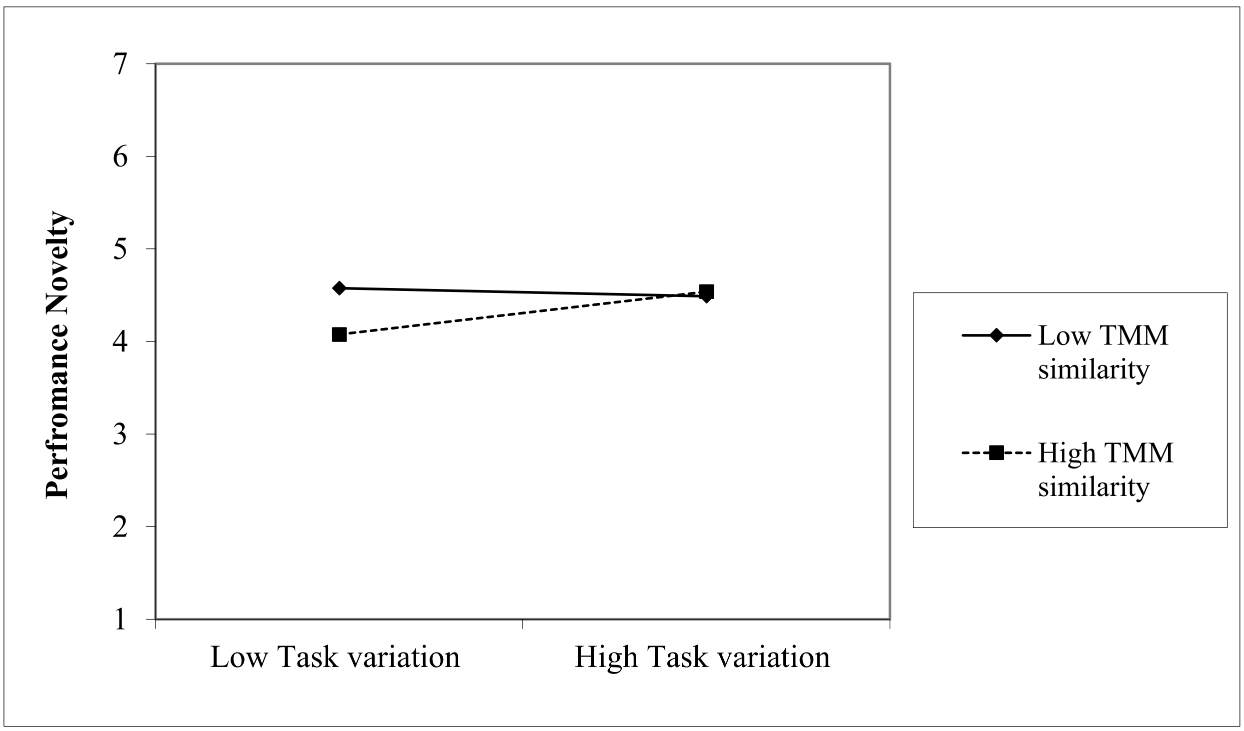

Figure 4. The effect of task variation on novel task performance novelty moderated by TMMs similarity.

TMM = Team mental model. Low task variation = groups in the control condition. High task variation = groups in the experimental condition. Low TMM similarity = TMM that developed less similar four measurement occasions. High TMM similarity = TMM similarity that developed more similar over four measurement occasions.

Overall, the results of these analyses do not lend support to Hypothesis 2—it seems that teams obtain higher performance when their TMMs are either more similar (performance novelty) or more complex and similar (performance efficiency) but not when they are more complex and divergent.

8. Discussion

In the introduction, I stated that there are two perspectives on team adaptation, a short term perspective which views adaptation as a response to a change in the team's performance environment and a long term perspective which views adaptation as adjustment to the demands or requirements of new tasks. The second perspective is also tied to the notion of adaptive performance transfer which refers to the ability of the team to transfer techniques and strategies effective in working on a task to novel tasks. In this study, I explored the second perspective on adaptive performance by examining the extent to which a technique advanced to increase performance on novel tasks at the individual level is also effective in determining team adaptive performance transfer. The technique explored in this study, task variation, which referred here to changes in performance requirements received during the work on an initial practice task, was assumed to lead to higher performance on a novel task. Furthermore, I expected that the influence of task variation on novel task performance will be moderated by the development of TMMs that are complex, diverse, and adjustable which I termed flexible TMMs. This study thus addressed the gaps noted in the introduction of assessing the long term role of TMMs for team adaptive performance and of researching the longitudinal development of TMMs.

With respect to the outcomes of the study, I found that task variation did not lead to significantly higher performance on a future task, although the differences were in the predicted direction for two of the three performance dimensions, efficiency and novelty. I also did not find support for the hypothesis that the development of flexible TMMs will moderate the effect of task variation on future task performance. I will address these findings first with respect to the influence of task variation on performance and then with respect to the role of TMMs.

8.1. Task variation and adaptive performance transfer

With respect to the study findings, task variation did not lead to higher team adaptive performance transfer. Although the literature on the role of task variation for individual transfer performance abounds, only a few studies have been conducted on the role of task variation for team performance. Fong, Slaughter, and Espinosa (2007) studied the relevance of diversity of experience for the productivity of individuals, groups, and organizational units. They found that more diverse experience leads to a higher productivity at the group and organizational unit levels but that experience in unrelated systems had the least influence on productivity at all three levels. Gorman et al. (2010) studied the impact of perturbation training, a method by which teams are faced with different roadblocks throughout their work, for team performance and coordination and found that perturbation trained teams had a higher performance and better coordination than teams receiving different types of training. Schilling et al. (2003) found that related variation practice as opposed to unrelated variation or specialized practice led to the best rate of team learning.

The results of these studies that investigated the effect of practice variation on performance at the team level suggest that there are significant performance advantages for teams that experience variation during the learning of a task. In this study, I did not find that task variation experienced on an initial practice task led to higher performance on a novel task. I submitted that varied experiences operationalized as encountering changes in the task demands during the work on the practice task should lead the teams to explore the task in order to discover rules, strategies, and solutions. This experience should have in turn made it easier for them to map the space of a new task and thereby increase their performance.

The two tasks on which the teams worked were sufficiently similar to enable transfer of best practices form the practice task to the transfer task. Several explanations could account for these results. First, although the two tasks were similar in that they addressed two organizations facing similar problems, they were also different in that different causes, consequences, and implications operated in the two organizations. Therefore, strategies effective to work on one set of problems may have been inefficient for working on the second set of problems. The problem of low transfer of deep structure is a well known phenomenon in the transfer of learning literature (Gick & Holyoak, 1983). Source analogs with structural similarity with the target were retrieved only 12 percent of the time (Blanchette and Dunbar, 2000). The varied tasks explored in the previous team level literature did not differ in deep structural ways which may have made transfer more likely, while the structural differences between the tasks employed here could have been greater limiting transfer.

However, it may also be possible that the analysis lacked the statistical power to capture a significant effect. In line with previous literature on task variation (Gary et al., 2012), I asked the participants at the end of the experiment how similar they considered the two tasks that they worked on. In line with the notion that variation will lead to the discovery of deep principles and deep structure, the participants in the task variation condition viewed the two tasks as significantly more similar than participants in the control condition ($t(22) = 3.12$, $p < .005$, $M_{\text{task variation}} = 6.00$ vs. $M_{\text{control}} = 5.02$).

It is also possible that feedback on the learning experience is necessary in order to derive the task relationships. The task variation by and of itself may not be effective at developing future task understandings if the general principles underlying the cases are not emphasized (Schwartz & Bransford, 1998). Without feedback the appropriate strategies or the cause-effect linkages are less likely to be encoded. In the task used here feedback was less feasible since the problem type was open ended which amounted to a high number of strategies and solutions possible, making it less possible to quantify. To explore these types of situations more in-depth and the learning that takes place as well as its transfer more realistic tasks with immediate feedback are required such as new product development simulated tasks. These may enable the introduction of targeted events, feedback, and process tracing (Hambrick, 2007). So far such simulated tasks have been mostly explored in action oriented domains such as military tasks or aviation (e.g., Holladay & Quiones, 2003).

8.2.TMMs and adaptive performance transfer

A second outcome of the study is that the development of TMMs during the work on the varied practice task moderated the relationship between task variation and novel task performance, albeit not in the hypothesized direction. Drawing on literature at the individual level, I argued that the effect of task variation on future task performance will be moderated by the development of flexible TMMs, that is TMMs that are complex, diverse, and adjustable. I argued for a generalization of these mental model characteristics at the team level advancing that teams that are able to develop more complex and more divergent TMMs should be able to map the space of the varied task comprehensively. This would endow them with the ability to process flexibly a new task (McDaniel & Schlager, 1990; Morris et al., 1977), thereby increasing their future performance. I investigated the role of these TMMs characteristics for a set of criteria relevant for work on open ended and ill-defined tasks such as project tasks or product development.

I found different effects of the moderators depending on the focal criterion. For performance novelty, the teams that experienced variation attained a higher future performance than teams that did teams that not experience variation when their TMMs became more similar.

This suggests that the attainment of novelty on a future task depends on the team mapping a few central principles that would guide their innovative efforts on a future task. In general, one would expect, according to theories on creativity and innovation and findings in multiple studies, that a higher divergence would lead to higher future performance novelty (Cox & Blake, 1991; Mannix et al., 2009; Schilling & Green, 2011; Shalley, Zhou, & Oldham, 2004; Walsh et al., 1988; Williams & O'Reilly, 1998). This is because when they develop dissimilar TMMs members may focus on different areas of the problem space and by tying across these areas they realize recombinational potential that is needed in innovation (Schilling & Green, 2011).

The fact that I did not find support for TMMs divergence influencing future task novelty performance here suggests that different mechanisms may be at play that have not been assessed. For example, divergent TMMs may relate differently to the quality versus the quantity of future ideas, but I did not control for this aspect here. Future research could further investigate this path to determine whether more similar or dissimilar TMMs are needed for innovation. For example, Skilton and Dooley (2010) proposed that teams that cooperate repeatedly on the development of innovative projects may obtain over time a lower project novelty score because their mental models become more similar which should make it harder to derive diverse ideas. More research is needed on these relationships to determine the true role of TMMs for innovative work.

I also found that teams that had more complex and more similar TMMs during the work on the varied task had a higher performance efficiency on the transfer task. Performance efficiency was operationalized as the time and resource appropriateness of the strategies suggested by the team to solve the company problems and as the appropriateness of the outcomes of these strategies. First, a higher TMMs complexity was necessary for high future performance efficiency. In this case, teams may need a more complex view to enable them to take into account different constraints and contingencies of their strategy development process. This constitutes an analytic view which may transfer into an ability to process and derive means to achieve goals on a novel task. Here a limited view may be harmful since it does not allow the team to consider and tie together the different factors that may affect their strategy implementation process. Efficient outcomes must consider the variety of constraints that are present during work on a practice task and these constraints may well generalize to work on a future task.

Second, a higher TMMs similarity was necessary for higher future performance efficiency. More TMMs similarity may be required because during the varied task members may be creating an understanding regarding resources, time, budget constraints and achievable outcomes. In such a case, developing dissimilar TMMs may lead to more confusion because members may tie resources, constraints, and goals differently. This could lead to a nonintegrated understanding which could transfer to a new task, hampering their performance.

The dimension of performance effectiveness seems to have been less affected by the mechanisms suggested in this work. Performance effectiveness was defined as the value, relevance, and implementability of the teams' strategies. Performance effectiveness is domain specific and the causal relationships identified in one task may not serve to map the structure of a new task. Performance novelty and efficiency may be better managed by applying general schemas that have been trained during the work on the varied task. But performance relevance may be more dependent on specific relationships and knowledge of cause-outcome linkages or exact performance feedback. This explains why no significant results were found for TMMs moderating the transfer on this dimension.

In this study, I attempted to bridge the individual and team literatures on the transfer of training by studying the role of mental models in influencing the relationship between varied practice and novel task performance. Summarizing the study results, it appears that there is no clear one-to-one mapping between the effect of mental models at the individual level and that at the team level. Task variation is a technique that aims to develop long-term flexibility in individuals and teams. Considering the scarcity of research at the team level on this method, I consider that this study creates a path for researchers to consider these relationships in a more complex operational web.

Secondly, I contribute to the TMM literature by expanding the characteristics of TMMs explored and assessing the construct longitudinally. The study results suggest that the development of different TMMs characteristics is differently related with future performance outcomes. While previous studies focused on the stable role of TMMs for adaptive performance, I managed to show that only considering the development of TMMs over time realizes the explanatory potential of the construct. In analyses not reported, I found that TMMs similarity at each timepoint assessed did not affect performance and it did not moderate the relationship between task variation and performance. This suggests that the trajectory of TMMs change over time is more important than the stable effect of TMMs at one timepoint. This longitudinal focus is especially relevant in the context of studying and developing adaptive skills therefore I recommend that researchers continue the exploration of the role of TMMs for long term performance and the role of its different characteristics in determining performance. More importantly, to determine the extent to which relationships posited at the individual level concerning the role of mental models for moderating the effects of task variation on transfer performance generalize to the team level, truly multilevel studies could be conducted. This could shed more light on the differences and similarities across levels.

There are a number of limitations that obscure the results. First, I relied on a student sample and a contrived task in testing the predictions. These factors may lessen the impact of the findings and preclude generalizations to real organizational samples and to more realistic operational environments. Nonetheless, most work on transfer of training is realized in lab settings using realistic simulations and trains neutral populations in testing the effectiveness of the different training interventions. I also assessed longitudinal performance by engaging teams in another task a few days after their first task. Real teams may rejoin to perform new tasks at different intervals which may affect their outcomes differently.

Second, I relied on the assumption that transfer performance will be enhanced to the extent that team members are able to develop flexible TMMs. Flexible TMMs should be developed by engaging certain information processing mechanisms but I did not assess the types of information processing that teams used. Future work could employ process tracing tools to give a more complete account of the development and role of flexible TMMs for managing task variation (e.g., Kozlowski, Chao, Grand, Braun, & Kuljanin, in press).

Third, I focused on the introduction of task related variation which meant that I maintained team membership fixed for both study phases. Although this enabled me to control the effects of factors related to team familiarity on the development of adaptive outcomes, the use of intact teams may also bear on results in ways not predicted (e.g., Lewis, Lange, & Gillis, 2005). Future studies should therefore take into account team formation and team composition aspects in testing models of adaptive performance.

Fourth, I tested in the study only one type of task variation mechanism—task requirements changes. But variation may be expressed in different forms and each may influence different performance criteria. To account for these varied effects future studies could employ different team and task related variation inducing mechanisms to determine how they influence singly and in combination the development of different adaptive capabilities.

In summary, this study showed that task variation is effective only to the extent that teams develop during the varied task more complex or more similar TMMs as a function of the performance criterion (i.e., more similar for performance novelty and more similar and more complex for performance efficienct). This calls for more research on the relevance of task variation for transfer to different performance dimensions and for identifying the role played by cognition in these transfer situations. In the following chapter, I take the exploration of the longitudinal effect of TMMs on performance one step further, by examining the effect the development of TMMs has on project team performance in real teams, that is in a field sample.

Chapter 4 - The Role of Team Mental Model Convergence for Performance in Project Teams

In this study, I continue the exploration of the dynamic role of TMMs for performance by investigating their convergence over time and the relationship between TMMs convergence and performance. Mental model convergence means that the individuals in the team shift their view from an individual understanding of the task and of the performance environment to a team level understanding. This shift is relevant because it defines the emergent team in terms of their common visions for the team and for its performance. Determining whether a shift realizes and on what contents the shift realizes becomes important for making predictions regarding future team interactions and performance. For example, do the team members begin to see their goals for the common work more similarly after a period of interaction and does a shared goal perspective aid their performance? Do they begin to form more similar understandings regarding their interaction requirements and the procedures by which to carry out the work and with what effect on performance?

With some notable exceptions (e.g., (Mathieu et al., 2000; Levesque et al., 2001; McComb, 2007) the previous literature on shared understandings in teams has addressed only snapshots or cross-sectional assessments of TMMs. This type of assessment does not enable us to address team developmental issues. The content on which and the point when understandings become shared in a team should be relevant knowledge for team managers that try to organize the team task for high performance. If the team members have not converged on an understanding of their goal, for instance, there may be conflicts or competing efforts in the team. Knowing whether understandings converge and how they affect performance can thus aid future team development efforts.

I focus on the convergence of certain TMMs contents. The content of TMMs refers to understandings regarding the team task, the team goals, the team interactions, and work procedures that are relevant for work on a particular task in a particular domain. Theories of group development (Kozlowski et al., 1999) predict that as members become more familiar with their task and their team, they enrich their understanding of these contents. As they pass through different team development stages, these cognitive contents also become more similar with those of other members. For example, when the team first forms, the members may have only a preliminary understanding of what they have to work on, their goals for the common task, how they should work on the task, and what each member should contribute to the task. As they start their work, they begin to develop a deeper understanding of these contents, as they start to accomplish the work requirements and to interact with others. Since the work is common and members discuss aspects related to their task performance, to what they have to do and to what they have to work on, it is likely that their understanding of the task related aspects will also become more similar.

In this paper I am interested in this process of developing shared understandings, specifically in whether understandings become more similar in a team over time and the contents which are likely to become more similar. In addition, there is a larger literature tying shared understandings with performance outcomes (DeChurch & Mesmer-Magnus, 2010a, b). Therefore, the second aim is to determine whether the convergence on certain types of TMMs contents relates with performance on different criteria.

In line with recent observations that TMMs should be studied in context (Mohammed et al., 2010), I focus in this work on TMMs convergence in interdisciplinary project teams. This extension presents an opportunity to observe the role of TMMs for other types of team settings than the ones previously explored, that is in action teams such as sport and military teams (e.g., Mathieu et al., 2000; Webber, Chen, Payne, Marsh, & Zaccaro, 2000). Interdisciplinary project teams are composed of members with different backgrounds, specializations, and expertise, which affords them a breadth of task relevant resources sustaining their problem solving, creativity, and innovation efforts (Cox and Blake, 1991; Kanter, 1996; Williams & O'Reilly, 1998). At the same time, due to their different backgrounds, members are also more likely to form different views on how to manage the work process and their interactions within the team with potentially negative effects on communication, understandings, and information sharing processes (e.g., Dahlin et al., 2005; Dougherty, 1992).

TMMs convergence becomes particularly relevant in this context, since the development of more similar TMMs may enable team members to manage their differences effectively and to integrate them into successful projects (Ericksen & Dyer, 2004). Due to scarce research in these settings, however (e.g., Levesque et al., 2001), it becomes difficult to advance predictions with respect to the appropriate form of TMMs in relation with interdisciplinary project team outcomes. Therefore, I focus on the relevance of TMMs development for a set of outcomes specific to interdisciplinary project teams.

Finally, I integrate the role of TMMs with a behavioral view. In line with the previous literature, I assume that TMMs may affect performance directly and indirectly, their effect being mediated by specific team process constructs. Different processes may underlie the effect of TMMs on performance, such as communication, coordination, and backup behaviors (Marks, Mathieu, & Zaccaro, 2001). Initially, TMMs have been considered to influence performance because they enable members to better predict the actions and needs of others and situation developments. This assumes that TMMs increase the implicit coordination of teams, which correspond to the capacity to predict what others will need or do or how the situation will develop. This hypothesis is less explored in the TMMs literature which causes a gap in our knowledge regarding the mechanisms via which TMMs operate. Therefore, in this study I look at the extent to which TMMs convergence influence performance indirectly via their effect on implicit coordination.

In summary, this study addresses the following gaps in the TMMs-team performance literature: first, it addresses how TMMs influence project team performance. Recent reviews (e.g., Mohammed et al., 2010) have asked for an expansion of the context in which TMMs are effective, with special emphasis on project teams that conduct innovative work. There have been though few studies that focus on these relationships (e.g., Casakin & Badke-Schaub, 2015). This does not enable us to develop integrative models of project team performance. We do not know whether the same mechanisms that promote the performance of other types of teams also promote the performance of project teams. Therefore, this study provides a step forward in this direction by assessing the relationship between TMMs and the performance of project teams.

Second, TMMs have been theoretically defined as constructs that change over time according to changes in the team or the team environment. In fact, models of TMMs development (McComb, 2007) specifically consider the developmental trajectory of TMMs. There have been however few empirical investigations (e.g., Mathieu et al., 2000) which limit our knowledge of how TMMs develop over time and how this development relates with performance.

To addresss these gap, in this study I assessed TMMs at multiple timepoints and related TMMs development with team performance. I apply the analysis of these gaps by investigating a particular domain of team performance, that is creative and innovative team performance. Through the focus on team innovation in the three studies reported in this dissertation I create a program of research through which I contribute to the literature on TMMs and team performance thereby enabling future researchers to predict the relationship between TMMs and performance innovation and develop more informed research models. Recall, the core results of study one were that teams with dissimilar TMMs obtain higher performance innovation scores, in study two I found that developing more similar TMMs influences positively future task novelty performance. In this study, I explore these relationships more in-depth looking at more carefully assessed and field sample based performance measures. This aspect of assessing the relationships between TMMs and team performance in a field sample is also important because most of the previous studies have been conducted in artificial settings which prevents generalizations.

With respect to the linkages between this study's predictions and the theoretical framework, I tested Proposition 4 while going beyond this proposition to capture a temporal aspect. Specifically, Proposition 4 proposes that in tightly coupled systems with an equifinal-multifinal path/goal structure dissimilar TMMs will match better the characteristics of the environment and will lead to higher performance. The tasks on which the teams worked in this study were complex tasks that required the creation of new products or processes. As such, they correspond to the characteristics of the task environments described in Proposition 4. This assumes that the teams would reach a higher performance on these tasks when they are able to form dissimilar TMMs.

In this paper, I propose that TMMs follow a developmental trajectory whereby the development of TMMs over time is more important for performance than the influence of TMMs at one timepoint. In other words, I assume that earlier in the team interaction, before the team has set goals, interaction norms, and established performance procedures, dissimilar TMMs may be useful because they help the team pool its resources and develop integrated understandings. But at later moments more TMMs similarity may be beneficial because it enables team coordination and feeds directly to team performance. This means that the development of TMMs over time and not TMMs at one time point affect performance. Thus, this goes beyond the arguments in the theoretical framework by including an explicit reference to the role of time.

This paper proceeds as follows: First, I discuss the dependent variable of the study. Then, I discuss the TMMs conceptualization used in this study and discuss findings pertaining to TMMs convergence over time. Next, I detail the role of implicit coordination as a mediator of the relationships between TMMs and performance. In the second part of the paper, I describe the results of the empirical study undertaken to test these relationships.

1. Performance

In this study, I focus on the role of TMMs for specific performance dimensions. Specifically, I focus on a set of performance dimensions directly related to project development work. Project development work has been typically defined in terms of the relevance of the work conducted for the customer and the efficiency in terms of meeting time and resource constraints (Lipovetsky, Tishler, Dvir, Aaron, & Shenhar, 1997; Pinto & Prescott, 1990). An additional dimension is novelty, which describes the potential of the project to introduce new ideas to an organization or to a market (e.g., West & Anderson, 1996).

The teams that I studied worked on the development of projects that presupposed the creation of new products or processes in a variety of engineering domains. In defining the performance criteria, I drew on the work of Frederiksen and Knudsen (2014) who constructed a set of performance dimensions that speak directly to this context. This expansion to a different set of criteria also answers calls in the TMMs literature to study the construct in relationship with a broader set of outcomes, such as innovation and creativity (Badke-Schaub, Neumann, Lauche, & Mohammed, 2007). In the context of this work, the following performance dimensions were considered: usefulness, market potential, and novelty.

Usefulness refers to the degree of value of the ideas, products, or processes to the customers and the users and is defined in terms of whether the outcomes of the project developed meet the customer demands, whether they are usable or accessible, and whether they are desirable in terms of meeting the customer wishes and reaching cost-benefit terms. Usefulness reflects the views of the intended recipients of the products, specifically the customers and users.

Market potential refers to the degree of short- or long-term value to the firm of the product, idea, or process. It touches aspects such as degree of strategic fit of the project outcomes with the company core competencies and its current positioning, the fit with the current portfolio, the degree to which the project is realizable in the sense that it is technologically possible and equitable in terms of quality versus cost criteria, and the general cost-benefit balance of the project in terms of short- or long-term return on investments in terms of increased know-how, brand value, or profit. Market potential reflects the firm perspective on the product.

Novelty refers to a fundamental aspect of an innovation related to the creativity or the originality of the ideas, products, or processes proposed. Novelty is defined in terms of the uniqueness of the product or process to the market, on a continuum where at one end the innovation constitutes only incremental improvement whereas at the other end it constitutes a radical departure from existing ideas. Novelty reflects the level of the customer or even the larger society that benefits the novelties developed.

I consider that all three criteria are relevant for project team performance. For example, a product may be useful but may not be novel or have low market potential not meeting key organizational and market demands. Similarly, a product may be novel but it may not be useful or it may have low market potential which decreases its value for the customer and the organization.

2. Team mental model content

In line with recent calls for domain and context specific TMMs conceptualizations (Mohammed et al., 2010), I drew on Cannon-Bowers et al.'s (1993) framework and focused on subtypes of task and team TMMs contents considered relevant for project teams' performance: task goals, task procedures, and team interaction TMMs. The goal TMM refers to the knowledge regarding the "overall mission goals and subgoals that indicate what and how much must be accomplished by a specified time and within certain quality standards" (Marks, Mathieu, & Zaccaro, 2001, p. 365). Goal TMM enables members to set common priorities for their performance ensuring that their efforts converge timely towards achieving the same outcomes.

The procedural TMM refers to the sequence, order and timing of tasks and aids members to prevent delays and misaligned steps in project work and to integrate their inputs efficiently. The interaction TMM refers to team members' roles, responsibilities, role interdependencies, interaction patterns, communication behaviors, and information flow. The team interaction TMM facilitates accurate understanding of each member's tasks, role requirements, and needs for role contributions.

I chose to focus on these contents over others due to their relevance for project development tasks. The goal TMM drives the overall team activity and it has been demonstrated an important determinant of performance in project teams (e.g., Pearce & Ensley, 2004). The interaction TMM defines how members distribute their roles and responsibilities. It has been shown that particularly the distribution of responsibilities in a project team differentiates between high and low performing teams (e.g., Eriksen & Dyer, 2004). Third, the procedural TMM corresponds to the notion that projects are accomplished according to a set of general steps that must be known by the members to facilitate their common actions (e.g., Brown & Eisenhardt, 1997).

3. Team mental model development

TMMs can be defined in terms of their content and their structure. Content has been reviewed in the previous section. Structure refers to how the contents of the mental model are organized internally, to the causal and noncausal linkages between the constructs stored in long-term memory. From a theoretical standpoint, researchers have advanced that teams may develop more similar TMMs content and structure over time or that they develop convergent TMMs (Cannon-Bowers et al., 1993; McComb, 2007). Researcher have assessed mental models usually using pairwise similarity ratings (DeChurch & Mesmer-Magnus, 2010b), which refers to offering team members a fixed and predefined set of mental models contents that they have to rate on how similar the contents are with each other. As a consequence of this assessment, most previous research has analyzed the convergence of the mental models structure. This literature provides mixed evidence with respect to the convergence of TMMs structure. Studies conducted over a shorter period of time find evidence for both team and task TMMs structure stability (Mathieu et al., 2000; Mathieu Heffner, Goodwin, Cannon-Bowers, & Salas, 2005). Studies that assessed the construct over a longer time frame find little evidence for task TMMs convergence but some positive evidence for team TMMs structure convergence (Cooke et al., 2001; Cooke et al., 2003; Edwards et al., 2006).

While this TMM structural assessment enables capturing the convergence of mental model structure or the linkages between the predefined contents becoming more similar over time, it does not allow to determine whether mental model contents become more similar over time. McComb (2007) relying on theories of group information processing (Hinsz, Tindale, & Vollrath, 1997) and team development (Kozlowski et al., 1999), proposed that different TMMs contents develop at different times during the teamwork, implicitly or explicitly, in an iterative cycle with feedback loops to update previous knowledge as or when required. According to this model, individuals first develop overarching goals and task TMMs followed by team and team interaction TMMs.

McComb (2007) states that the convergence on structure may be more relevant for teams such as action teams that must coordinate swiftly to overcome performance barriers in dynamic and uncertain situations. In such cases, sharing the linkages among the TMMs contents facilitates predictable actions by ensuring that the members will apply the TMMs content in the same way. Members can thus anticipate what others will do and when they will do it permitting coordinated collective action (e.g., Marks et al., 2002). In teams such as project development teams however, the sharing of the TMMs structure may be less relevant since these teams do not meet high demands for coordination and fast collective action. Interpredictability may be achieved to the extent that they are able to reach similar conclusions based on similar TMMs contents.

There is very limited research on the convergence of TMMs content in teams and similarly to the research on TMMs structure convergence the findings are inconsistent. Levesque et al. (2001) found that project team members' team interaction TMMs diverged across three months, results attributed by the authors to the role of specialization and infrequent interaction. McComb (2007) found that project members developed more similar team interaction TMMs across an interval of one week, but not more similar goal TMMs, with the content of all TMMs remaining stable following the first week of assessment through the next three months of teamwork. McComb, Kennedy, Perryman, Warner, and Letsky (2010) found evidence for TMMs convergence on multiple contents. A recent review has addressed the relevance of TMMs for performance in project teams (Badke-Schaub et al., 2007) but so far there have been no investigations of the role of TMMs convergence for project team performance. To be able to accurately predict project team performance, we need therefore more exact and theoretically grounded investigations of the effect of TMMs on performance in project teams. This lead I follow here.

Specifically, I continue the investigation of TMMs content convergence which is much less researched than the convergence of structure. According to the evidence cited, the convergence of TMMs contents should also be more relevant for project teams that do not meet high demands for temporal coordination and thus gain no specific advantage from a convergence of structure. In describing the process by which I expect TMMs contents to converge I draw on theories of work group development. Specifically, the Kozlowski et al. (1999) theory of group development describes the development of team level contents, processes, and outcomes as a shift in level from the individual to the dyadic, to the team level. I find this model relevant to sustain the discussion on the development of TMMs because it represents a model of working and learning in teams or work groups.

In this theory, team development is represented as a sequence of four modal phases where the teams proceed from one phase to the next by shifting their attention and their patterns of behavior: team formation, task compilation, role compilations, and team compilation, where compilation refers to the development of routines, norms, and understandings with respect to a specific team aspect. What interests us here is the TMMs content convergence from earlier to later moments of group development. In other words, I look at whether multiple TMMs contents become more similar in a team over a period of work interaction. Although I do not provide indication on the exact moment when these contents will converge (e.g., McComb et al., 2010), I assume, in accordance with the Kozlowski et al.'s (1999) theory of team development, that by the halfway of team interaction, the team will have converged on most of the TMM contents considered here.

First, the goal TMMs is likely to converge first because in the team formation phase the individuals develop an understanding of the team goals, climate, and group interaction norms and interpersonal knowledge about the team members. Then, in the task compilation phase, members become familiarized with the task and develop an understanding of the skills required to perform their work and the effective performance strategies. This is likely to influence the TMM of member interaction. The interaction TMM is likely to be further developed during the role compilation phase when members shift their attention to the team level to understand the role of other members and the contributions required from them.

According to Kozlowski et al. (1999) during these phases the members learn to coordinate by answering questions as "With whom must I interact to complete tasks?" and "How do I balance the requirements others place on me with my own requirements?" (p.266). In other words, they develop the role knowledge necessary for team level performance, or knowledge about whom they must interact with, the content of the interaction or the boundaries of member responsibilities, and the timing of the interaction. The knowledge developed in this phase becomes central for the enactment of coordinated behavior. More specifically, members develop knowledge of other's capabilities and needs that may facilitate the replacement of explicit forms of communication and coordination with implicit forms. I will revisit this issue in the discussion on implicit coordination.

Then, as the members understand their task and each member's role in it, they are likely to need guidance in the form of an overall plan or procedure to conduct the work (Marks et al., 2001). This general plan should also be developed at early stages of the team development and then be completed or refined as the team receives more specific knowledge about its requirements for performance. I expect thus goal, interaction, and procedural TMMs to develop early into the team interaction and to be further developed as the team transitions through different stages of development that complete their knowledge. In other words, I expect that over a period of team existence that cumulates these developmental stages I will observe convergence on the goal, interaction, and procedural TMMs.

I expect to observe considerable TMM convergence in the teams studied due to the timing during their performance when the TMMs were assessed. More specifically the teams in this study followed a sequence of predefined stages that defined how and when the work will be conducted. In a first phase, the teams had to develop learning objectives, to create a competence triangle that helped them to define their personal skills and capabilities for the task, to develop a general activity and time plan, and to define their personal roles using a predefined role definition tool. Pertaining to their task, they had to generate a business idea by drawing on their expert knowledge and to find an application for their idea. Therefore, in the first stage of work the team already had to consider their goals for the performance, their interactions and contributions to the task, and their procedures to work on the task. This leads me to advance that early on the core of the TMMs was established. To capture these initial understandings, I assessed the TMMs at one week after the team started its work.

In the second phase, they had to further develop the skills and the understandings created in the first phase by drawing on tools for people management and project management which helped them manage their contributions and their task work. In this phase, they had to develop their idea into a concept which meant that they had to define the product that they aimed to create, their market, and their customers. This required further development of their goals which should have become more specific, of their procedures to work on the task which should also have been revised based on the emerging task requirements, and of their contributions and interactions which should have become more well-defined after the initial role definition phase.

At the end of this second phase I assessed the teams' TMMs again because these should have become more well-defined, that is they should have converged to team level understandings. In the third phase, the teams worked on developing their business model further into a marketable concept by conducting market and budget analysis and recording their weekly activities. I expected at this phase their TMMs to have consolidated and for the team to place less emphasis on the development of team and task related understandings but instead to place more emphasis on their action skills, specifically their coordination capabilities. At this point, I assessed implicit coordination, in line with the theoretical idea that coordination should be the outcome of successful TMM convergence (Kleinman & Serfaty, 1989).

Other work focused on project teams found that shared understandings develop after a period of teamwork and that they are relevant for performance. Kilduff et al. (2000) found that high performing diverse top management teams had a diversity of interpretations on role specialization, power, causes of performance, decision making process, and procedures for achieving effectiveness at the beginning of their work on a simulated organization but had more convergent interpretations towards the end of their performance. Fiol (1994) describes the consensus building episode of a project team around the interpretation or framing of issues. At the beginning of the project, members held diverse interpretation contents and framed issues differently but towards the end of their performance they framed issues related to the definition of the project and its potential contribution to the business similarly. On a similar note, Walsh et al. (1988) discuss that high diversity of perspectives and low consensus is necessary at early stages in the decision making process to ensure that the group has a diverse outlook on the situation but convergence is needed later on for the implementation of the ideas.

Support is available generally in the project development literature that agreement on a set of goals, interaction requirements, and procedures for performance is necessary. Eriksen and Dyer (2004) showed that project teams that set early on at their pre-launch meetings goals, strategies, and role distribution expectations outperformed teams that did not set clear expectations early on. The teams with an initial shared set of expectations were in turn able to refine and revise these as the projects progressed. Brown and Eisenhardt (1997) also noted that successful project teams first develop structures around responsibilities and priorities and then as the project develops they build on and refine these initial structures to fit the emerging aims. Cumulating this evidence, there is support for the notion that the TMMs contents considered here develop in project teams and that they lead to higher team performance.

Hypothesis 1: The goal, interaction, and procedural TMMs of project development teams will converge over a period of interaction.

4. The relationship between TMMs and performance

As to the role of TMMs convergence for project team performance, there is a larger literature that suggests that more similar TMMs lead to higher performance (DeChurch & Mesmer-Magnus, 2010a, b). Convergent TMMs should be particularly valuable in project teams where members may bring different views to the task that may preclude the development of a common view. For instance, members may hold a great amount of unique information that they fail to share with the team preventing the creation of a shared understanding (e.g., Stasser, Stewart, & Wittenbaum, 1995). Convergence on the goal TMM should be particularly relevant for project team performance. Eriksen and Dyer (2004) emphasize that teams that did not set early on project goals, overall performance plans, and that did not distribute their roles and tasks had a lower performance than teams that handled these issues early on. Similarly, Pearce and Ensley (2004) found shared vision, a mental model related to the future team goals and outcomes, to be related with different ratings of innovation effectiveness. Gilson and Shalley (2004) showed that teams high on shared goals had higher creativity.

The interaction TMMs convergence should also be related positively with team performance. Converging on an interaction TMM means that teams understand better their roles and their potential for contribution to the project. This should make relating with each other easier and more fluent, enhancing, as I discuss further their implicit coordination. In regard to the procedural TMMs convergence's effect on performance, the result may depend on the emphasis on individual versus team procedure definition. When the emphasis is on each member attending to the procedures and rules for developing the work as corresponding to the member's role on the task (McComb, 2007) then the procedures may not be shared among the members and a higher sharing may actually be detrimental. However, when the procedures for conducting the work are to a large extent shared, as for example the presence of certain regulations that demands that all members become aware of and put into place these regulations, procedural TMMs convergence may be required. In the context of the project teams investigated in this work, the teams faced certain regulations for how their project should develop that needed to be known by all members in order to develop the project. For example, certain deliverables were needed by certain predefined stages or certain project development and collaboration tools needed to be used during project development. This makes it likely that convergence on the procedural TMM is also relevant for team performance.

In this paper, I examine the effect of TMMs convergence on the performance dimensions described in the introduction. The goal TMM provides a shared vision for the team to conduct its work, an integrated framework for project development. Therefore, to the extent that the goals are defined with the customer perspective in mind then, convergence on a goal TMM is likely to be relevant for performance usefulness. If the organizational goals are adopted during project development, then convergence on the goal TMM is also likely to be relevant for performance market potential. And considering previous evidence on the value of a shared goal or a shared vision for innovation, it is also likely to be relevant for performance novelty.

When members converge on the interaction TMMs they can more easily define useful contributions that create the potential for useful projects, they are also more likely to understand their contributions in terms of the organization needs which should increase their market potential, and they are also more likely to be able to combine their contributions into novel product or processes. Convergence on the procedural TMM is likely to be relevant for performance usefulness if the team follows a set of procedural rules which define requirements for obtaining valuable products, it is similarly likely to be relevant for market potential when the procedures followed are in relation with the organizational needs, and finally to the extent that the shared procedures address key stages in the innovation process they are also likely to be relevant for novelty performance. Therefore, I examine the role of TMMs convergence in relation with all three outcomes. I expect that the convergence on the goal, procedural, and interaction TMMs to relate positively with these outcomes.

Hypothesis 2: Goal, interaction, and procedural TMM convergence will be related with the performance dimensions of novelty, market potential, and usefulness.

5. **Implicit coordination**

The theory of team development (Kozlowski et al., 1999) suggests that after the teams have developed cognitive contents related to their task and team role distribution during the team development stages, they will be able to progress through the rest of their performance fluently by coordinating implicitly. Implicit coordination refers to substituting the explicit forms of communication with implicit shortened forms. Implicit coordination requires the team to have a common understanding of the meaning of the condensed communication (Kozlowski et al., 1999).

Implicit coordination is a form of coordination which relies on members anticipating others' actions and needs and task demands and acting in anticipation of those needs and demands (Rico, Sánchez-Manzanares, Gil, & Gibson, 2008). Such behaviors include providing information, resources, feedback, backup to others without request when this behavior is required or is relevant for others' needs, monitoring the team activity and adapting to the behaviors of others on the team. According to the theory of team development, implicit coordination is an outcome of developing shared understandings regarding the team objectives, role requirements, and procedures or TMMs.

Implicit coordination becomes more relevant in the action stages of team performance (Marks et al., 2001). When there is limited time for the work, there are increasing task demands, and there is pressure to perform quickly, members are required to share information and resources and coordinate their activities to accomplish the set goals quickly and efficiently. This requires that they share an understanding of those goals, of the roles and task distribution, and of the overall procedure to conduct the work. There is evidence that teams that are in a phase of intensive activity achieve higher performance when they coordinate implicitly (Kleinman & Serfaty, 1989; Serfaty, Entin, & Volpe, 1993; Urban, Bowers, Monday, & Morgan, 1993, 1995; Walle, Gupta, & Giambatista, 2004). Consistently, in this study I assessed implicit coordination when the teams were in the phase of preparing the report of their work, the most action intensive period of work.

Implicit coordination is composed of behaviors that indicate an anticipation of the task developments and the needs of others such that less information and other task relevant resources are requested and more is transmitted voluntarily. The role of TMMs in this process is to facilitate the understanding of what information or resources are needed and to transfer these accordingly. Despite the posited role of TMMs for the enactment of implicit coordination, there are few studies that address directly these relationships. Stout, Cannon Bowers, Salas and Milanovic (1999) hypothesized that planning as an antecedent of TMMs should enhance TMMs which in turn should enhance anticipatory behaviors. They found support for the relationship between planning and the two outcomes, but no direct effect of TMMs on anticipatory behavior. Another study by Marks et al. (2002) found positive evidence for the effect of TMMs on coordination, and the indirect effect of TMMs on performance, mediated by coordination. Recently, Fisher et al. (2012) researched the influence of TMMs on implicit coordination and performance and found significant results for implicit coordination as a mediator of the relationship between TMMs and performance.

Drawing on this larger literature, in this study I aim to take a closer look at the relationship between TMMs and coordination by investigating implicit coordination as a mediator of the relationship between TMMs and performance. First, I submit that TMMs convergence indicates an increasing awareness in the team of relevant goals, interaction requirements, and procedures which should increase the potential for transmission of information and resources without request. When members understand the task in terms of the same goals, when they are clear about what their responsibilities are, and when they are on the same page in terms of effective procedures then they may more easily account for each other's needs and the task requirements because they will be able to anticipate these and to act thus in advance. So, first, in line with previous literature I posit a link between TMMs and implicit coordination.

Second, implicit coordination should have a positive effect on performance. Implicit coordination means that members will actively share information and resources without being asked which should make their interactions more fluent and less effortful. This capacity should be especially relevant when the teams are in a phase of intensive activity, when the time and opportunities for extensive discussion over needs and resources should be lower. Considering thus the posited positive effect of TMMs on implicit coordination and the effect of implicit coordination on performance, therefore I predict the following:

Hypothesis 3: Implicit coordination will mediate the relationship between TMMs convergence and performance.

6. Method

Procedure

6.1. Sample

Data was collected from a sample of 14 new product development teams, composed of undergraduate students enrolled in different engineering programs at a public university in Denmark. The students were randomly assigned to teams of five or six members and were required to work together for the length of an academic semester (i.e., four months) to develop a new product as part of an academic course requirement on team interdisciplinarity. Teams were allowed to select their project's topic from a predefined list of open ended topics within a specific engineering domain.

Throughout the semester, members were involved in a variety of tasks, including research and documentation, reporting at different project stages, deciding on and selecting materials to develop and to test product models, conducting market analysis, and showcasing their models. Thus, their work resembled the work of organizational new product development teams. The teams met approximately once per week in class over the course of the semester. Each team's project was different according to the theme and topic selected, but the teams' work was equivalent in that according to the course requirements all teams worked on a project with a broad scope and similar degree of complexity. The projects' topic spanned areas as the offshore windpower services sector or welfare technology. The final teams' work output consisted of a business report and a product proposal.

Twenty percent of the participants were female, the mean age of the sample was 23.89 years (*SD* = 4.2), and participants worked as employees on average for 5.09 years (*SD* = 4.28). Participants were enrolled in 10 different study disciplines, among which the majority (64%) represented different degrees in engineering (mechanical engineering, software engineering, information technology, robot technology, electronic and data, energy technology, design engineering, and product development and innovation) and the rest represented other disciplinary areas (educational studies, economics and business administration). Most participants had experience working in a team context (50% academic project groups, 27% production groups, 21% service groups, 41% project or new product development groups). Fifty-six percent of the sample reported not having worked before with their current teammates and 30% to have worked with at least some of the teammates.

6.2. Data collection waves

Data was collected at three times throughout the students' projects by means of an online survey: at one week after course onset, at five weeks, and at nine weeks. Based on the requirements of the host university, in order to determine the potential sample, students were in a first step sent a consent form via email, which described the study and invited the students to take part in the research. Of the 200 students that received the study consent form invitation, 100 agreed to take part and consistently, 100 responses were collected for the first survey wave and, consistently, $N = 100$ represents the initial sample size of the study. For the following waves, students received the survey via email and were required to provide their responses within one week of survey receipt. I opted for this interval to prevent interference with students' course activities. Most participants provided their answers in the required one-week interval.

Seventy-three responses (i.e., 73% response rate) were received for the second survey wave, and 43 responses (i.e., 43 % response rate relative to wave one) for the third survey wave. For the first wave, I received responses from 31 teams with a number of responses per team ranging from 1 (11 teams) to 6 (6 teams) with an average of 3 responses per team. For the second wave, 25 teams were represented with a number of responses per team ranging from 1 (11 teams) to 5 (6 teams) and an average number of responses of 2.5. For the third wave, 19 teams were represented with a number of responses per team ranging from 1 (11 teams) to 5 (2 teams) and average number of responses of 2. I retained in the analysis teams that provided more than two responses per team to the TMMs items in waves one and waves two of data collection. TMMs are emergent constructs which requires that they are assessed using multiple responses per team. This yielded a final sample of 14 teams with a number of responses per team across the two waves between 2.5 (1 team) and 5.5 (6 teams) and an average of 4 responses per team.

Individual background variables (age, gender, education, work experience, team experience) were included in the first survey. TMMs items were included in the first two surveys, and the coordination items in the third survey. The timing of assessment for each of the three surveys will be further referred to as Time 1, Time 2, and Time 3. Performance data was collected at one month after the teams handed in their projects, in the form of academic supervisor ratings of teams' projects (i.e., Time 4). The student respondents were informed that their answers to the survey are not related to their course performance. To examine the effects of subject attrition, I followed the recommendation by Goodman and Blum (1996) to use multiple logistic regression on the independent variables collected at Time 1. A dichotomous variable was created to distinguish between subjects that responded to all three measurements and those that answered only the Time 1 measurement. Comparison between respondents and nonrespondents showed no significant differences with respect to the demographic variables, gender, age, nationality, work years, and academic grade, or with respect to the TMMs measurements ($\chi^2(12) = 17.44$, $p = .13$). The results suggest that data are missing at random and attrition did not affect the study results.

6.3. Research instruments

6.3.1. Team mental models

Previous studies have relied on different elicitation and representation techniques to derive TMMs content and to form TMMs similarity scores (Cooke et al., 2004; Langan-Fox, Code, & Langfield-Smith, 2000; Mohammed, Klimoski, & Rentsch, 2000). Researchers assessing the construct via structural techniques such as similarity ratings typically collect members' ratings of the similarity of pairs of task relevant concepts, which they compare with other members' ratings and then aggregate to form indices of TMMs similarity (e.g., Mathieu et al., 2000). Studies using Likert-type content only scales rely on assessment of member consistency and agreement in rating certain items to determine degree of similarity (e.g., Levesque et al., 2001). Both structural and content based approaches have been shown as accurate TMMs representations for the prediction of performance (DeChurch & Mesmer-Magnus, 2010b). In this study, I rely on a content based open-ended approach, by which the TMMs relevant content is directly elicited from the respondent. This is in line with the study focus on TMMs content convergence as opposed to structure convergence.

To elicit the relevant TMMs content, members were asked to provide in writing their answers to questions regarding their interpretations and knowledge related to different mental models, thus: "What are your team's goals or priorities for this project?" (goal TMM); "How do you need to execute the tasks to achieve your goals? Specifically, what's the process to get work done? What's the procedure to get the work done?" (procedural TMM); "How has your team established how members make contributions to the project?" (team interaction TMM).

To assess the degree of convergence at each time point, team members' responses were compared according to a scheme based on the sentence completion test and scoring protocol developed by Schroder et al. (1967) and used by McComb (2007) to assess TMMs convergence. This protocol consists of seven integration transitions, from 1- *No similarity (the whole team has completely different responses. No common ideas or topics are reported)* to 7- *All team members report the same topics and use the same formulations (All team members have responses that are formulated in the same way)*, which capture differences in TMMs content within and across measurement occasions. Table 1 provides the complete protocol.

Table 1. *Team Mental Models Scoring Protocol*

1	No similarity	The whole team has completely different responses. No common ideas or topics are reported
2	Half the team reports same topics, different formulations	Half of the team has very similar responses in that they contain the same topic but are formulated differently
3	Majority of team reports same topics, different formulations	The majority of team members have similar responses and the formulations are different
4	All team members report same topics, different formulations	All team members have similar responses that are formulated differently. The responses must show that all the team members possess similar ideas with respect to the mental model being scored
5	All team members report same topics, half use same formulation	All team members have similar responses, and half of the team formulates the response in the same way
6	All team members report same topics, majority use same formulations	All team members have similar responses, and the majority of the team formulates the response in the same way
7	All team members report same topics and use same formulations	All team members have responses that are formulated in the same way

Note. From McComb (2007). Mental model convergence: the shift from being an individual to being a team member (p. 132).

6.3.2. Implicit coordination

To represent implicit coordination, I relied on relevant definitions and the following indicators provided by Entin and Serfaty (1999), MacMillan, Entin, and Serfaty (2004), and Salas, Rosen, Burke, and Nicholson (2007): reduction in requests for action and information and increases in task-relevant unsolicited action and information transfer. Consistently, three items were developed to capture the extent to which members anticipated others' action and information needs and acted accordingly: "Members passed information relevant to the task to one another in a timely and efficient manner", "Members communicated information about their status, needs, and objectives as often as needed (and not more)", "Team members offered project relevant information before it was requested". Members were asked to evaluate these items on a 7-point scale according to how much their team engaged in the respective behaviors during the project work, from 1 (*does not apply*) to 7 (*applies completely*). Members' scores were averaged to form the team level construct. The teams evidenced high level of within-group agreement (r(wg) = .78; ICC(1) = .33). Results of an explorative factor analysis on the scale items revealed the extraction of a single factor that explained 58.59% of the scale variance ($\alpha = .65$). Additionally, the convergent validity of the scale was also determined by comparing it with a general coordination scale by Lewis (2003) composed of five items measured on a 7-point scale according to how much the team engaged in the activities described during their work (sample item: "Our team worked together in a well-coordinated fashion", $\alpha = .81$). The association between the implicit coordination scale and the general coordination scale was acceptable ($r = .58$, $p < .001$).

6.3.3. Performance

Performance was assessed on three criteria, based on a scheme developed by Frederiksen and Knudsen (2014): novelty, the degree of uniqueness of the idea or product to the market; usefulness, the degree to which the product fits the needs, wishes, and ability of the target group; and market potential, the expected value a new product may bring to a firm. The dimensions were rated using a 0-100% scale, thus: Novelty—0 (*nothing new or original about the product proposal, just existing solutions and knowledge represented in a new way*)-100 (*the product proposal is entirely new and original*); Usefulness-0 (*the product proposal does not sufficiently meet the needs and wishes of the relevant target group*)-100 (*the product proposal is completely in tune with the needs and wishes of the relevant target group*); Market potential-0 (*the product *proposal will not be sold or be sufficiently profitable to bring onto the market)*-100 (*the product proposal will most likely be sold and be profitable to bring onto the market*).

The teams' projects were evaluated according to the three dimensions by the rater that also supervised the teams' work. The rater was blind to the study hypotheses and did not have access to the team questionnaire ratings. The performance dimensions showed small to moderate correlations (performance novelty-usefulness (r = -.01, p = .97); performance novelty-market potential (r = .31, p = .30); performance usefulness-market potential (r = .61, p < .05). To determine the validity of these assessments, a subset of 14 team projects was rated by two additional raters, another team supervisor and an external expert, knowledgeable of the project development requirements. The average intraclass correlation coefficient ICC(2), used to assess degree of convergence among raters, showed consistent ratings (novelty: .82; usefulness: .77; market potential: .64). Thus, the performance assessment scores of the first rater were used in the analysis. In total, performance data was available for 20 teams. [1]

6.3.4. Control variables

Several demographic variables were measured: age, gender, education specialization represented by five categories—information technology, product development and manufacturing, robotics and civil engineering, and other for the other specializations, nationality represented by two categories indicating whether the respondent had Danish nationality or other nationality (23.9%), academic grade as student's reported academic grade obtained in the previous academic year, and number of years of employment. Since these variables were not significantly related to any of the study variables, they were not used in further analysis.

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[1]The performance data represents a subsample of a larger data collection effort conducted on the teams enrolled in the course across three years (i.e., 2012; 2013; 2014; see Frederiksen and Knudsen (2014) for more details). This database included assessments made by team project supervisors and external examiners. The latter were recruited by the course leader for their business expertise, they had 10 to 16 years of work experience in the project related industries, and had broad knowledge of the project topics. The experts rated the team projects on the same set of criteria as the supervisors.

7. Results

Means, standard deviations, and correlations among study variables are reported in Table 2.

Table 2. *Means, Standard Deviations, and Correlations Among the Study Variables*

Variables	*M*	*SD*	1	2	3	4	5	6	7	8	9	10
Novelty	56.23	24.81	1.00									
Usefulness	53.08	28.67	-0.01	1.00								
Market Potential	57.23	16.48	0.31	.61*	1.00							
Goals TMM1	2.93	0.92	-0.25	0.18	0.25	1.00						
Goals TMM2	4.62	1.50	0.36	0.30	0.55	0.37	1.00					
Interaction TMM1	2.07	1.14	0.17	0.20	-0.13	-0.07	0.13	1.00				
Interaction TMM2	2.15	0.90	.72**	0.02	0.16	-0.32	0.23	0.30	1.00			
Procedures TMM1	1.57	0.65	-0.10	0.38	0.19	0.07	-0.11	-0.27	-0.43	1.00		
Procedures TMM2	2.35	1.41	-0.07	-0.42	-0.33	-0.41	-0.44	-.61*	-0.01	-0.26	1.00	
Implicit coordination	3.80	0.57	-0.22	0.38	.64*	0.32	0.26	0.16	0.06	-0.26	-0.33	1.00

Note. TMM = team mental model. TMM1 = TMM Time 1. TMM2 = TMM Time 2.

* $p < .05$. ** $p < .01$.

7.1. Hypothesis 1

A repeated measures analysis of variance showed that the TMMs contents changed significantly from the first measurement, one week into the project, to the second measurement, five weeks later. Specifically, goal TMM similarity increased from Time 1 ($M = 2.93$, $SD = .92$) to Time 2 ($M = 4.62$, $SD = 1.50$), $F(1,12) = 197.49$, $p < .001$; procedural TMM increased from Time 1 ($M = 1.57$, $SD = .65$) to Time 2 ($M = 2.35$, $SD = 1.41$), $F(1,12) = 98.09$, $p < .001$; and interaction TMM increased from Time 1 ($M = 2.07$, $SD = 1.14$) to Time 2 ($M = 2.15$, $SD = .90$), $F(1,12) = 120.62$, $p < .001$). Thus, Hypothesis 1 was supported, in that teams' TMMs converged significantly over a period of work.

7.2. Hypothesis 2 and 3

Due to the limited sample size, I base the analysis of Hypotheses 2 and 3 on correlations between the study variables and on mean comparisons of TMMs scores for teams with high and low performance.

7.2.1. Correlation analysis

TMMs convergence was represented as difference scores between the Time 2 TMMs similarity score and the Time 1 TMMs similarity score. I correlated the TMMs convergence and the implicit coordination variable with the performance. I found a positive correlation between performance novelty and goals TMM ($r = .59$, $p < .05$). The correlations between performance novelty and the other TMMs variables and the implicit coordination variable were not significant. None of the correlations between the dimension performance usefulness and the TMMs variables or the implicit coordination variable were significant. For performance market potential I found a positive correlation with goals TMM ($r = .65$, $p < .05$) and a positive correlation with implicit coordination ($r = .64$, $p < .05$). I predicted in Hypothesis 3 that the effect of TMMs on performance will be mediated by implicit coordination.

To determine whether this hypothesis can be sustained, I examined the partial correlations between the TMMs variables and the performance dimensions, partialing out the effect of implicit coordination. Table 3 provides this comparison. I found that controlling for the effect of implicit coordination, goals TMMs did not relate significantly with the novelty performance dimension ($r = .54$, $p = .11$). The relationship between the goal TMMs and the performance dimension market potential continued to remain significant after controlling for the effect of implicit coordination ($r = .77$, $p < .01$). This suggests that implicit coordination mediated the relationship between goal TMMs and performance novelty but not between goal TMM and performance market potential.

Table 3. *Zero-order and Partial Correlations Among the Study Variables*

Variables	*M*	*SD*	1	2	3	4	5	6	7
Novelty	56.23	24.81	—	-0.01	0.31	.59*	-0.01	0.35	-0.22
Usefulness	53.08	28.67	.02	—	.61*	0.36	-0.47	-0.29	0.38
Market potential	57.23	16.48	.59	.45	—	.65*	-0.31	0.10	.64*
Goals TMM convergence	1.85	1.41	.54	.37	.77**	—	-0.19	0.24	0.13
Procedural TMM convergence	0.81	1.70	-.22	-.47	-.33	-.30	—	0.50	-0.16
Interaction TMM convergence	0.00	1.22	.24	-.25	.26	.20	.517	—	-0.17
Implicit coordination	3.80	0.57							—

Note. $N = 14$. TMM = team mental model. Zero-order correlation in the upper half of the table, partial correlations in the lower half of the table. TMMs convergence represented as difference scores between the Time 2 and Time 1 measurement.

* $p < .05$. ** $p < .01$.

7.2.2.TMMs differences between high and low performance teams

I was interested also in knowing whether TMMs convergence is associated with performance (Hypothesis 2). Thus I examined whether teams with high or low performance scores increased or decreased significantly their TMMs over time. To determine which teams had high and low performance, I performed a median split on the performance variables. Based on the median split performed on each performance dimensions, 7 teams were categorized as having high novelty, 6 teams as having high market potential performance, and 6 teams as having high usefulness performance. Independent samples *t*-tests were conducted with each performance dimension as an independent factor and the TMMs scores as the dependent variables.

For performance novelty, there were no significant differences between teams with high and low performance in their TMMs convergence. The analysis of the means showed that teams with higher novelty performance had a higher goal TMM convergence score ($M_{\text{low performing}} = 1.33$, $SD = 1.63$ vs. $M_{\text{high performing}} = 2.33$, $SD = 1.21$), a higher interaction TMM convergence score ($M_{\text{low performing}} = -.17$, $SD = 1.17$ vs $M_{\text{high performing}} = 0$, $SD = 1.41$), and a lower procedural TMM score ($M_{\text{low performing}} = 1.25$, $SD = 2.23$ vs. $M_{\text{high performing}} = .50$, $SD = 1.22$). These differences are represented in Figure 1.

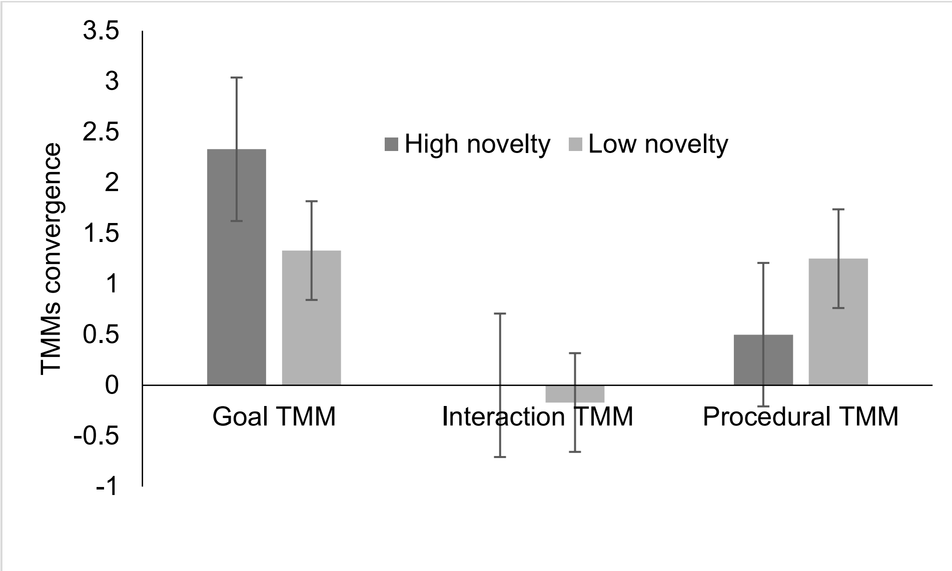

Figure 1. Differences in TMMs convergence between teams with high and low novelty performance.
Error bars represent standard errors. TMM = team mental model. The vertical axis represents the difference between the Time 1 and Time 2 TMMs scores.

For performance market potential, there were significant differences between high and low performing teams in their goal TMM convergence ($t(10) = 2.26$, $p < .05$). The analysis of the means showed that teams with higher market potential performance had a higher goal TMMs convergence score than teams with lower performance ($M_{\text{low performing}} = 1.14$, $SD = 1.34$ vs. $M_{\text{high performing}} = 2.80$, $SD = 1.10$), had a higher interaction TMMs convergence score ($M_{\text{low performing}} = -.29$, $SD = 1.25$ vs $M_{\text{high performing}} = .20$, $SD = 1.30$), and they had a lower procedural TMM convergence score than teams with lower performance ($M_{\text{low performing}} = 1.36$, $SD = 1.25$ vs $M_{\text{high performing}} = .88$, $SD = 1.76$). These differences are represented in Figure 2.

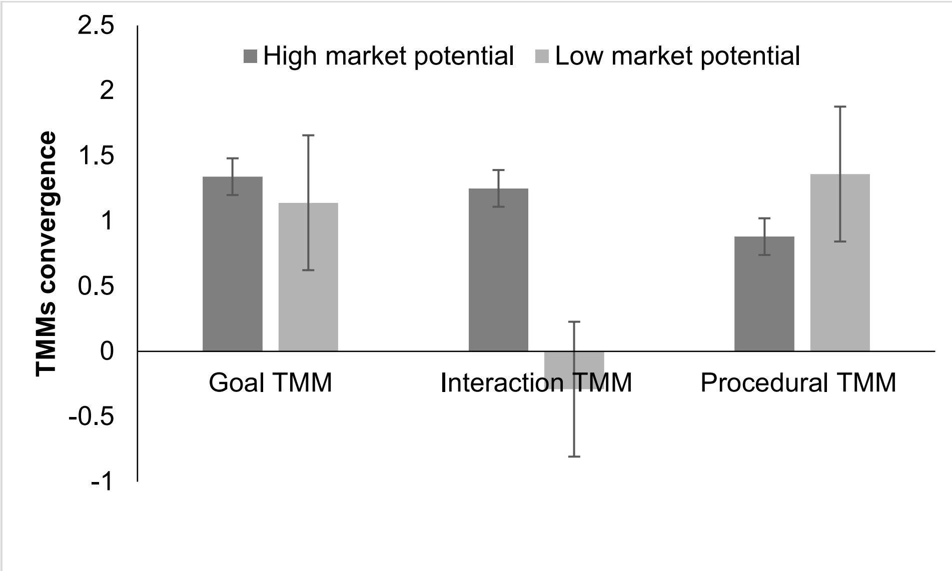

Figure 2. Differences in TMMs convergence between teams with high and low market potential performance.
Error bars represent standard errors. TMM = team mental model. The vertical axis represents the difference between the Time 1 and Time 2 TMMs scores**.**

For performance usefulness, the independent samples *t*-test showed a significant difference between high and low performing teams in the goal TMM convergence ($t(10) = 2.26$, $p < .05$). The analysis of the means showed that teams with higher usefulness performance increased their goal TMM convergence compared with teams with lower performance usefulness (M low performing = 1.14, SD = 1.35 vs M high performing = 2.80, SD = 1.10), had a lower procedural TMM convergence score (M low performing = 1.36, SD = 1.25 vs M high performing = .20, SD = 2.28), and decreased their interaction TMM convergence score (M low performing = .14, SD = 1.07 vs M high performing = -.40, SD = 1.52). These differences are represented in Figure 3.

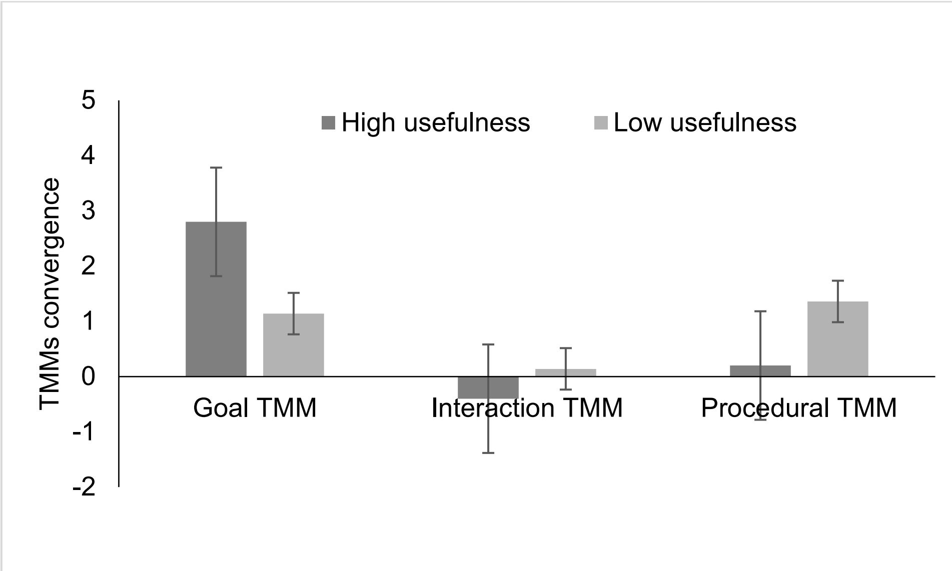

Figure 3. Differences in TMMs convergence between teams with high and low usefulness performance.

Error bars represent standard errors. TMM = team mental model. The vertical axis represents the difference between the Time 1 and Time 2 TMMs scores.

8. Discussion

This study aimed to answer several questions related to the relevance of TMMs for project development teams. First, I wanted to know whether project development teams develop more similar understandings related to their goals, team interaction, and procedures over time. Second, I wanted to know whether the development of TMMs improves team performance under different criteria. Third, I wanted to know whether specific process mechanisms as implicit coordination mediate the relationship between TMMs convergence and team performance. I hoped, in answering these questions, to provide insights into how TMMs develop over time in real teams, which is a limitedly explored aspect in the TMM research, and to provide a more fine-grained view on the multiplicity of relationships between TMMs and performance. Thus, this study addressed the following gaps which were noted in the introduction: it assessed the effect of TMMs on project team performance with special emphasis on innovative performance and it investigated the role of the development of TMMs over time for team performance.

In large part, this research reached its objectives. The goal, procedural, and interaction TMMs similarity of student teams working on the development of innovative products in academic settings converged over a five-week measurement interval. Thus the results of this study show that TMMs contents relevant for project teams develop over time, reflecting the different requirement and stages of team development. I complement thus studies that investigated the convergence of TMMs structure and add to the emergent literature that focuses on the development of TMMs content (e.g., McComb et al., 2010; Levesque et al., 2001).

Furthermore, the convergence of different TMMs contents was related to different team performance-relevant criteria, specifically novelty, usefulness, and market potential (Frederiksen & Knudsen, 2014). The analysis showed specifically that convergence on the goal TMM differentiated between high and low performing teams on the dimensions of performance usefulness and market potential. The more detailed analysis of the variables' means showed that convergence on the goal TMM was related with higher performance on all three performance dimensions, that convergence on the procedural TMM was related to lower performance on all three performance dimensions, and that convergence on the interaction TMM was associated with higher performance on the novelty and market potential performance dimensions but with a lower performance usefulness score. These results suggest several implications for future work related to the convergence of TMMs in project teams.

First, the results emphasize the relevance of establishing and developing the team knowledge related to the team goal. The goal is the most relevant unifying element in the teams' work, it focuses efforts and creates an overarching reason for why the team should engage in performance actions. A shared vision becomes the basis of motivation, planning, and goal setting in teams (Pearce & Ensley, 2004) and thus guides efforts around a set of common objectives. Without a common goal TMM the members could address different aspects and engage in competitive action which should hurt their final performance. The relevance of a goal TMM for performance usefulness suggests that members need to consider a similar set of objectives in order to work towards the development of a product that is useful, usable, and desirable.

Similarly, for the members to achieve fit between their products and the organizational strategic environment, they need to converge on a common goal TMM. There is no room for competing efforts or for diversity because such diversity in the core aspects of work can lead to disbanding processes. This is supported by work in strategic management that emphasizes the relevance of goal consensus for the attainment of integrated organizational strategies (e.g., Dess, 1987). The relevance of setting and agreeing on a goal is also emphasized in models of temporal team processes as the first and most relevant step being related with allocating and sustaining effort for task accomplishment (Marks et al., 2001). According to Strange and Mumford (2005) a goal TMM specifies idealized goals and causes and enables the development of a view that specifies what should be changed and the standards that should be maintained. As such, it guides behavior in diverse situations and helps maintain different performance standards in different domains.

Although the results did not reach significance, the analysis of the variables' means also suggests that convergence on the procedural TMM is negatively related to higher scores on all the performance dimensions. In this study, the procedural TMM was defined as the procedures and processes by which the work is conducted. It may be possible that a specific understanding of how to do the work is not necessary and that this is more distributed among the members. This makes sense in interdisciplinary project teams since each member may have a specific role and set of responsibilities and the processes or procedures may be more narrowly defined in relations with these role distributions as opposed to being general guidelines for the entire team. It may also be possible for the same outcomes to be achieved via different means, which suggests equifinality in how the task is done. In this case, as long as the members are able to converge on a general set of expectations for their performance it may matter less how the outcomes are achieved for their performance.

This suggests that sharing an understanding of the performance procedures may be more efficient in high paced and strictly coordinated environments (e.g., Marks et al., 2002) but not for work on open ended tasks where sharing the sequence of steps may lock teams into predictable routines that leave little room for innovations and adaptation (Brown & Eisenhardt, 1997; Feldman & Pentland, 2003). These findings thus portray a complex role of TMMs for team performance on novel tasks. The extent to which teams develop a shared purpose or goal for their work and agree on how to contribute towards the achievement of this goal seem to be the most relevant factors for performance. Contrarily, sharing a view on the exact steps to achieve this goal may actually be detrimental, as the process is likely to be equifinal.

Team managers of interdisciplinary project teams can draw on this knowledge and design systems that facilitate a timely convergence on a goal TMM but that instead encourage and make it possible that a diversity of means for achieving the goals is available. Also, managers should make sure that convergence is realized by timely addressing the importance of setting a goal in order for the members to create the knowledge associated with the goals and be able to refine it as they progress through their task, that is that they manage to converge over time. Similarly, at the beginning of the team interaction, the managers should emphasize that procedures are not fixed and that multiple means may be available to reach the goals giving an impetus to the teams thus to discover those alternative means.

I also hypothesized that the effect of TMMs convergence on performance will be mediated by implicit coordination. I stated this because previous literature considers the development of TMMs as important stepping stones towards the development of team anticipation behaviors reflecting implicit coordination. I found that the correlation between the performance novelty dimension and goals TMMs became nonsignificant once I controlled for the effect of implicit coordination. This suggests that a part of the effect of goal TMMs convergence on novelty may be translated in better anticipation capabilities of the team. When the team develops a shared goal for its performance it should be easier to define the original ideas in terms of that goal.

I found however that the correlation between the dimension of performance market potential and goal TMMs convergence was still significant after I controlled for the effect of implicit coordination. This suggests that higher market potential depends on the teams holding a shared goal for their performance and that this shared goal guides their efforts throughout the task without being translated in improved anticipation behaviors. Implicit coordination was related to market potential suggesting that a better anticipation ratio during the business development phase helps the team achieve products that are integrated and correspond to the organizational needs.

The study findings draw attention to several fundamental facts. First, TMMs convergence seems to differentiate between teams that obtain a higher and teams that obtain a lower performance. In this study I focused on the convergence of TMMs content based on the assumption that content that enables similar expectations is more relevant in the type of teams that I investigated that is project teams (McComb, 2007). Future studies could draw on this research and find improved ways of measuring convergence on both content and TMMs structure depending on which is more relevant for the performance context.

Second, I expanded the set of performance criteria to include dimensions that are related with innovation, usefulness, and market potential of the team projects. To my knowledge, this is the first attempt to capture a broader set of performance factors, as most previous literature has focused either on dimensions such as quantity and quality of performance operationalized as scores on simulation games or decision effectiveness of the team (e.g., Mathieu et al., 2000; Randall et al., 2011). This study answers a call in the literature and encourages future researchers to expand their criteria to capture outcomes such as innovation on which there is little knowledge of the role of TMMs (Badke-Schaub et al., 2007).

Third, I provide an integrated view of the development and of the role of TMMs content convergence for interdisciplinary project work. The findings presented here could aid team managers in designing team development strategies that facilitate the development of those TMMs contents most relevant for performance. To aid this process, I integrated the TMMs development discussion into a framework of team development which could provide for guided development efforts. Thus, this study points to the relevance of assessing multiple TMMs contents longitudinally and of relating the TMMs investigated with a broader range of performance criteria. Only doing so we may gain a more complete picture on the role of TMMs for team performance.

There are a number of limitations of the current study that must be noted. First, the sample size was limited. This is to be expected considering the challenges of collecting longitudinal data in field settings. Ployhart and Vandenberg (2010) noted that it is common for response rates to drop from the first to the last measurements by more than 50%. Baruch and Holtom (2008), examining the response rate in organizational studies published between 2000 and 2005, found an average response rate for studies that collected data from individuals of 52.7%. The response rates within each measurement wave in this study are comparable with this rate. Further, I found no significant differences between respondents and nonrespondents on the study variables. This provides some confidence that attrition was random (Goodman & Blum, 1996). Considering the requirement to expand the investigations of TMMs development (Mohammed et al., 2010) and the limited number of studies that addressed this phenomenon longitudinally in field settings (e.g., Levesque et al., 2001), I consider thus that the findings of this study contribute positively to existent research.

Second, the study sample was formed of student teams developing projects as part of a course assignment, which may preclude generalizations to real organizational teams. These teams though worked on sufficiently realistic and complex projects and had high stakes in their projects' outcomes. The project structure, contents, and requirements resembled those of organizational teams' projects. Further, successful teams could gain support to further develop their projects into actual businesses. Thus, the sample closely resembles organizational project teams.

Third, I focused in this study on the convergence of TMMs content. Although this provided valuable insights regarding how TMMs develop in project teams and their relevance for team performance, in other settings the convergence of TMMs structure may be more relevant. Thus future studies could add to these results by examining the convergence of structure on multiple TMMs contents.

In summary, this study supported arguments in the TMMs literature that different TMMs contents develop differently in teams and that TMMs convergence has an effect on team performance. These findings may inform managers about team developmental stages and developmental potential. For instance, the consistent results with respect to the role of TMM goal for performance suggest that special care should be given to an appropriate pooling of perspectives for the development of a common vision at early moments of the team work and then as the team progresses through different stages. At the same time, performance may be enhanced when members are actively encouraged to explore multiple project development paths and work procedures. According to the project scope, adequate emphasis should also be placed on coordination requirements. These findings depict a complex role of team cognition and behavior in the prediction of multifaceted team performance. In the following section, I will provide an integrated general discussion of the results of the three studies reported, as well as discuss the contributions of this work, its limitations, and the future research directions.

Chapter 5 - General Discussion

Organizations face increasingly dynamic and uncertain environments to which they must adapt continuously in order to survive for the long term. The complexity of the organizational life is increasing. New products become quickly obsolete and strategies effective yesterday are not necessarily effective tomorrow. Therefore, the organizational members are permanently confronted with an inflow of novelty and change. The successful organizations and the successful units are those that are able to receive this inflow and to quickly adapt to it by changing their ways of doing things, inventing new strategies, or deriving solutions in situ. This type of environment places demands on all the organizational members to adapt but some organizational levels are more affected than others. Teams are at the boundary between organizations and their environments and are at the boundary between higher and lower organizational levels and therefore most of the adaptation burden falls on the shoulders of teams. Not all teams are though created equal with respect to their adaptation potential therefore a growing body of literature investigates the mechanisms that lead to higher or lower adaptation potential.

Among the mechanisms that promote team adaptation, recently there has been a surge of interest in understanding the relationship between team adaptation and team cognition. Team cognition represents the understanding of the environment in which the team operates and the meaning of the events that the team encounters throughout its work. Team cognition has been placed at the core of adaptation in several theoretical models (Burke et al., 2006) and empirical studies (e.g., Marks et al., 2000). For example, the model by Burke et al. (2006) represents team cognition as an important determinant of each of four adaptation stages. Marks et al. (2000) were the first to consider the practical implications of TMMs for team performance in changing situations. They found that team cognition led to higher team adaptation to novel task environments.

Team cognition is important because in order to adapt effectively to new environmental demands, the team must be able to interpret the meaning of the demands, to represent, and to store these new meanings internally. When the team is not able to understand the significance of the events that they encounter, they may fail to issue the appropriate responses or they may issue responses that are not adequate for the changed situation. This failure of understanding can have serious consequences. An industrial team may miss the opportunity provided by an external favorable environment while a military team may miss to take action against adversaries by failing to interpret the environmental cues.

With general support that team cognition aids team adaptation (e.g., Ellis, 2006; Marks et al., 2000), this literature is nonetheless young. Researchers have just started to determine the implications of team cognition for team adaptation. It is this line of work that this dissertation aimed to advance. In several studies, I try to determine the importance of team cognition for team adaptation and performance. Given that there's limited research so far on these relationships and that team cognition has been demonstrated an important determinant of adaptive performance, there is a need to know more about these relationships.

First, in studying the relationship between team cognition and team adaptation, previous research has focused only on certain performance contexts. Second, it has treated these relationships only cross-sectionally. Third, it has looked only at certain performance outcomes. These three areas within the larger stream of research on team cognition and team adaptation are addressed in this dissertation. First, I expand the context by focusing on the performance of project teams. Project teams are ubiquitous in today's organizations but there has been little research on the mechanisms that promote their adaptation. This expansion of focus is informed thus by the need to understand the adaptation of project teams better.

Second, the adaptation models propose dynamic relationships between team cognition and team adaptation (Burke et al., 2006) but most of the research exploring these relationships has been cross-sectional. The studies reported here take the next step and explore the longitudinal relationships between these constructs. Third, most of previous research tended to look at the relationships between team cognition and team performance outcomes such as efficiency and effectiveness. There have been recent models (Badke-Schaub et al., 2007; Reiter-Palmon et al., 2008) that point to the need of understanding the relevance of team cognition for team outcomes such as creativity and innovation. There is a need to know whether team cognition relates differently with different outcomes to make more informed decision regarding team training and development. Thus, within the stream of team cognition and team adaptation, this research aimed to address these three larger areas.

1. Overview the three studies

Three studies have been conducted to determine the relationship between team cognition and team adaptation. Each study addresses the previous limited focus on the relationship between team cognition and team adaptation through a unique perspective. In study one, I tried to determine whether TMMs, the central team cognition construct represented in this dissertation, have an effect on team adaptation. Drawing on literature in team adaptation and individual problem solving, I advanced the hypothesis that more dissimilar TMMs as represented by a diverse view of members on team and task related aspects should aid performance during changes because it enables the derivation of diverse ideas, strategies, and solutions. This hypothesis is novel in the TMMs-adaptation literature. It has not emerged in previous studies due to a limited focus on later stages of the adaptive process which emphasize the relevance of similar TMMs. But adaptation is a longitudinal process therefore the assessment of the supporting mechanisms should also be conducted with a process view.

Complementing thus previous literature with a process view, I found that TMMs dissimilarity is relevant for the performance of teams that face changes, at early moments of critical events. Further, complementing work in creative problem solving, I found that a divergence-convergence mechanism is more relevant for obtaining novel projects in that divergent TMMs are needed at early stages of changing situations but later convergence is needed for the implementation of the problem solving plans and solutions. The major contribution of this work is an expansion towards the consideration of context and time as additional dimension to the ones considered in the literature on the relationship between TMMs and team adaptation. Only by considering the role of different contexts and timing of TMMs assessment, more directed hypotheses can be derived, supporting further model building and testing. The role of TMMs at different stages of team adaptation can be assessed by future research to enrich our understanding of the complex role of TMMs for adaptation. This study contributed to the literature by: (1) advancing the exploration of the relationship between TMMs and adaptive performance by showing that TMMs dissimilarity has a positive effect on the performance of teams that face changes; (2) advancing theorizing on the role of TMMs for performance by arguing that both TMMs dissimilarity and TMMs convergence have a positive effect on adaptive performance, but at different stages of the adaptation process.

In study two, I drew on research on adaptive expertise development to propose a model in which TMMs moderate the effect of task variation, a technique proposed to enhance adaptive outcomes at the individual and team level, on future task performance. I advanced that the development of flexible TMMs which were characterized by complexity, diversity, and change over time, will moderate the effect of task variation on future task performance. In this study, I expanded the consideration of the relationship between TMMs and adaptation with a temporal view and by considering additional TMMs properties that were not considered in previous research. Specifically, in line with the view on TMMs as constructs that develops over time, I assessed the development of TMMs four times during the work on an initial practice task. I found that TMMs develop differently depending on the conditions that the teams experience.

Specifically, for teams that work on stable tasks, the TMMs seem to decrease in similarity over time while for teams that work on varied tasks the TMMs seem to become more similar initially and then to decrease in similarity. This supports previous literature that found that TMMs tend to decrease over time in project teams (e.g., Levesque et al., 2001) but importantly it also provides an account of the relevance of this development for teams' future adaptation. Whereas previous studies looked only at the TMMs development, in this study I tied this development with performance indicators based on research on individual expertise. Specifically, I translated the characteristics of diverse and complex mental models discovered in the individual literature to account for the performance of experts into the characteristics of TMMs divergence which represents the development of more dissimilar TMMs over time and TMMs complexity, which represents increasing the number of the task dimensions and their interactions represented in the TMMs. By investigating these characteristics, I bridge literatures on individual and team adaptive performance and provide a starting point for future work to develop and test more comprehensive models of the TMMs characteristics and their relevance for team performance.

The findings showed that similar (performance novelty) and similar and complex (performance efficiency) TMMs developed in the context of varied tasks were required to obtain high performance on future tasks. Although I hypothesized, according to the individual level literature, that more divergent and more complex TMMs will support the work on a future task, the finding that more similar and not more divergent TMMs are beneficial is insightful for future research. This implies that the mechanisms effective at the individual level may not be equally effective at the team level where different processes may intervene. This also orients future literature to explore these differences using truly multilevel models. Also, to provide a more complete perspective on the TMM construct, future research should explore different TMMs characteristics and should do so longitudinally. This study contributed to the literature by: (1) exploring the issue of adaptive performance transfer at the team level which is necessary in today's turbulent environments (2) exploring the role of TMMs for adaptive performance transfer, finding that the role is more complex that hypothesized and that relationships between the constructs at the team level cannot be generalized from the individual level; (3) exploring the development of TMMs over time, which is a rarely undertaken endeavor, despite theoretical developments that suggest that TMMs are dynamic constructs.

In study three, I continued the exploration of the TMMs development over time and their relationship with performance within a field sample. Continuing the longitudinal exploration of the role of TMMs in project teams within a field setting addresses questions of external validity. This study also contributed to the literature by investigating the role of TMMs within a larger framework of performance determinants and by considering additional TMMs contents not addressed in the previous studies. There have been different calls in the literature to explore the role of different TMMs contents for team performance.

Generally, TMMs can be differentiated in a task and a team TMM, but within these overarching contents, different types of contents emerge. Drawing on initial theory on TMMs (Cannon-Bowers et al., 1993) and answering the call for more specific investigations, I looked at the role of goal, procedural, and interaction TMMs for project team performance. By looking at project team performance, the study addressed another call in the literature to investigate the role of TMMs for different types of teams other than action teams. Further, I incorporated in the study's model a process view by considering the mechanisms that may translate the effect of TMMs on performance, here implicit coordination.

Thus, this study contributed to the literature in three ways: (1) it considered the role of different types of TMMs contents convergence (2) for the performance of project teams (3) with a view to understanding the processes that mediate between TMMs and different performance criteria. Continuing with the emphasis on longitudinal development that infuses the dissertation, I assessed the TMMs at two different time points to determine whether the results obtained in the laboratory samples replicate. I found, consistent with the first study reported, that goal, procedural, and interaction TMMs of project teams became similar over time. In line with a focus on performance, I also found that convergence on all these contents was not needed for high performance.

Specifically, higher goal TMM convergence lead to higher performance but higher procedural TMMs convergence led to lower performance on all the dimensions assessed. In line with a focus on processes, more than the direct effect of TMMs on performance, I also examined whether implicit coordination mediates the relationship between TMMs and performance. I found support only for a mediated relationship between the goal TMM convergence and the performance novelty dimension. For future research, this study emphasizes that TMMs are emergent constructs that should be assessed longitudinally to truly capture their effect and that more attention should be paid to the content of TMMs that converges because it may relate differently with performance outcomes.

Finally, in this thesis I took one step further from previous research and attempted to integrate the different accounts on the role of team cognition here represented by TMMs for team performance and adaptation. In line with a contingency view on organizations (e.g., Galbraith, 1973), I advanced an environment-cognition fit hypothesis in which I detail the role of different TMMs types for performance in different types of environment. The development of this framework addresses a need for organizing the current research on team adaptation which so far has proceeded with a multidimensional focus or with a narrow view focused on certain contexts or constructs. The model developed demonstrates that the relationships between cognition and adaptation can be considered within a larger and more comprehensive frame, integrating thus the results of the studies reported in this work and of other studies.

This framework details, drawing on a broader literature in organizational theory and problem solving, how performance can be increased when the TMMs characteristics of similarity, complexity, and accuracy match the environmental characteristics of complexity, path/goal structure, and coupling. These relationships in turn are moderated by the type of environmental events or changes that the team experiences, which lead to some types of environment-TMMs matches to be more effective than others. This framework also integrates an account of the influence of different types of changes on the teams' behavioral and cognitive adjustment. This focus is relevant because previous literature has tended to look at different types of changes without specifically detailing the expected influences of these on team cognition and behavior. Providing a representation of these changes can direct future research to assess those relevant behavioral or cognitive changes, for a better account on adaptation mechanisms.

2. Implications

2.1. Team mental models

The work reported here contributes to research on TMMs in several ways: with respect to its characteristics and their relevance for performance; with respect to TMMs content; with respect to the context of assessment; with respect to the timing of assessment; with respect to the TMMs criterion.

First, TMMs have been represented on a continuum where at one end members hold highly similar TMMs of task and of their team while at the other end members hold highly dissimilar TMMs of their task and their team. The majority of previous work has focused on exploring the role of similar TMMs for team outcomes and paid little consideration to the role of other TMMs types on the continuum. In this thesis, I address these limitations by deriving a model of environment-cognition fit in which I detail the relevance of different types of TMMs, specifically TMMs similarity, dissimilarity, and TMMs complementarity, for performance in different types of environments. I discuss not only the role of TMMs similarity types but also the role of other TMMs characteristics which have not been explored in previous studies such as TMMs complexity. By focusing on multiple characteristics, I also bridge literatures at the individual and team level that focused on the role of cognition for adaptive outcomes. In the empirical studies, I take on the task of exploring the role of different TMMs characteristics for performance by looking at the role of dissimilar TMMs and complex TMMs for team outcomes. Thus, I complement previous work which took a more limited approach to considering the role of TMMs.

Second, TMMs have been originally proposed to represent different contents that develop as the team conducts its work. These contents have often been collapsed in a task and a team TMM content. There have been however calls to assess different TMMs contents and their development (e.g., Mohammed et al., 2010). This is relevant because different contents may tie differently with performance, accounting for predictive potential. I addressed these calls in this research by investigating the role of both team and task TMMs in study one, which have been rarely been assessed in the same study (e.g., Lim & Klein, 2006). Further, in study three, I took a multidimensional and longitudinal view by looking at the development of different TMMs contents and their role for performance. Therefore, this work also speaks to the requirement of considering TMMs as a multifaceted construct and demonstrates the role of these different TMMs contents for team performance.

Third, TMMs have been considered previously as constructs influencing the development and performance of action oriented teams such as military teams or aviation crews. There has been less emphasis on knowledge oriented teams such as new product development or project teams, despite calls to expand the context of investigation (Badke-Schaub et al., 2007; Mohammed et al., 2010). In this work, I addressed this limitation first by proposing a framework of contexts within which to consider the role of TMMs. I proposed and argued that different types of TMMs may be needed to perform in different types of environments and a focus on only one type of environment limits the predictive potential of the construct. In the empirical studies that I conducted, I explicitly tried to expand this focus to incorporate an emphasis on project teams. The studies reported here clearly show that different TMMs characteristics affect the performance of project teams as opposed to action oriented teams. The former are shown to benefit under certain circumstances a higher TMMs dissimilarity while the latter a higher similarity. Expanding the context of research thus permitted a more comprehensive view on the role of TMMs.

Fourth, theoretical accounts have emphasized the importance of treating TMMs as emergent constructs that develop over time from members' perspectives on their task and on their team. Most work however has tended to take a static view on the TMM construct—with few exceptions the studies have treated the construct as general and unchanging. In the studies reported here, I aimed to expand this view to include the temporal consideration in TMMs research. Specifically, in the theoretical framework that I developed I addressed the phenomenon of environment-cognition fit as developing over time, as members' TMMs align with the environmental characteristics. I also addressed the different development of TMMs for teams that face various types of environmental demands or changes. In the empirical work, I tried to incorporate the temporal consideration by assessing TMMs at different time points, with the aim of determining how they develop over time and how their development affects team outcomes. In the first study, I showed that considering the TMMs at only one time point limits the understanding of the predictive potential of different TMMs characteristics (i.e., similarity vs. dissimilarity).

Specifically, I found that both TMMs similarity but also TMMs dissimilarity are relevant for team performance but at different moments throughout the team's task. If I had looked at the role of TMMs at only one time during the performance this influence would have been missed. This establishes also for future research the relevance of considering the TMMs via a temporal lens. In the second study, I take a more explicit longitudinal focus and look at the development of TMMs during the teams' work on a task but I also look at their long-term effect on performance on a future task. This contributes by showing that beyond stable characteristics that affect performance in a setting TMMs represent dynamic capabilities and they should be investigated as such. Finally, I replicate these results on TMMs development in a field sample, showing that these relationships generalize outside the lab.

Fifth, the literature on TMMs has tended to focus on its relationship with performance and with several team processes such as coordination and communication. This focus is important because TMMs demonstrate large predictive potential in different contexts and settings. In line with a focus on action teams, performance has been represented as a quantitative results obtained at the end of a performance trial. There have been though recent calls for exploring the relationship between TMMs and team outcomes such as creativity and innovation on the account that TMMs may relate differently with these outcomes. Not knowing these specific relationships prevents us from developing more complete models on the relationship between TMMs and performance. In the studies that I conducted, I explicitly look at multiple performance dimensions to address these limitations of previous research. Further, I contribute by focusing on team creativity and innovation, criteria which have not been explored in previous studies and for which there is a need to understand the role of TMMs. TMMs are constructs that are assumed to enable better coordination and higher quantitative performance but their relationship with innovation, that requires a diversity of views and perspectives for the development of novel and original products and processes, is not known. Focusing on this link, in this research I find that the relationship is complex and that merits further investigation.

To be more concrete, in the first study I find that TMMs dissimilarity is needed to obtain innovative outcomes, at early moments when the teams face changes. In the second study, I find that TMMs similarity and complexity moderates the effect task variation on a practice task on future performance efficiency and innovation. Also, in the third study I find that similarity on goals TMMs and dissimilarity on procedural TMMs differentiate between high and low team performance innovation. This addresses directly the arguments in recent theoretical work that TMMs similarity may be relevant for the achievement of some performance outcomes while dissimilarity may be relevant for the attainment of other outcomes such as innovation (e.g., Badke-Schaub et al., 2007). This depicts a complex role of TMMs and urges future researchers to expand their work to different criteria in relationship with TMMs.

2.2.Team adaptation

The contributions to the literature on team adaptation are: the advancement of a contingency perspective on adaptation that integrates previous and future efforts; the exploration of the perspective on adaptation both as adaptation to change and as long-term performance; the multidimensional consideration of changes.

First, there have been different treatments of team adaptation in previous research. Adaptation has been regarded as a series of behavioral, cognitive, and structural adjustments to a salient change in the team's performance environment and as the long-term process of responding to novel or changed situations. At the core, adaptation represents the process of attaining a level of fit with the demands of the environment. At the organizational level, adaptation has been described through various contingency theories that address the appropriate level of match between different organizational characteristics and the characteristics of the environment (Donaldson, 2001). This fundamental view has not made its way into team adaptation research where a narrower focus on specific adaptation processes has emerged.

Therefore, in this work I aimed to go beyond a focus on specific adaptation processes and address the core of team adaptation by advancing a contingent theory of team adaptation. Drawing on theories of organizational learning and adaptation, I proposed that teams adapt better to their environments when the characteristics of their cognition match the characteristics of their environments. This view integrates a long and a short term perspective on team adaptation. The short term perspective proposes that teams that encounter changes during their work must change their cognition to match the new environmental demands and that teams that are able to realize this match perform better. The long term perspective proposes that environments have certain characteristics that require that the teams develop certain cognitive structures to be able to effectively deal with those environments for the long term. In the studies that I conducted, I test both a short and a long term perspective on adaptation.

In the first study, I tested the assumption that project teams that encounter changes must develop certain types of cognition to meet the environmental demands. I found support for a contingency view as the dissimilar TMMs served teams' adaptive performance at the initial moments of changes but TMMs similarity served team adaptive performance at later stages of dealing with changing situations. In the third study, I found support for a contingency view in that project teams adapted better to the demands of their environments when they developed similar TMMs on some contents but dissimilar on other contents. In the second study, I extended the research on the relationship between cognition and team adaptation by taking an explicit longitudinal view.

Specifically, in the second study, I took the definition of adaptation as the long-term adjustments to the demands of novel situations and tasks. This definition emerged in the individual level adaptive performance literature but it is scarcely investigated at the team level. Teams, however, must also meet continually changing demands and they must thus achieve a capacity to permanently adapt to these novel environmental demands. In this context, I showed that TMMs represent not only a capability enabling adaptation to punctuated environmental demands but a dynamic capacity that can aid team adaptation for the long term.

Second, in the theoretical framework I expand the view on adaptation with an understanding of the types of changes that can trigger an adaptive episode and their effects on team cognition and behavior. I draw on literature in organizational theory and strategic management and derive a series of consequences for team cognition and team behavior of dealing with changes with different types of characteristics. This focus is important because previous work tended to investigate changes indistinctly without a specific view towards organizing these changes around common factors or understanding their differential effects. Therefore, the typology of changes and the consequences of changes addressed in this work can aid research on team adaptation by providing a working framework within which to consider future investigations.

3. Methodological contribution

The work reported here added several methodological contributions. First, the team cognition constructs were elicited and represented in different ways, providing for convergent validity. In study one, I operationalized TMMs via Pathfinder networks, in study two via QAP correlations, and in study three as cognitive text-based maps. This multi-method assessment approach enabled the derivation of conclusions with respect to construct validity across studies. Further, to the extent that few studies used text-based maps to assess TMMs (e.g., Carley, 1997), their use in study three in relation with different team outcomes provides indications that this assessment method can be reliably used in future studies.

Second, I assessed multiple TMMs characteristics in addition to TMMs similarity, complementing previous work that has focused mostly on the role of TMMs similarity. In all the studies, I focused on both similarity and dissimilarity as determinants of team outcomes, covering the range of similarity noted theoretically. In addition, in study two I assessed TMMs complexity. By assessing complexity in addition to similarity, one can determine whether the characteristic of TMMs similarity affects team outcomes, their comprehensiveness, or both. By assessing these characteristics, I also bridged worked on expertise at the individual level with work on team adaptation, making possible future points of contact. The third characteristic investigated emerged as an outcome of the interaction between the TMMs characteristic of dissimilarity and complexity. I labeled this characteristic TMMs flexibility, drawing on previous research that advanced that teams must possess flexible TMMs to perform in dynamic environment (e.g., Marks et al., 2000). Previous literature has though not operationalized this characteristic while study two in this work provides an explicit operationalization and related it with performance.

Third, the assessment of TMMs was intended longitudinal, whereby the measures of TMMs were collected at two or multiple timepoints. The longitudinal assessment of TMMs is relevant because these are constructs assumed to emerge over time from members' mental models and that cause outcomes differently as a function of their development. The missing focus on longitudinal assessment in previous studies limited knowledge with respect to the TMMs convergence or divergence over time and its relationship with performance. Therefore, the temporal focus in this work expands this knowledge and sets the terrain for future longitudinal research. Further, I tested a long-term perspective on adaptive performance by focusing on longitudinal assessment of performance in study two. This bridges literatures at the individual and team level and provides a framework for future research to continue investigations on longitudinal team adaptive performance, in addition to short term adaptation.

4. Practical contribution

The results of the investigations in the three studies point to the relevance of considering the effects of TMMs development over time. First, TMMs dissimilarity emerged as relevant for performance in two of the three studies. This suggests that managers must put into place the mechanisms needed to diverge constructively in a team. This applies especially for project teams and for teams that meet changes throughout their work. If teams see things too similarly, this may narrow their attention to only a few elements relevant for performance which will be considered only within an explanatory frame. But innovative project work requires a diversity of perspectives on strategies, solutions, and goals to be truly productive. Therefore, asking team members to consider different perspectives and to voice and refine these perspectives may be an effective way to achieve dissimilarity. A focus on dissimilar aspects seems to be more relevant when teams meet changes, therefore, special efforts should be made for teams to consider their performance elements diversely during these moments.

However, achieving TMMs dissimilarity may be difficult because it has been shown that group members tend to take a narrow convergent focus when they meet novelties and unexpected events (Staw et al., 1981). Therefore, the mechanisms for divergence should be put into place and trained prior to experiencing changes to be effective. Importantly, both divergence and convergence seem to be relevant for performance, which asks for a balance of exploration and exploitation of knowledge in the team. Project managers should analyze their teams' performance context to determine when multiplicity of views is needed and when convergence on an overall perspective that would allows implementation is needed. Then, this divergence-convergence mechanism should be trained such that teams possess the required skills for managing new or changed situations.

Second, the convergence and divergence on different contents seems to be related differently with performance. For instance, the convergence on the procedural TMM was negative for performance in study three but the convergence on the goal TMM was positive for performance. This requires that managers explicitly analyze the performance environments to determine on which contents it may be better for teams to hold diverse perspectives and which contents should they hold more similar because otherwise it would hurt their coordination and integration.

Third, managers should consider the implications of TMMs for long term performance. In highly turbulent environments, I found that the development of more similar and more complex TMMs aids future team performance. This suggests that the managers of teams that operate in highly dynamic and changing environments should train the teams' capacity to develop more similar and more complex TMMs.

Fourth, the theoretical framework advanced provides the possibility to develop informed predictions with respect to the development of TMMs in different environments. The relationships proposed enable the managers to define their organizational environments in terms of a few characteristics and then to relate these characteristics to certain types of TMMs effective in the specific environment. Realizing the match is discussed both cross-sectionally as when the organizational environments have certain characteristics that need to be matched with certain TMMs types for high performance, but also longitudinally as when the organizational environments change or develop requiring the change of TMMs for the match to be realized. It is the thesis of this work that a higher match enables higher organizational performance. Therefore, the theoretical chapter also contains indications on how these types of TMMs can be developed. Further, by incorporating a framework of changes, the chapter enables managers to determine the types of changes in cognition and behavior that they should expect when teams meet certain types of changes and it also enables them to address these modifications before the changes take effect.

5. Limitations

There are a few limitations of the studies reported in this work that need to be noted. First, two of the three studies were conducted in artificial experimental settings using contrived tasks. The tasks that teams had to work on however resembled real organizational tasks. For instance, in both study one and study two the teams worked on the development of organizational process improvement plans, akin to real organizational task forces tasked with the resolution of organizational problems. In the third study, I get closer to the organizational environment by assessing the work of interdisciplinary student project teams working on the development of new product or service development.

The latter had real stakes in their projects which were evaluated by external organizational experts and which could be concretized into real new products or processes. The groups also worked with time and resource constraints, which adds to the realism of the task and increases probability for generalizability beyond the contexts investigated. Notwithstanding, many of the constraints and the dependence relationships existent in a true organizational sample could not be reproduced which asks for caution in generalizing the results. Future work would benefit investigations in the field to determine the true level of relationships between the constructs (e.g., Lim & Klein, 2006).

Second and relatedly, organizational teams do not usually function in a vacuum—they are embedded in a larger organizational environment which can affect the relationships described. Teams are meso elements between the larger organizational environment and the lower level individual entities. Thus, teams can both influence in a bottom up fashion and be influenced in a top down fashion by the elements in their organizational environment. As per the top down influence, they can be constrained by the organizational structure, by organizational climate and culture, and by factors related to leadership and interteam interdependence. As per the bottom up influence, the relationships between constructs realized at the team level can emerge across levels and influence the development of organizational structures, climate, culture, and the relationships among teams in the organization. Therefore, the absence of a context in which teams are embedded in these studies prevents more informed conclusions with respect to the development of the relationships investigated. Again, future research would greatly benefit a focus on real organizational teams in studying the relationships between TMMs and team outcomes.

Third, the theoretical framework that I advanced described the relationship between different environmental configurations and different TMMs types in determining adaptive performance. In my work however, I tended to focus on one type of environment—that in which project teams conduct their work. This environment can be characterized as complex, tightly coupled, and with a multiplicity of path and goals. I advanced that this type of environment will be related with the development of dissimilar TMMs, and that this level of match will increase performance. I elected to focus on this type of environment in order to complement previous work that focused on environments were more similar TMMs enabled team performance, that is environments that are characterized by complexity, tight coupledness and singularity of path and goal structures. The match between other types of environments and team cognition has though not been investigated. Further, there may be transitions between team environments during the teams' work which may require corresponding shifts in TMMs. Future work may thus benefit a more comprehensive test of the relationships described in the theoretical framework for a complete account of the role of the environment-cognition fit.

Forth, TMMs are advanced to influence team outcomes such as performance and adaptation both directly and indirectly through processes such as communication and coordination. In study three, following the early theoretical accounts of TMMs, I investigated the mediating effect of implicit coordination on the relationship between TMMs and performance. In this study, I find only weak evidence for a mediating effect suggesting that for interdisciplinary project teams working on the development of novel projects different processes may account for the effect of TMMs on performance. In study one and study three, I did not assess the processes that may account for or may moderate the effect of TMMs on performance. Communication and interaction patterns may be key omitted variables that have been demonstrated as relevant for the development of TMMs for teams facing changes. Despite a focus on processes in study three, this work is limited to self-reported accounts. Future work could benefit a more exact determination of the moderators and mediators of the effect of TMMs on outcomes and could also employ varied assessments such as other report or process tracing tools to avoid potential for common method bias.

Fifth, there are several limitations related to the treatment of TMMs in these studies. In the first place, in most of the studies I focused on the effect of TMMs similarity or dissimilarity on outcomes. In study two, I also assessed the relationship between TMMs complexity and team outcomes. There are however other characteristics of TMMs that have not been assessed such as TMMs accuracy that may bear on the results. As per my arguments though, TMMs accuracy should be more relevant for teams whose work can tied to specific goals and paths towards their achievement, which is not the case in this work, where the task required a multiplicity of approaches and the consideration of a multiplicity of goals. Relatedly, although in two of the studies I assessed both team and task TMMs, I assessed only their independent and not their interactive effects on outcomes. Previous work (e.g., Smith-Jentsch, Mathieu, & Kraiger, 2005) suggests that different TMMs contents have both independent and interactive effects on team outcomes, which calls for more exploration of these relationships in future studies.

In the second place, in two of the studies I assessed the TMMs using pairwise similarity ratings and in a third content analysis. There are different ways to operationalize TMMs though such as multidimensional scaling, causal mapping, and interactive maps which may bear differently on the results. Nonetheless, a recent metaanalysis and validation studies show that structural ratings in the form of pairwise Pathfinder assessment as employed in these studies present the strongest relationships with team outcomes.

In the third place, in these studies I aimed to capture the emergent character of TMMs by assessing the construct at multiple time points. This was aimed at complementing previous literature that looked only at the influence of TMMs at one time point and did not take a longitudinal view. In study one, and study three I assessed the TMMs at two time points and found that TMMs convergence related with performance instead of TMMs as assessed at one time point. Nonetheless, a measurement consisting of two time points is not truly longitudinal—it does not allow inferences with respect to the shape and rate of growth of the construct which give an account of TMMs development and which may be critical in the relationship with outcomes. Thus, these studies only partially satisfy the requirement for longitudinal assessment.

Nonetheless, in study two, I assessed the TMMs at four time points and I was able to capture both the shape and rate of growth and related these with future team performance, thereby contributing to literature on the longitudinal effect of TMMs. Further, the assessment of TMMs in study two allowed inferences with respect to TMMs flexibility, which is a characteristic of TMMs propounded as necessary for adaptive teams but which has not been assessed in previous studies.

6. Future research

There are other potential areas in the stream of team cognition and team adaptation not addressed in this dissertation and I will discuss some of them briefly. For example, in study two I tried to assess the long term effects of TMMs on team adaptive performance. In doing this, I relied on literature at the individual level. I did not find that the characteristics of mental models advanced to enhance performance at the individual level are also effective for enhancing performance at the team level. To determine more exactly the nature of these relationships truly longitudinal multilevel studies are required, in which individual and team performance and supporting mechanisms are compared (e.g., Chen, Thomas, & Wallace, 2005). This would enable more exact theorizing and predictions.

Second, in study two I assessed the relationship between TMMs contents and team performance. Research in different streams however shows that it is the organization of knowledge that is relevant for performance and not necessarily its content (DeChurch). Therefore, studies are needed where both TMMs content and structure are assessed in the same study and their effects on performance are compared.

Third, literature (Badke-Schaub) establishes that the TMMs contents and performance dimensions of innovation and creativity are complexly related for project teams. For instance, it has been proposed that innovative project development teams would benefit more dissimilar task TMMs but that they will benefit more similar team TMMs. While the studies reported here adduce some evidence that task TMMs dissimilarity can be beneficial for the performance of project teams, more research is needed on this topic and in more contexts, to determine the extent to which these theoretical arguments can be sustained.

Forth, although the studies reported here attempted to provide the first steps for the longitudinal assessment of TMMs, we still know very little about how TMMs develop over time and how this development relates with performance. For example, do TMMs content and structure converge at the same time? What is the relationship between convergence on different contents and performance? Is the TMMs convergence influenced by the team context, in other words, do TMMs converge differently in project teams compared to other types of teams? These questions would need to be answered by future research to determine the true role of TMMs for team development and performance. Cannon-Bowers et al. (1993) in their original exposition of the TMM construct stated that TMMs do not have to be similar but that they have to provide teams with similar expectations for their performance. What is the relationship between TMMs and expectations and when is each of the two more important?

Fifth, more work needs to be done to understand the role of TMMs for team adaptation. Burke et al. (2006) proposed a complex model in which TMMs affect the different stages of the adaptation process by providing the teams with the necessary understandings needed to manage their performance. To my knowledge, study one is the first that tries to test a part of this model, with respect to initial and later stages of adaptation. But the model is more complex than this, including several stages and different mediators and moderators that are related with TMMs. Future studies could thus more broadly explore this model and provide a more comprehensive view on the relationship between team cognition and team adaptation. To aid in this process, more complex methodologies could also be employed. Studies could draw for example on literature in individual cognition and human factors, and try to trace the development of TMMs during adaptive performance episodes using different process tracing tools. TMMs represent constructs that emerge out the information processing of the group but so far there have been no studies focusing on the information processing functions of the group to determine how and when TMMs emerge and with what effect on performance.

These are only a few of the topics that have not been addressed in this dissertation but that merit further attention. It is the hope of the author that future research will continue the path opened here and build more comprehensive and bolder research in this area.

7. Conclusion

This dissertation aimed to shed more light on the phenomenon of team adaptation to novel and unexpected events. Team adaptation has been regarded as a phenomenon through which the team achieves a fit between its cognitive structures which incorporate its knowledge, understanding, and interpretation of the world, and its performance environment. Several testable propositions have been derived that relate certain team cognition configurations with certain team environment configurations. The fit between these configurations was described as affecting the level of team adaptation. This hypothesis is not novel but previous research has made no attempts to systematize these relationships and to organize the discussion in terms of environmental characteristics and team characteristics. It is hoped thus that a larger interpretation framework will provide ground for the development of future research.

Secondly, the main tenets of the thesis were that project teams are better adapted to their environments when they develop TMMs that correspond to the characteristics of the environments in which they work. Each study described in this work adduces evidence for this contention. The first study shows that both TMMs dissimilarity and convergence lead to higher performance at different stages of the adaptation process. The second study shows that the characteristics of TMMs complexity and similarity aid teams that face varied task to obtain a higher performance on a future task. The third study shows that TMMs convergence on different contents differentiates between teams achieving high and teams achieving low performance. At the same time, throughout the thesis the relevance of context and time is emphasized. Adaptation cannot be considered atemporally or in the abstract. The work shows that certain forms of cognition serve teams better in certain contexts and at certain times throughout their work. This spurs future research to consider issues related to the team developmental timing and their settings in the derivation of research models on adaptation. Also, the work shows fundamentally that the role of cognition may be misspecified if these factors are not considered. Therefore, the main strength of this work is that it draws attention to the emergent nature of both cognition and adaptation in context.

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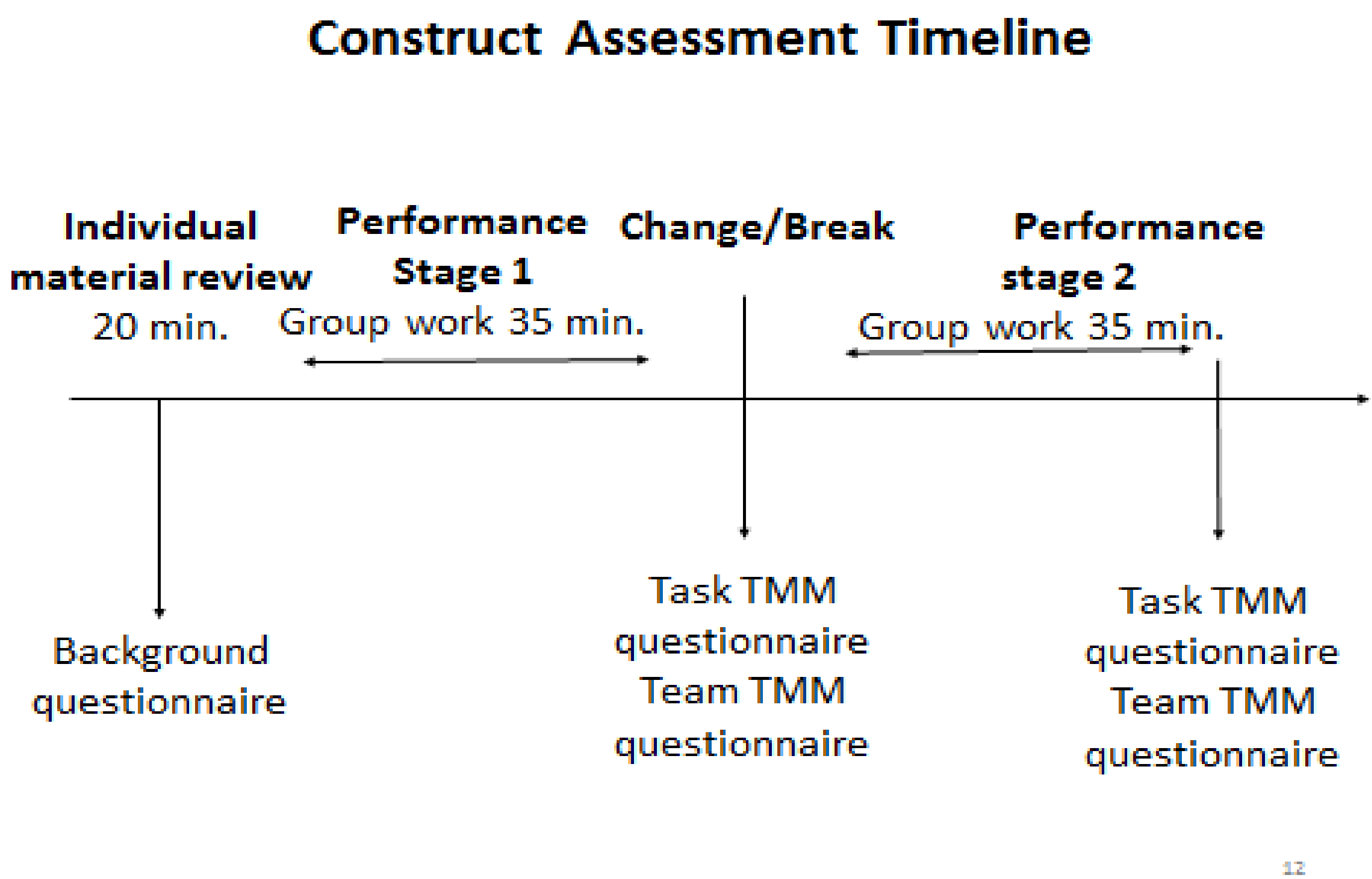
Appendices
Study materials and questionnaires

Study 1


Construct Assessment Timeline
Individual material review
20 min.
Performance Stage 1
Group work 35 min.
Change/Break
Performance stage 2
Group work 35 min.
Background questionnaire
Task TMM questionnaire
Team TMM questionnaire
Task TMM questionnaire
Team TMM questionnaire
12

Study materials (in German)

Study instructions

Instruktionen zur Studie

Willkommen!

Sie nehmen an einer Studie zum Lösen von Gruppenproblemen teil. Sie werden in dieser Studie mit zwei anderen Teilnehmern* zusammenarbeiten, um eine Problemstellung in einer Organisation zu lösen. Nachdem Sie das Labor betreten und sich gesetzt haben, schalten Sie bitte Ihre Handys und anderen elektronischen Geräte aus, damit sich alle Teilnehmer während der Studie auf die Aufgaben konzentrieren können. Essen und Getränke sind im Labor nicht gestattet. Bitte beachten Sie, dass Computer oder andere Geräte in der Kabine bei diesem Experiment nicht verwendet werden. Alle für die Bearbeitung der Aufgabe nötigen Materialien befinden sich bereits in der Kabine. Falls Sie während der Studie Fragen haben sollten, heben Sie bitte die Hand. Ein Versuchsleiter wird dann zu Ihrer Kabine kommen.

Die Studie wird etwa zwei ½ Stunden in Anspruch nehmen. Durch Ihre Unterschrift erklären Sie sich dazu bereit, während der gesamten Zeit anwesend zu sein. Sie werden unabhängig von Ihrer Leistung eine Entlohnung von 20 Euro, einschließlich der Show-up-fee, für Ihre Teilnahme erhalten. Sie werden am Ende der Studie bezahlt, nachdem Sie alle Fragebögen und Problemlösungen abgegeben haben. Sie werden eine Quittung mit Ihrem Namen und dem erhaltenen Geldbetrag unterzeichnen müssen.

Wenn Sie in der Ihnen zugewiesenen Kabine Platz genommen haben, finden Sie die Studienmaterialien vor sich auf dem Tisch. Dies sind eine Beschreibung des Problems, das Sie mit Ihrem Team lösen sollen sowie zusätzliche Dokumente, die Ihnen bei der Problemlösung helfen sollen. Bitte die Untersuchungsmaterialien nicht durch Hinzufügen oder Wegstreichen von Informationen verändern. Im Verlauf der Aufgabenbearbeitung werden Sie außerdem gebeten werden, drei Fragebogen zu beantworten. Diese werden sich in einem Hefter neben Ihnen befinden. Die Nutzung Ihrer Antworten geschieht in anonymisierter Form und ausschließlich zu wissenschaftlichen Zwecken. Bitte lesen Sie alle Studienmaterialien für sich **allein** durch und füllen Sie anschließend den ersten Fragebogen aus, welcher sich unter den Materialien vor Ihnen befindet. Wenn Sie mit dem Ausfüllen des ersten Fragebogens fertig sind, legen Sie ihn bitte unter den Hefter, der sich neben Ihnen auf dem Tisch befindet. Nachdem alle Teammitglieder die Informationen gelesen und den ersten Fragebogen ausgefüllt haben, kann die Gruppe mit der Arbeit am Prozessverbesserungsplan beginnen. Alle Lösungen der Fallstudie müssen in einem Arbeitsplan gesammelt werden. Der Plan befindet sich vor Ihnen in der Mitte des Tisches. In diesem Dokument müssen von einem oder mehreren von Ihnen, basierend auf Ihren Entscheidungen und den zur Verfügung stehenden Informationen, die Problemlösungen notiert werden. Stifte und Papier stehen hierfür bereit. Sollten Sie mehr Papier/Stifte benötigen, wenden

Sie sich bitte an den Versuchsleiter. Bitte fangen Sie mit der Arbeit am Plan erst an, nachdem alle Teammitglieder die Informationen gelesen und die Fragebogen ausgefüllt haben.

Sie werden mit den anderen Teilnehmern zusammenarbeiten müssen, um das Problem zu lösen. Sie haben 60 Minuten Zeit, um die Aufgabe zu lösen.

Sobald die Hälfte Ihrer Bearbeitungszeit um ist, wird der Versuchsleiter Sie auffordern, Ihre Arbeit zu unterbrechen und den zweiten im Hefter befindlichen Fragebogen auszufüllen. Nachdem Sie den Fragebogen ausgefüllt haben, legen Sie ihn bitte ebenfalls unter den Hefter. Am Ende der Aufgabe werden Sie aufgefordert werden, den dritten im Hefter befindlichen Fragebogen auszufüllen. Nachdem Sie den Fragebogen ausgefüllt haben, legen Sie bitte auch diesen unter den Hefter.

Während des Experiments wird Ihre Arbeit gefilmt. Die Aufnahmen werden streng vertraulich behandelt und nur der Versuchsleiter hat Zugang zu diesen. Die Aufnahmen werden nur zu Studienzwecken verwendet. Informationen über Sie oder einen der anderen Studienteilnehmer werden ausschließlich für Analysen und statistische Tests Ihrer Teamarbeit verwendet. Wenn Sie damit einverstanden sind, gefilmt zu werden, kreuzen Sie dies nun bitte an:

☐ Ich bin damit einverstanden, für diese Studie gefilmt zu werden. Ich verstehe, dass diese Aufnahmen nur für Studienzwecke verwendet werden und dass niemand außer dem Versuchsleiter Zugang zu ihnen hat.

Wenn Sie diese Teilnehmerinformation gelesen und verstanden haben, können Sie mit der eigentlichen Arbeit beginnen.

☐ Ich habe die Instruktionen zu dieser Studie gelesen und verstanden.

☐ Ich verstehe, dass diese Studie anonym ist und dass alle gegebenen Informationen nur für Forschungszwecke verwendet werden.

☐ Ich bin damit einverstanden, meine persönlichen Daten anzugeben, um die Entlohnung für die Studienteilnahme zu erhalten.

Case study
Fallbeschreibung

Diese fiktionalisierte Fallstudie basiert auf einer echten Organisation. Der Fall spielt in einer britischen Schule, allerdings sind einige der Probleme dieselben wie in anderen Ländern und Bereichen.

Rahmenbedingungen:
Gewerbe: öffentlicher Sektor im Vereinigten Königreich, Bildung (eine allgemeinbildende Sekundarschule), staatlich finanziert, gemeinnützige Organisation.
Personal: 156 Mitarbeiter (93 Lehrkräfte und 63 nicht lehrend)
Schülerschaft: mehr als 400 Schüler im Alter zwischen 11 bis 15 Jahren

Eine britische Sekundarschule hatte in den letzten Jahren hohe Fluktuationsquoten in der Lehrerschaft zu verzeichnen und hat daher beschlossen, ihr Anwerbungs- und Auswahlverfahren zu überprüfen, um herauszufinden, ob die Anwerbung und Auswahl geeigneter Lehrer verbessert werden kann.

Überprüfung des Anwerbesystems

Viele Jahre lang hat sich die Eastwood Schule auf eine einzige Anwerbemethode verlassen. Alle Lehrerstellen wurden per Werbeanzeige in einer Fachzeitschrift ausgeschrieben. Standardwerbeanzeigen wurden einmalig aufgegeben, mit der Aufforderung an interessierte Kandidaten, die Schule zu kontaktieren, um nach den erforderlichen Bewerbungsunterlagen zu fragen.
Die Bewerbungsunterlagen enthielten lediglich:

- einen Brief, in dem beschrieben war, wie man sich für die Stelle bewerben solle und
- ein Bewerbungsformular.

Manchmal wurden zusätzliche Informationen beigelegt, dies hing jedoch vom Fachbereichsleiter ab, der die Stellenausschreibung vornahm. Folgende zusätzliche Informationen konnten vorhanden sein:

- Informationen über das aktuelle Personal des Fachbereichs.
- Beispiele für vom Fachbereich organisierte Projekte (wie Schüleraustausche und
- Exkursionen, die von Schülern und Lehrerschaft unternommen wurden). Eine Kopie des Schulentwicklungsplans über die nächsten drei Jahre.

Die Bewerber schickten das Bewerbungsformular zum entsprechenden Abteilungsleiter. Nach dem Einsendeschluss beurteilten drei Lehrer des betreffenden Fachbereichs unabhängig voneinander die eingegangenen Bewerbungen. Abhängig vom Grad, in dem die Bewerber die

Auswahlkriterien erfüllten, wurde eine endgültige Liste von Kandidaten erstellt, die zur Teilnahme an einem Auswahltag eingeladen wurden. An Tagen, an denen Bewerbungsgespräche stattfanden, wurden normalerweise drei bis vier Bewerber eingeladen – abhängig davon, wie viele sich beworben hatten.

Überprüfung des Auswahlsystems

Als Auswahlmethode verwendete die Schule ausschließlich ein Bewerbungsgespräch bei dem der Direktor, der Abteilungsleiter und der Oberstudienrat anwesend waren. Aus Zeitgründen waren die Mitglieder dieses Interview-Teams normalerweise nicht in der Lage, sich vor dem Bewerbungsgespräch zu treffen, um die Fragen, die sie den Bewerbern stellen wollten, zu diskutieren. Obwohl der Direktor die Bewerbungsgespräche leitete, wurden sie nur selten gleich durchgeführt und es gab nur ein geringes Maß an Übereinstimmung zwischen den Fragen. Außerdem verwendete das Team kein formales Bewertungsschema (z.B. Noten) für die Bewertung.

Normalerweise lief der Tag nach folgendem Plan ab:

9:00 Begrüßung durch den Direktor

9:30 Führung über das Schulgelände

10:00 offizielle Bewerbungsgespräche mit einer Dauer von etwa 30 Minuten pro Bewerber

12:00 Interviewer kommen zur Entscheidungsfindung zusammen

13:00 Interviewer wenden sich an den erfolgreichen Bewerber und bieten ihm die Stelle an

Nach den Interviews gab es eine Gruppenabstimmung um zu entscheiden, wem der Job angeboten werden sollte. Dies führte oft zu einer hitzigen Debatte der Stärken und Schwächen des Bewerbers. Gewöhnlich wurden die Bewerber noch am selben Tag darüber informiert, ob sie ausgewählt wurden oder nicht. Erfolglose Bewerber erhielten eine kurze mündliche Rückmeldung, wurden jedoch nicht um Anmerkungen zu ihren Eindrücken vom Bewerbungsgespräch gebeten.

Problemstellung

Das Management-Team hat die Anwerbungs- und Auswahlverfahren der Schule überprüft, da die Befürchtung bestand, dass keine optimalen Methoden angewendet worden waren. Außerdem war der Direktor der Meinung, dass einige nicht geeignete Bewerber angestellt worden waren, was durch bessere Methoden hätte vermieden werden können.

Sie, als einer der Fachbereichspersonalleiter/ Fachbereichsleiter/ Fachbereichsbetriebsleiter* der Schule, sind Teil eines Dreier-Teams, das zusammengestellt wurde um einen Verbesserungsprozess sowohl des schulinternen Anwerbe- als auch Auswahlverfahrens des Personals zu konzipieren. Normalerweise hat jeder von Ihnen die Rolle inne, die durch Ihre Berufsbezeichnung definiert ist (siehe Rollenbeschreibung), doch jetzt sind Sie als Team von Prozessverbesserungsberatern tätig.

Sie werden die Aufgabe haben, Verbesserungsvorschläge sowohl für das oben genannte Anwerbe- als auch das Auswahlsystem zu machen und diese Empfehlungen in einem Projektplan (siehe Projektplan) umzusetzen. Das Ziel der Schule ist es, hervorragende Lehrer zu gewinnen. Es stehen Ihnen ein Budget und Ressourcen zur Verfügung, um das Anwerbesystem der Schule zu verbessern. Zudem werden Sie auch Strategien und Maßnahmen zur Verbesserung des Auswahlsystems innerhalb des gleichen Prozessverbesserungsplans definieren müssen. Verfügbare Ressourcen sind der Ressourcen-Pool der Schule (Ausstattung, Material, Räume, Personal) und ein Budget von 5.000 £, von denen 3.500 £ von der Schulleitung für die Verbesserung des Anwerbesystems und der Rest für die Verbesserung des Auswahlsystems eingeplant sind. Die Zeitspanne des Projekts beträgt 6 Monate.

* **Beachten Sie**! Der Projektplan (ein Dokument oder eine Sammlung von Dokumenten) kann sich im Laufe der Zeit ändern, sobald weitere Informationen zum Projekt verfügbar werden. Die Standards, mit denen Ihre Leistung verglichen und gemessen werden wird, werden sich in der Regel nur zeitweise, und nur als Reaktion auf eine gegebene Veränderung innerhalb eines bestimmten Arbeitsrahmens ändern.

* The roles differed between the members. Each member received the same case study description but the roles of the members differed in the study.

Additional materials

School schedule of events

Jahreskalender 2014/2015

EASTWOOD SCHOOL

August `14	September `14	Oktober `14	November `14	Dezember `14	Januar `15	Februar `15	März `15	April `15	Mai `15	Juni `15	Juli `15
01 Fr	01 Mo START	01 Mi	01 Sa	01 Mo	01 Do Neujahr	01 So	01 So	01 Mi	01 Fr	01 Mo	01 Mi
02 Sa	02 Di	02 Do	02 So	02 Di	02 Fr	02 Mo	02 Mo	02 Do	02 Sa	02 Di	02 Do
03 So	03 Mi	03 Fr	03 Mo	03 Mi	03 Sa	03 Di	03 Di	03 Fr	03 So	03 Mi	03 Fr
04 Mo	04 Do	04 Sa	04 Di	04 Do	04 So	04 Mi	04 Mi	04 Sa	04 Mo	04 Do	04 Sa
05 Di	05 Fr	05 So	05 Mi	05 Fr	05 Mo	05 Do	05 Do	05 So	05 Di	05 Fr	05 So
06 Mi	06 Sa	06 Mo	06 Do	06 Sa	06 Di	06 Fr	06 Fr	06 Mo	06 Mi	06 Sa	06 Mo
07 Do	07 So	07 Di	07 Fr	07 So	07 Mi	07 Sa	07 Sa	07 Di	07 Do	07 So	07 Di
08 Fr	08 Mo	08 Mi	08 Sa	08 Mo	08 Do	08 So	08 So	08 Mi	08 Fr	08 Mo	08 Mi
09 Sa	09 Di	09 Do	09 So	09 Di	09 Fr	09 Mo	09 Mo	09 Do	09 Sa	09 Di	09 Do
10 So	10 Mi	10 Fr	10 Mo	10 Mi	10 Sa	10 Di	10 Di	10 Fr	10 So	10 Mi	10 Fr
11 Mo	11 Do	11 Sa	11 Di	11 Do	11 So	11 Mi	11 Mi	11 Sa	11 Mo	11 Do	11 Sa
12 Di	12 Fr	12 So	12 Mi	12 Fr	12 Mo	12 Do	12 Do	12 So	12 Di	12 Fr	12 So
13 Mi	13 Sa	13 Mo	13 Do	13 Sa	13 Di	13 Fr	13 Fr	13 Mo	13 Mi	13 Sa	13 Mo
14 Do	14 So	14 Di	14 Fr	14 So	14 Mi	14 Sa	14 Sa	14 Di	14 Do	14 So	14 Di
15 Fr	15 Mo	15 Mi	15 Sa	15 Mo	15 Do	15 So	15 So	15 Mi	15 Fr	15 Mo	15 Mi
16 Sa	16 Di	16 Do	16 So	16 Di	16 Fr	16 Mo	16 Mo	16 Do	16 Sa	16 Di	16 Do
17 So	17 Mi	17 Fr	17 Mo	17 Mi	17 Sa	17 Di	17 Di	17 Fr	17 So	17 Mi	17 Fr
18 Mo	18 Do	18 Sa	18 Di	18 Do	18 So	18 Mi	18 Mi	18 Sa	18 Mo	18 Do	18 Sa
19 Di	19 Fr	19 So	19 Mi	19 Fr	19 Mo	19 Do	19 Do	19 So	19 Di	19 Fr	19 So
20 Mi	20 Sa	20 Mo	20 Do	20 Sa	20 Di	20 Fr	20 Fr	20 Mo	20 Mi	20 Sa	20 Mo
21 Do	21 So	21 Di	21 Fr	21 So	21 Mi	21 Sa	21 Sa	21 Di	21 Do	21 So	21 Di
22 Fr	22 Mo	22 Mi	22 Sa	22 Mo	22 Do	22 So	22 So	22 Mi	22 Fr	22 Mo	22 Mi
23 Sa	23 Di	23 Do	23 So	23 Di	23 Fr	23 Mo	23 Mo	23 Do	23 Sa	23 Di	23 Do
24 So	24 Mi	24 Fr	24 Mo	24 Mi	24 Sa	24 Di	24 Di	24 Fr	24 So	24 Mi	24 Fr
25 Mo	25 Do	25 Sa	25 Di	25 Do 1. Weihnachtstag	25 So	25 Mi	25 Mi	25 Sa	25 Mo	25 Do	25 Sa
26 Di	26 Fr	26 So	26 Mi	26 Fr 2. Weihnachtstag	26 Mo	26 Do	26 Do	26 So	26 Di	26 Fr	26 So
27 Mi	27 Sa	27 Mo	27 Do	27 Sa	27 Di	27 Fr	27 Fr ENDE	27 Mo	27 Mi	27 Sa	27 Mo
28 Do	28 So	28 Di	28 Fr	28 So	28 Mi	28 Sa	28 Sa	28 Di	28 Do	28 So	28 Di
29 Fr	29 Mo	29 Mi	29 Sa	29 Mo	29 Do		29 So	29 Mi	29 Fr	29 Mo	29 Mi
30 Sa	30 Di	30 Do	30 So	30 Di	30 Fr		30 Mo	30 Do	30 Sa	30 Di	30 Do
31 So		31 Fr		31 Mi	31 Sa		31 Di		31 So		31 Fr

Work plan

EASTWOOD SCHOOL PROZESSVERBESSERUNGSPLAN

Ziel der Schule: Attraktivität, Anwerbung, Auswahl hochwertiger Lehrer: die besten Lehrer, die das Potential haben, die allerbesten Lehrer zu werden und damit den größten Beitrag für Schule und Schüler leisten, gewinnen, rekrutieren und anstellen.
Maßnahmen: 5 bis 10 Maßnahmen in jedem Bereich, in dem Verbesserung erforderlich ist, von der Schulleitung vorgeschrieben.
Budget: 5.000 €
Zeitrahmen des Projekts: 6 Monate ab Projektbeginn / 1. September 2014 - 27. März 2015

Ihr Plan wird durch externe Projektmanager bewertet, die mit Projekten dieser Art vertraut sind.

Begriffserklärungen, die Ihnen helfen werden:

Ziel (Teilziel): Bitte definieren Sie, was Sie durch die Umsetzung der Maßnahmen erreichen wollen.
Maßnahme – alle Schritte, die im Laufe des Projekts vollzogen werden und Beschreibungen jedes Schrittes, um sicherzustellen, dass die Projektmitarbeiter verstehen, wie die Arbeit zu erledigen ist
Kostenschätzung – Kosten für Ressourcen, die zur Vollendung der Projektmaßnahmen erforderlich sind (Arbeits-, Material-, Liefer-, Reservekosten); Sie können Maßeinheiten, wie die benötigten Arbeitsstunden des Personals oder Arbeitstage (Bezahlung/Stunde), zusammen mit deren Kostenschätzung, verwenden(in der Form, dass ein bestimmter Mitarbeiter für eine bestimmte Dauer einen Betrag X kostet).
Schätzung der Dauer der Maßnahme: Quantitative Schätzung der wahrscheinlich benötigten Arbeitszeit, um eine Maßnahme zu vollenden
Risiken – Ein Risiko ist ein unsicheres Ereignis oder eine Bedingung, die, sollte sie eintreten, positive oder negative Effekte auf die Projektziele hat. Ermitteln Sie Risiken der von Ihnen vorgeschlagenen Handlungen, die eine Implementation der jeweiligen Handlung be- oder verhindern könnten – beschreiben Sie sie: Welche Bereiche betreffen sie, was verursacht sie und wie beeinflussen sie die Implementation der Handlung.
Erwartete Ergebnisse der durchgeführten Maßnahme –Erwartete Veränderung an der Schule durch die durchgeführten Maßnahmen
Ergebnis: Ein Ergebnis ist die kurze, klare Aussage, die die beabsichtigten Resultate des Prozesses in messbarer Größe wiedergibt. Ergebnisse fokussieren die spezifische Leistung der Beteiligten, von der erwartet wird, dass sie anzeigt, wann das Ziel erreicht worden ist.
Ergebnisindikator (z.B. prozentuale Steigerung der Bewerber/der Auswahl/der Anstellungen; verringerte Fluktuationsraten; Schülerleistungen; Medien-Feedback etc.)

Ziel (Teilziel) 1: (klares Ziel, Indikator, Meilenstein-Datum)

VERBESSERUNGSPLAN	Benötigte Ressourcen (Art, Menge)		Kostenschätzung
	Material, Ausstattung, Raum	Personal Mitarbeiter und Stunden	
Maßnahme:			
Maßnahme:			
Maßnahme:			
Maßnahme:			
Maßnahme:			
Maßnahme:			
Maßnahme:			
Maßnahme			
Maßnahme			
Maßnahme:			

Einschätzung der Dauer der Maßnahme (Tage, Wochen)	Projekt-Zeitplan		Risiken	Risikobewältigungsstrategien	Erwartete Ergebnisse
	Startdatum	Enddatum			

Erwartete Ergebnisse	Ergebnisindikator

School resources

Mitarbeiterbüros und Arbeitsräume

Mitarbeiterbüros und Arbeitsräume	**Klassenzimmer**
Besprechungszimmer Aufenthaltsraum Büro des Bibliothekars Direktor Verwaltungsbüro Schuleinschreibung Krankenschwester: Erste-Hilfe-Zimmer Schulpsychologe Führungsebene Instandhaltung und IT-Wartung Einkauf und Buchhaltung Kommunikation **Lehr- und Hilfspersonal** Hilfspersonalzimmer Sprachen Geisteswissenschaften Mathematik Kunst Naturwissenschaften Assistenten	**Jeweils 60/40 Schüler** Bibliothek Bibliotheksklassenzimmer Cafeteria Sporthalle Musik-und Kunsträume Kleingruppenunterrichtsräume Theater Spielplatz und Sportplatz Kopierraum und Papierlagerraum Labore (Labor-)Räume für Physik, Chemie und Biologie, Informatik Medienraum (Macbooks & Videokameras) Vorbereitungsräume der Naturwissenschaften (Lagerung von Chemikalien und Ausstattung)
Möbel Stuhl, Schüler	**IT-, Audio-Video-Geräte** 22 Computer und ein interaktives SMART-

Tisch, Schüler Tisch, Schreiben Schließfächer Bücherregal Stuhl, Büro Schreibtisch, Büro Schrank, Ablage Klapptisch Konferenztisch Arbeitstisch Stuhl (normal) Büro-, Stahl- Lobby-Stuhl (2-Sitzer) Kaffeetisch Kleiner Besprechungstisch (rund) Klappstuhl Sofa (Dreisitzer) Schrank Lehrertisch , Schreiben, Lehrerstuhl Stapelstuhl mit Schreib-Arm (für Schüler) Computertisch Computerstuhl	Whiteboard 50 vernetzte Computer mit kontrolliertem Internetzugang 16 interaktive SMART-Boards 40 Allzweck-Desktop-PCs (Schüler) mit 20 "-LCD-Monitor Computer-Überwachungssoftware-Kontrollsystem (Lehrer) Computer-Peripheriegeräte Arbeitsgruppen-Laserdrucker Microcomputer-Arbeitsplatz: Allzweck-Desktop-PC mit 20 "LCD-Monitor Drucker (Standard-Tintenstrahldrucker) Netzwerkgeräte Fernkopierer Normalpapier-Fotokopierer Mikrocomputerarbeitsplatz : Allzweck-Desktop-PC (Lehrer) mit 20 "-LCD-Monitor Microcomputer-System: Allzweck-Desktop-PC mit 20 "LCD-Monitor (Computerraum – Schülerversion) Microcomputer-System: Allzweck-Desktop-PC mit 20 "LCD-Monitor (Computerraum - Lehrerversion) **Audio / Video-Geräte** VCD-Player, Digital-Video-Kamera DVD-Player und Videorekorder DVC: ~ $ 12.000 DVD: ~ $ 3000 VCR: ~ $ 2500

<table>
<tr><td></td><td>LCD-Projektor
Headset
Megaphon</td></tr>
<tr><td colspan="2">Einige Bereiche können ohne Zahlung einer zusätzlichen Gebühr nicht außerhalb der Unterrichtszeiten verwendet werden (sie können je nach Verfügbarkeit gemietet werden), d.h.:
nach 17.00 Uhr, vor 8 Uhr oder am Wochenende.
Theater: 50 €
Schulkantine: 50 €
Informatik- und Computerraum: 50 €
Media Suite (Macbooks & Videokameras): 50 €
Klassenzimmer: 30 €
Sporthalle: 50 €
(alle Preise verstehen sich pro Stunde)</td></tr>
</table>

Personnel

Personal	**Lehrende 97** **Nicht-lehrendes Personal - 63, unter ihnen 44 VZ**
	VZ – Vollzeit Arbeitende (8 Stunden/Tag)
Führungskräfte	**TZ – Teilzeit Arbeitende (4 Stunden/Tag oder anders spezifiziert)**
Direktor - 1 VZ	
Assistent - 2 - 1 VZ, 1 TZ	20€//14€
Stellvertretender Direktor - 1 VZ // Assistent - 1 VZ	20€
Rechtsberater - 2 VZ	21€
Personalleiter	
Betriebsleiter	
Schulleiter	
Lehrer und Betreuer	
Betreuer - Klasse 5 - 8; 2 pro Klasse = 10 VZ	25€
Fachlehrer	
Kunst - 2 VZ	VZ - 29€; TZ - 15€
Englisch - 7; 4 VZ, 3 TZ	
Englisch als Fremdsprache - 10; 5 VZ, 5 TZ	
Ethik - 2 VZ	
Deutsch - 15; 10 VZ, 5 TZ	
Geisteswissenschaft - 6 - 4 VZ, 2 TZ	
Informatik - 4, 3 VZ	
Koreanisch 1 VZ	
Literaturwissenschaft 2 VZ, 1 TZ	
Mathematik - 8 - 6 VZ, 2 TZ	
Musik und Theater - 6, 5 VZ, 1 TZ	
Sport - 3 VZ	
Leiter Sportfachbereich - 1 VZ	
Naturwissenschaft - 5 - 4 VZ, 1 TZ	
Laborassistent - 2 VZ	
Spanisch - 3, 2 VZ, 1 TZ	
Schülerberatung - 5 - 3 VZ, 2 TZ//Assistent - 1 VZ	
Sozialkunde - 3 - 1 VZ Koordinator, 2 VZ regulär	
*einige der Vollzeitlehrer sind in Programme, die nach der regulären Schulzeit stattfinden, eingebunden (zwischen 14 und 17	

Uhr, abhängig vom Stundenplan)	
Koordinator für außerschulische Aktivitäten - 1 VZ// Assistent - 1 TZ	24€//12€
Lehrassistent – 3 TZ	12€
Verwaltung	
Personalmanagement - 2 VZ // Personalverwaltung - 1 TZ (6h)	25€//15€TZ
Chefbuchhalter - 1 VZ // Buchhalter - 1 VZ	21 €//18€
Einkauf - 1 VZ	21€
Veranstaltungen und Kommunikation - 1 VZ / Assistent - 1 TZ (6h)	21€ VZ//16€
Archivar - 1 VZ	13€
Büroleiter – 1 VZ // Verwaltungsassistent - 2 TZ	20 €//14€ TZ
Leitung Cafeteria - 1 VZ // Assistent - 1 VZ	18€//12€
Essens-Hilfskräfte - 5 TZ	8€VZ
Zulassung - 1 VZ	12€
Sekretariat - 2 VZ	15€
Rezeptionist - 2 TZ (6h)	9€/VZ
Schulkrankenschwester - 2 VZ	15€
IT Manager - 1 VZ//IT Administrator - 3 - 2 VZ, 1 TZ	34€//16€VZ, 9€
Betriebsleiter - 2 VZ // Assistent (Wartung) - 2 TZ	19€//13€
Verwaltungsmitarbeiter - 1VZ	14€
Bibliothekar - 3 VZ // Assistent - 1 TZ (6h)	16€ VZ//8€

Strategieplan der Eastwood Schule für die Jahre 2014-2015

Wir werden eine Schule sein, die hochqualifizierte Mitarbeiter anwirbt, einstellt und hält, um unsere Vision, Mission und Philosophien durch unseren Lehrplan zu vermitteln, indem wir
durch Förderung und Stärkung unserer Mitarbeiter unsere Vision, Mission und Philosophien entwickeln.
die Betreuung, die berufliche Entwicklung und Beurteilungsprozesse entwickeln, umsetzen und kontinuierlich verbessern.
auf unseren Bewertungsprozess für Personalleistung aufbauen.
unserem Personal ermöglichen, zusammenzuarbeiten und seine berufliche Entwicklung durch den Austausch von bewährten Methoden voranzutreiben.
ein wettbewerbsfähiges Arbeitspaket und gute Arbeitsbedingungen gewährleisten.

Wir werden eine Schule sein, die das Verantwortungsgefühl aller Beteiligten für die Gemeinschaft fördert, indem wir
das geteilte Verständnis für unsere Vision, Mission und Philosophien fördern.
Elternbotschafter einbeziehen und darauf schulen, bei der Aufklärung der Eltern über aktuelle Bildungsmaßstäbe und Forschung zu helfen.
die Einbindung der Familie in das Schulleben und die Entwicklung und Förderung einer Kultur der Partizipation aktiv fördern.
einen Kommunikationsplan für Transparenz und Zusammenarbeit mit den Eltern, Schülern und Mitarbeitern entwickeln.
eine Kultur der Offenheit und des Respekts fördern.

Wir werden eine Schule sein, die sich in unser Land und unsere Lokalregion integriert, indem wir
gezielt lokale Partnerschaften entwickeln, die unsere Schulprogramme stärken.
die pädagogische und wirtschaftliche Bedeutung unserer Schule für den Staat erhöhen.
Individuen und Gruppen ermutigen, am örtlichen Gemeindeleben als aktive und verantwortungsbewusste Weltbürger teilzunehmen.

Change statement

Veränderung

Die Schulleitung hat wiederholt Beschwerden von ehemaligen Bewerbern, aufgrund der Behandlung, die sie während des Auswahlprozesses erfahren haben, erhalten. Insbesondere haben sich die Kandidaten darüber beschwert, dass man ihnen diskriminierende Fragen gestellt und dass man ihnen keine gleichen Chancen gegeben hatte, die Stelle zu bekommen. Angesichts dieser neuen Information und den Regierungsvorschriften, welche Gleichbeschäftigung als einer der obersten Prioritäten für Schulen unterstreichen, hat die Führungsebene beschlossen, die Mittel für die Prozessverbesserung neu zu verteilen. Vom anfänglichen Finanzplan müssen Sie nun Ressourcen (1500 £) nutzen, um den Rekrutierungsprozess zu verbessern und Ressourcen (3500 £), um den Auswahlprozess zu optimieren. Sie **müssen** unter allen Umständen diese neuen Informationen in Ihren Überlegungen berücksichtigen, um Ihr Verbesserungskonzept weiter zu entwickeln und auszubauen. Ihr Team muss den bisherigen Planungsprozess überdenken und sich auf diese Veränderungen einstellen. Ihr Plan wird nur zugelassen werden, wenn die neuen Anforderungen miteinbezogen werden.

Team mental models

Task TMM

Hier sind einige Beschreibungen der Ereignisse in der Prozessverbesserungsaufgabe. Bitte bewerten Sie, wie VERBUNDEN, INEINANDERGREIFEND oder IN BEZIEHUNG STEHEND jedes Konzept oder Ereignis zu den anderen ist.
HINWEIS: Bitte nur die weißen Quadrate vervollständigen. Zum Beispiel werden Sie im obersten Quadrat gebeten zu bewerten, wie " Verbesserung des Anwerbesystems" mit " Verbesserung des Auswahlsystems“ verbunden ist. Wenn Sie Fragen haben, wenden Sie sich bitte an den Versuchsleiter.

Beim Ausfüllen der Felder ist es am besten, alle Definitionen durchzulesen, bevor Sie versuchen, die Zahlen einzusetzen, damit Sie wissen, was jede der Spalten bedeutet. Sobald Sie die Dimensionen kennen, ist es am besten, extreme Zahlen zuerst aufzuschreiben. Füllen Sie also diejenigen Kästchen zuerst aus, von denen Sie denken, dass sie gar nicht verbunden sind (1) und die, die sehr verbunden sind (7) und fahren Sie dann mit dem nächsten Item fort.

1 nicht verbunden
2
3
4 etwas verbunden
5
6
7 sehr verbunden

*** Beim Ausfüllen der Felder ist es am besten, alle Definitionen durchzulesen, bevor Sie versuchen, die Zahlen einzusetzen, damit Sie wissen, was jede der Spalten bedeutet.**

Items:

Erweiterung der Anwerbemethoden – Nutzen verschiedener Anwerbungsquellen

Verbesserung der Anwerbemethoden – Verbessern der aktuellen Anwerbemethoden der Schule

Erweiterung der Auswahlmethoden – Nutzen verschiedener Auswahlmethoden

Verbesserung der Auswahlmethoden – Verbessern der aktuellen Auswahlmethoden der Schule

Projektbedingungen – für Projekt vorgesehenes Budget, Ressourcen und Zeit

Interne Schulpraktiken – Richtlinien und Anweiungen für Schulpersonal

Schulziele und -prioritäten – was die Schule zu erreichen versucht

Ursachen der Probleme der Schule – was die aktuelle Situation der Schule verursachte

Effektivität des Plans – Effektivität des Teamsplans zur Lösung des Falls

Erweiterung der Anwerbemethoden – Nutzen verschiedener Anwerbungsquellen	Verbesserung der Anwerbemethoden	Erweiterung der Auswahlmethoden	Verbesserung der Auswahlmethoden	Projekt-bedingungen	Interne Schulpraktiken	Schulziele und -prioritäten	Ursachen der Probleme der Schule	Effektivität des Plans
Verbesserung der Anwerbemethoden – Verbessern der aktuellen Anwerbemethoden der Schule								
Erweiterung der Auswahlmethoden – Nutzen verschiedener Auswahlmethoden								
Verbesserung der Auswahlmethoden – Verbessern der aktuellen Auswahlmethoden der Schule								
Projektbedingungen – für Projekt vorgesehenes Budget, Ressourcen und Zeit								
Interne Schulpraktiken – Richtlinien und Anweiungen für Schulpersonal								
Schulziele und -prioritäten – was die Schule zu erreichen versucht								
Ursachen der Probleme der Schule – was die aktuelle Situation der Schule verursachte								
Effektivität des Plans – Effektivität des Teamsplans zur Lösung des Falls								

Team TMM

Hier sind einige Beschreibungen der Ereignisse in der Prozessverbesserungsaufgabe. Bitte bewerten Sie, wie VERBUNDEN, INEINANDERGREIFEND oder IN BEZIEHUNG STEHEND jedes Konzept oder Ereignis zu den anderen ist.

HINWEIS: Bitte nur die weißen Quadrate vervollständigen. Zum Beispiel werden Sie im obersten Quadrat gebeten zu bewerten, wie " Informationen analysieren und eine Problemdefinition entwickeln" mit " Mit anderen beraten“ verbunden ist. Wenn Sie Fragen haben, wenden Sie sich bitte an den Versuchsleiter.

Beim Ausfüllen der Felder ist es am besten, alle Definitionen durchzulesen, bevor Sie versuchen, die Zahlen einzusetzen, damit Sie wissen, was jede der Spalten bedeutet. Sobald Sie die Dimensionen kennen, ist es am besten, extreme Zahlen zuerst aufzuschreiben. Füllen Sie also diejenigen Kästchen zuerst aus, von denen Sie denken, dass sie gar nicht verbunden sind (1) und die, die sehr verbunden sind (7) und fahren Sie dann mit dem nächsten Item fort.

1 nicht verbunden
2
3
4 etwas verbunden
5
6
7 sehr verbunden

*** Beim Ausfüllen der Felder ist es am besten, alle Definitionen durchzulesen, bevor Sie versuchen, die Zahlen einzusetzen, damit Sie wissen, was jede der Spalten bedeutet.**

Items:

Probleme definieren – Informationen analysieren und diskutieren um festzustellen, welche Probleme angegangen werden müssen

Handlungsprioritäten setzen - Handlungsmaßnahmen festlegen, die schwierig durchzuführen sind

Handlungsplan entwickeln – einen primären Handlungsablauf, bzgl. woran oder wie gearbeitet werden soll, erstellen

Fokus auf die anfallende Aufgabe - genau darauf achten, woran das Team gerade arbeitet

Bewusstheit der Situation – auf verschiedene Elemente des Plans oder der Augabensituation achten

Strategie- oder Planänderungen – die Teamstrategie oder den Handlungsplan verändern, wenn es die Situation erfordert

Einvernehmliche Entscheidungsfindung erreichen – mit anderen beraten um zu entscheiden und die beste Handlungsoption zu wählen

Zielfokus – Aktivitäten immer im Zusammenhang mit Projektzielen betrachten

	Probleme definieren	Handlungsprioritäten setzen	Handlungsplan entwickeln	Fokus auf die anfallende Aufgabe	Bewusstheit der Situation	Strategie- oder Planänderungen	Einvernehmliche Entscheidungsfindung	Zielfokus
Probleme definieren – Informationen analysieren und diskutieren um festzustellen, welche Probleme angegangen werden müssen								
Handlungsprioritäten setzen - Handlungsmaßnahmen festlegen, die schwierig durchzuführen sind								
Handlungsplan entwickeln – einen primären Handlungsablauf, bzgl. woran oder wie gearbeitet werden soll, erstellen								
Fokus auf die anfallende Aufgabe - genau darauf achten, woran das Team gerade arbeitet								
Bewusstheit der Situation – auf verschiedene Elemente des Plans oder der Augabensituation achten								
Strategie- oder Planänderungen – die Teamstrategie oder den Handlungsplan verändern, wenn es die Situation erfordert								
Einvernehmliche Entscheidungsfindung erreichen – mit anderen beraten um zu entscheiden und die beste Handlungsoption zu wählen								
Zielfokus – Aktivitäten immer im Zusammenhang mit Projektzielen betrachten								

Questionnaires

Background questionnaire

1.Alter: ___________

Geschlecht:
O Männlich
O Weiblich

2. Höchster Bildungsabschluss: ____________

3. Studienfach: _________________________
Fachsemester:________________________

4. Ungefährer Notendurchschnitt im vergangenen akademischen Jahr: _____________

5. Dauer Ihrer Ausbildung in Jahren (bitte berücksichtigen Sie schulische und universitäre Ausbildung sowie Ausbildungen und Trainings in anderen Einrichtungen): ____________

6. Schulform der von Ihnen besuchten Schule:
O Privat
O Staatlich
O Sonstiges:

7. Erfahrung mit Anwerbung und Auswahl/Personalwesen:

O Ich habe Kurse zur Anwerbung und Auswahl von Personal absolviert.
O Ich habe an Fallstudien zur Personalanwerbung und –auswahl im Rahmen einer wissenschaftlichen Lehrveranstaltung gearbeitet.
O Ich habe im Bereich Personalanwerbung und –auswahl für eine Firma, Einrichtung oder Nicht-Regierungs-Organisation gearbeitet.
O Sonstige (bitte erläutern
Sie):____

____

Falls Sie Kurse zur Anwerbung und Auswahl von Personal absolviert haben, geben Sie bitte Ihre Durchschnittsnote über diese Kurse an (d.h., falls Sie mehr als einen Kurs absolviert haben, ermitteln Sie den Durchschnitt aller absolvierten Kurse und schreiben Sie ihn auf): ___________

8. Anzahl der Jahre, die Sie bisher insgesamt gegen Bezahlung gearbeitet haben: __________

9. Wie viele Arbeitsstellen/Tätigkeiten/ Berufe haben Sie bislang insgesamt ausgeübt? (Bitte geben Sie alle Stellen an, die Sie sowohl bei unterschiedlichen Arbeitgebern als auch bei demselben innehatten, wenn Sie beispielsweise innerhalb der Firma Ihre Position gewechselt haben): __________________

10. Wie lange arbeiten Sie in Ihrer derzeitigen Firma? _______ Jahre_______ Monate
11. Wie lange arbeiten Sie in Ihrem derzeitigen Beruf? _______ Jahre_______ Monate

12. Waren Sie in der Vergangenheit selbstständig tätig?
O Ja
O Nein
Falls Ja, Anzahl der Jahre, die Sie bisher insgesamt selbstständig tätigt waren:

13. Sind Sie derzeitig selbstständig tätig?

O Ja
O Nein

14. Art der derzeitigen Arbeitsstelle oder der zuletzt innegehabten Arbeitsstelle, falls momentan nicht beschäftigt:
O Teilzeit
O Vollzeit

15. Wie viele Wochenstunden arbeiten Sie bei Ihrer derzeitigen Arbeitsstelle oder der von Ihnen zuletzt innegehabten Arbeitsstelle, falls momentan nicht beschäftigt:_________

16. Hatten Sie bei Ihrer letzten Arbeitsstelle die Befugnis, Aufgaben an andere zu delegieren?
O Ja
O Nein

17.Wurden Sie bei Ihrer letzten Arbeitsstelle mit der Koordination eines zeitlich begrenzten Projekts beauftragt?
O Ja
O Nein

18.Hatten Sie bei Ihrer letzten Arbeitsstelle eine Führungsposition inne?
O Ja
O Nein

19. In welchem Bereich oder in welcher Industrie haben Sie am längsten gearbeitet?

O Management
O Marketing/customer service
O Accounting/ controlling
O Engineering
O Research and Development
O Manufacturing/Production
O Human resources
Other (please specify)

20. Welches der folgenden Items beschreibt am besten die Art von Unternehmen, in der Sie am längsten gearbeitet haben?

O Gewinnorientiertes Unternehmen

O Familienunternehmen oder Landwirtschaft
O staatlicher Dienst
O nicht gewinnorientiertes Unternehmen, steuerbefreites und / oder öffentliches Unternehmen
O Einzelperson (z.B. als Haushaltshilfe)
O Sonstiges:

21. Was war Ihr Qualifizierungsgrad bei der Arbeitsstelle, bei der Sie am längsten gearbeitet haben (aktuelles Qualifikationsniveau, falls Sie befördert wurden)?

O Anfänger/Einsteiger
O erste –Berufserfahrung (Junior)
O fortgeschrittener Mitarbeiter (Intermediate)
O erfahrener Mitarbeiter (eventuell leitende Aufgaben) (Senior)
O Sonstiges:

22. Haben Sie Erfahrung im Projektmanagement / bei der Projektplanung?

O Ja
O Nein

23. Falls ja, welche Art von Erfahrung konnten Sie bisher sammeln?

O Ich habe im Projektmanagement/ in der Projektplanung innerhalb eines Unternehmens mitgewirkt
O Ich habe im Projektmanagement/ in der Projektplanung in einem schulischen/ universitären Projekt mitgewirkt
O Sonstige (bitte erläutern Sie):____

____

24. Anzahl der Projekte, an denen Sie im Management oder bei der Planung mitgewirkt haben:____

25. Länge des längsten Projekts (in Wochen):______________________________________

26. Was war Ihre Rolle innerhalb dieses Projekts?____

____

27. Haben Sie ein spezielles Training bekommen, um an diesem Projekt mitzuarbeiten?

O Ja

O Nein

Falls Ja, welche Art von Training haben Sie bekommen?

____

____

____

28. Wie erfolgreich war das Projekt in Bezug auf das Erreichen seiner Ziele? Bitte geben Sie in Prozent an:

__0% - Nicht erfolgreich __10% __20% __30% __40% __50% __60% __70% __80% __90% __100% - absolut erfolgreich

29. Der Einfluss des Projekts auf die Langzeiteffektivität der Organisation:

__1 – geringer Einfluss __2 __3 __4 __5 __6 __7 – Hoher

30. Bitte beschreiben Sie erwähnenswerte Schwierigkeiten, denen Sie während des Projekts begegnet sind:

____

Control variables

1. **Task self-efficacy**

Berücksichtigen Sie die Informationen, die Sie bis jetzt in den Instruktionen und Studienmaterialien gelesen haben und geben Sie Ihre Zustimmung zu folgenden Aussagen an:

1 Trifft gar nicht zu 2 3 4 5 6 7 Trifft voll zu

1. Ich bin zuversichtlich, dass ich die Planungsaufgabe erfolgreich lösen kann.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
2. Ich habe Vertrauen in meine Fähigkeit, die Herausforderungen bei der Planungsaufgabe zu meistern	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
3. Ich habe Vertrauen in meine Fähigkeit, die Anforderungen dieser Aufgabe zu meistern	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
4. Ich bin davon überzeugt, dass ich bei dieser Aufgabe eine gute Leistung erbringen werde, selbst wenn sie schwieriger wird	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
5. Ich bin zuversichtlich, dass ich effiziente Strategien entwickeln kann, um die Aufgabenanforderungen zu erfüllen.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
6. Ich bin mir sicher, dass ich durchführbare Lösungen für diese Aufgabe entwickeln kann	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
7. Ich bin davon überzeugt, dass ich meine Arbeit so organisieren kann, dass sie den Anforderungen der Aufgabe gerecht wird.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

2. Goal orientation (Button et al., 1996)

Wie charakteristisch ist das für Sie:

1 Sehr untypisch 2 3 4 5 6 7 Sehr charakteristisch

1. Wenn ich arbeite, suche ich oft nach Möglichkeiten, neue Fähigkeiten und neues Wissen zu erwerben.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
2. Ich genieße es, wenn andere wissen, wie gut ich arbeite.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
3. Ich versuche herauszufinden, wie ich den anderen meine Fähigkeiten beim Arbeiten unter Beweis stellen kann.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
4. Für mich ist die Weiterentwicklung meiner Fähigkeiten bei Arbeiten wichtig genug, um Risiken einzugehen.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
5. Wenn ich arbeite, bin ich bereit, eine anspruchsvolle Aufgabe zu wählen, von der ich viel lernen kann.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
6. Wenn ich arbeite, bevorzuge ich Situationen, die ein hohes Maß an Können und Talent voraussetzen.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
7. Ich habe Spaß an herausfordernden und schwierigen Aufgaben, bei denen ich neue Fähigkeiten erlernen kann.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
8. Ich bin besorgt, zu zeigen, dass ich beim Arbeiten besser bin als meine Kollegen.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
9. Ich bevorzuge es, an Projekten zu arbeiten, bei denen ich anderen meine Fähigkeiten unter Beweis stellen kann.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
10. Wenn ich die Wahl hätte, würde ich lieber in einem Team arbeiten als allein	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
11. Ich denke, dass das Arbeiten als Mitglied eines Teams meine Fähigkeit, effektiv Leistung zu erbringen, steigert.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

3. Task difficulty (Maynard & Heckel, 1997)

Bitte beantworten Sie folgende Aussagen bezüglich Ihrer Erfahrung bei der Arbeit am Verbesserungsplan bis zu diesem Zeitpunkt:

1-Sehr anspruchslos 2 3 4 5 6 7-Sehr anspruchsvoll

1. Wie herausfordernd war diese Aufgabe?	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
2. Wie anspruchsvoll war das Ziel, das Ihr Team gewählt hat?	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

1-Sehr einfach 2 3 4 5 67-Sehr schwierig

3. Wie schwierig war Ihr Leistungsziel?	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
4. Wie schwierig war Ihre Aufgabe?	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

4. Task ambiguity

Wie würden Sie die Aufgabe am treffendsten beschreiben, die Sie durchführen mussten?

- ☐ Die Aufgabe war relativ gut definiert, leicht zu verstehen und einfach zu lösen.
- ☐ Die Aufgabe war relativ schlecht definiert, stiftete Verwirrung und war schwer zu lösen.

5. Task workload (Hart & Staveland, 1988)

Bitte beantworten Sie folgende Aussagen bezüglich Ihrer Erfahrung bei der Arbeit am Verbesserungsplan:

1-Sehr wenig 2 3 4 5 6 7-Sehr viel

1. Wie geistig anspruchsvoll war die Aufgabe?	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
2. Wie schnell oder gehetzt war das Tempo der Aufgabe?	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
3. Wie hart mussten Sie arbeiten, um Ihr Leistungsniveau zu erreichen?	☐ ☐ ☐ ☐ ☐ ☐ ☐
4. Wie unsicher, entmutigt, gereizt, gestresst und genervt	☐ ☐ ☐ ☐ ☐ ☐ ☐

waren Sie?	

6. Task complexity

Wie sehr gelten folgende Aussagen für Ihre Teamarbeit bei dieser Aufgabe?

Trifft nicht zu-1 7-trifft in hohem Maße zu

1. Die Anforderungen der Aufgabe haben sich während unserer Arbeit daran häufig geändert	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
2. Wir erlebten große Veränderungen in den Anforderungen der Aufgabe	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

7. Team interdependence

In welchem Ausmaß haben Sie das Gefühl, dass Ihre Leistung bei dieser Aufgabe von der Leistung der anderen Teammitglieder abhing?

☐ Es war nicht nötig, mich mit den anderen zu koordinieren oder mit ihnen
☐ Ich musste mit meinen Kollegen zusammenarbeiten, um die Aufgabe gut zu erfüllen.

8. Team familiarity

Wie gut kennen Sie Ihre Teammitglieder bei dieser Aufgabe? Bitte wählen Sie eine der folgenden Aussagen:

☐ Wir haben uns nie vorher getroffen
☐ Kaum
☐ Sie oder er ist ein Bekannter
☐ Sie oder er ist ein Freund
☐ Sie oder er ist ein enger Freund

9. Task material perception

Bitte bewerten Sie auf der zur Verfügung gestellten Skala das Ausmaß, in dem Sie jeder der unten stehenden Aussagen zustimmen.

1-Starke Ablehnung 2 3 4 5 6 7-Starke Zustimmung

1. Es gab zu viele Informationen zu berücksichtigen.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
2. Die auszufüllenden Fragebogen waren verwirrend.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
3. Es fiel mir schwer, die Informationen der Materialien dieser Studie zu verstehen.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
4. Ich fand die Materialien dieser Studie nützlich.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
5. Ich hatte den Eindruck, dass ich mehr Informationen benötigte, um korrekte Entscheidungen zu treffen.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
6. Ich habe keine Verbindungen zwischen den Informationen in den Materialien erkannt.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7

Performance rating scheme and instructions

Rating scale **1 - none or almost no action is** **2 - very few actions** **3 – less than half of the actions** **4 - half of the actions** **5 - more than half of the actions** **6 – many but not all** **7 - - almost all actions are**
1. Efficiency
1.1. General - There is a detailed plan (including time schedules, milestones, staff requirements, etc.) for the completion of the project:
1. There is a detailed budget for the project.
2. There is a detailed timeframe for the project.
3. Key personnel needs (who, number of people, when, effort required) are specified in the project plan.
1.2. Appropriateness of timeframe 1. Is the timeframe specified realistic for the implementation of the plan actions? (see example) **Example** 1 - Overview job descriptions – 3 days; 3 people (160 JD can't be done in 3 days by 3 people) 3 - Build a school profile – 4 days, 3hrs/day; 8 workers (can be done but with large oversights) 5 - Build an evaluation system – 3 months and 2 for evaluation (enough time to implement and monitor)
2. Temporal sequence of actions makes sense
1.3. **Appropriateness of resources** 1. Are the resources specified realistic to achieve the implementation of the plan actions? **Example**

1 – School national marketing – marketing students within one month – requires extensive knowledge and expertise

3 – Establish school philosophy – all teachers and leadership within one week – can be done but schedule constraints and availability are not considered; don't specify work hours for activity

5 – School marketing – one person, within one month, three hours per day

2. **Usefulness/Relevance: The extent to which the actions proposed are feasible and appropriate for addressing the problems:**

1. Actions serve the purposes described in the plan statement and case description.
2. Solutions display knowledge of existing school facts and context and satisfy the requirements specified in the problem statement.
3. The actions satisfy real organizational needs.
4. Fully satisfying the school's objectives takes precedence over other objectives.
5. Read the following items and rate the extent to which the problems addressed in the actions are important for the school current problems (are the actions proposed better described by items on the left than those on the right):

Significant – insignificant

Essential – inessential

Necessary – unnecessary

Important – unimportant

3. **Implementability - The extent to which the actions can be realized, given the resources or with additional resources:**

1. The actions, as they are specified in the plan, can be translated into realized actions, put into practical effect.
2. Solutions are reality oriented.
3. Read the following items and rate the extent to which the actions proposed are better described by items **on the left** than on the right:

Feasible – infeasible

Operable – inoperable

Workable – unworkable

Functional – nonfunctional

Usable – unusable
4. **Value-added** Valuable – worthless The extent to which actions significantly contribute to the improvement of the organizational systems:
1. The extent to which actions add value more than if they were not implemented or beyond other actions.
2. Actions go beyond the standard expectations and provide something "more" to the client or users.
3. The results of implementing the actions represent a definite improvement in performance over the way clients used to perform these activities.
4. The actions better influence the delivery of other organizational processes.
5. Impact - The extent to which actions proposed induce fundamental changes and create a departure from existing practices in the organization.
1. By implementing the actions, a change in the status quo would be likely to result.
2. In order to develop and introduce the new actions, the organizational structure/ the organizational processes / the organizational culture has to be significantly changed.
3. The implementation of the actions proposed will place much demand on the organization.
4. The implementation of the actions will cause much disruption.
5. The implementation of the actions proposed will require much coordination effort.
6. Many different groups will be involved in the implementation of actions proposed.
7. The plan actions proposed are compatible with users' needs, values, and behaviors.
8. The actions proposed are likely to be accepted by others in the organization.
9. The consequences of the actions proposed would be great.
6. **Originality**/Uniqueness - an original idea is one which is unusual or novel. It may be entirely unique, and in any case is an idea which other people would be unlikely to think of'; originality – infrequency of the usefulness, uncommonness, or statistical occurrence; unique, not generated by any other group
1. The extent to which the actions proposed are unique and elicit surprise on the part of the evaluator.
2. The actions proposed represent a unique, unusual, original, surprising and unexpected vs. usual, ordinary, commonplace, customary, and expected approach to the problem.
7. **Novelty – The degree of extrapolation from the stimulus context (the problem scenario presented). The degree to which the solution is not structured by the problem and has gone beyond the rote. The degree of novelty of the solution. Solution adds to existing knowledge. Solution develops new knowledge.**
1. The group approached the problem in a novel, imaginative, unpredictable, or innovative

manner.
2. The group went beyond the stimulus materials provided to include additional material and experiences.
3. The group included a large amount of information that is new to the group.
4. Germinality – the actions proposed suggest new ways of looking at existing problems.
5. Pathfinding – the actions proposed open up a new conceptualization of the issue.
6. Transferability – the actions proposed offer ideas for solving apparently unrelated problems.
7. Reinitiation – the solution indicates a radically new approach.
8. Generation – the solution offers a fundamentally new perspective on possible solutions.
8. Risks **Definition - A risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on a project objective. Identified risks, description, areas affected, causes, how they affect project objectives**
1. Appropriateness - Are the risks mentioned specifically related to actions proposed?
2. Long-term/Short-term focus
3. Completeness - Risks described in sufficient detail for someone to confront most of them.
4. Specificity - Identify and describe the applicable impact in terms of specific causes, constraints, restrictions of any of the following risk factors − schedule, − budget − resources – material, personnel − quality, − technology to be used, − risks in the customer project relationship, − risks caused by the size and complexity of the project, − risks in achieving customer acceptance of the deliverables
9. Outcomes **Definition - An outcome is the brief, clear statement identifying in measurable terms the intended result of processes and services of the unit. Outcomes focus on the specific performance stakeholders are expected to demonstrate when the unit achieves its goal.** Example - increase staff attraction by 50% in the next 6 months; . % increase in candidates applying/recruitment/selection/decrease turnover; student achievement; media feedback, etc.); train 6

employees in diversity management issues in the next 2 months; increase monthly application rates by %; %staff tested on diversity issues;
1. Elaboration – outcome described in sufficient detail for the stakeholders to have a clear perspective on the areas that will be improved, how, and how much.
2. Relevance for the task – outcomes address the goals, problems, requirements, and needs of the school. (example inappropriate – attract more students to the school; appropriate – attract more teachers to apply to the school)
3. Specificity The extent to which the outcomes described are specific, measurable, attainable, relevant/results oriented and time bound.
4. Long-term/Short-term focus - does the outcome speak to long or short term school effectiveness (e.g., long-term – define the school recruitment strategy for the next three years; short-term – attract more candidates to apply to the school for the next three months)

General Instructions

1. Read all the information included in the study materials, including the case study description, the roles, the plan, the resources, the change statement (note that not all groups received the change).

[General] Instructions received by participants:

School objective: Attraction, Recruitment, Selection of High Quality Teachers: to attract, recruit, and employ the best teachers who possess the potential for being the very best teachers and making the greatest contribution to the schools and pupils therein

You will have to suggest recommendations to improve the two school systems (i.e., the recruitment system and the selection system). The school's priority is to attract high quality candidates, thus you will be offered more money and resources to improve the recruitment system, but will also have to define strategies and implementation actions to improve the selection system, within the same process improvement plan.

2. Read first the performance rating sheet, note all definitions, subdimensions, and items included.
3. Read through each plan once before rating and pay attention to – the actions described, the resources used, the timeframe, the risks mentioned, the risk responses strategies, the outcomes.
4. After reading the plan once, you may start rating it, based on the dimensions provided in the rating sheet. When rating each dimension, read the element to which it refers in order to offer your rating (e.g., when completeness of actions is the dimension rated, read the

dimension items first, afterwards read the actions stated in the plan relating them mentally to the dimension items, and then give your rating for each item across all actions. Note the scale when giving your rating – when less than half of the actions can be best described by the dimension items, then offer the corresponding score. Some actions may be better represented by the items, while some not. Remember when you offer your rating that you are rating the overall plan. Thus for a plan consisting of overall complete actions, one incomplete action will not lower the score considerably.)

4.1. Note the Novelty dimension. The suggested actions may draw more on the case study and other information provided, draw on this information or go beyond it, to be to a considerable extent new to the group. In order for you to make the judgment of novelty, please read in detail the information provided in the materials. Participants use information in the case study, role information, school strategic plan description to help them suggest actions. Thus, although some of the actions may appear novel, you may find them in the information available. To help you further make the judgment of novelty, note the categories table. Information in the table has been divided into available and new. Read the categories before making any judgment of action novelty, to enable you to determine to what extent the actions suggested are novel. Note for instance category attraction, possible improvement area – application pack. An action „add more elements to the application pack" would be characterized as based on the case study and not entirely new; an action such as send potential applicants a video recording of school events would be characterized as novel, because it goes beyond the information provided.

5. Rate one plan at a time for all dimensions.
6. The scores must be in numeric form.

Table. Improvement areas description and examples				
	Goals			
	Attraction	**Recruitment**	**Selection**	**Other**
Means – based on case study	Recruitment media diversity – use more than one recruitment; Publish in more places or use different media Improve application package Application package (add more elements) Job ad (improve content and/or format) Competitive employment packages and working conditions Mentoring, professional development	References check – different means to determine the prior performance or quality of applicants Redesign application procedure (online, direct application)	Use more selection methods Selection method – only interview Design new schedule procedure for the interview Design formal scoring system Develop standardized interview questions/interview guide; Standard scoring; Note taking formats; Records of interview assessments	Performance assessment Best practices Promote understanding of school mission and vision Training parents to market the school Developing communication plan Developing partnerships Encouraging participation in the community
Means – original	Marketing – promote school, improve school image, job ad design; Employment branding Develop a publication that provides career development information and	Redesign application procedure (e.g., everyone can apply instead of sending application form and letter)	Applicant competencies - indicators of teacher quality e.g. Pedagogical content knowledge; Competencies in the areas of classroom	Organizational assessment – vacancy causes; Audit – fluctuation; performance assessment; surveys; training

	promotional paths (i.e., career ladders) RJPs – Realistic job previews - Testimonies from current employees about why they like their jobs. Testimonies from current employees about the hard parts of their jobs Incentives – resources career development, bonuses, subsidized tuition, and assistance purchasing a home; Extra compensation for supervising extracurricular activities Tuition assistance and exam fees to become Highly Qualified; Provide reimbursement to teachers who take the Praxis to get other eligible endorsements on their teaching license; One-time compensation for new teachers (signing bonus; Additional compensation for	Nontraditional recruitment - Recruit substitute teachers Recruit retired teachers Recruit former teachers who have left teaching Provide assistance to paraprofessionals to become certified teachers Third-party employment agencies, or professional meetings or conventions. Distribute flyers to colleges/ universities and other school divisions Cocktail parties and dinners with prospective candidates Recruiting qualified teachers from other countries Post-baccalaureate	management and discipline; determine characteristics of top performers and select based on these; Fit with the mission and culture of the organization Panel diversity – e.g. other teachers, students, parents etc. Training of interview panel; Soft skills training for interviewers Roles responsibilities staff interview Other selection techniques - Diversify methods of selection - Teaching observation; online testing; Psychometric testing - Aptitude, personality, intelligence tests, Assessment centers; Special hiring authorities; experimental design – half hired by interview/half by other methods and determine rate of retention and	needs analysis Survey current staff; Determine positions that need recruitment support initially Employee relationships Periodic assessment Interview staff assessment – assess competencies and skills of staff involved in the selection New staff assessment - Assess new hires – expectations met, retention at 3-6 months, 1 year, ask what they liked/not about RJP Instructional program redesign

	teaching in hard-to-staff schools; Benefits and retirement programs); Provide resources for professional development (membership dues, professional conferences, journal subscriptions, continuing education) Non-monetary - Performance recognition and awards Certificates, plaques, or trophies as awards for outstanding performance or service "Teacher of the month" award Deliberate role design - defining expectations and perhaps job obligations First year teachers have a reduced workload Development opportunities - Staff development – e.g. skills training, workshops, seminars; Career development	professionals working in other fields School-university partnerships Paid internships and early employment Open days National advertising (to tie in with regional/national campaigns) Professional industry journals and publications Nontraditional recruitment practices/sources – e.g. radio/TV; Job notices at colleges; internships; websites targeted at teachers; Recruit teachers certified through alternative routes Online recruitment – ad originality Candidate	performance after a period; online interviewing/testing Improve selection procedure – Interview feedback – follow-up; Applicant follow-up – answering messages, survey applicants that declined or ones that were not hired, store in database	

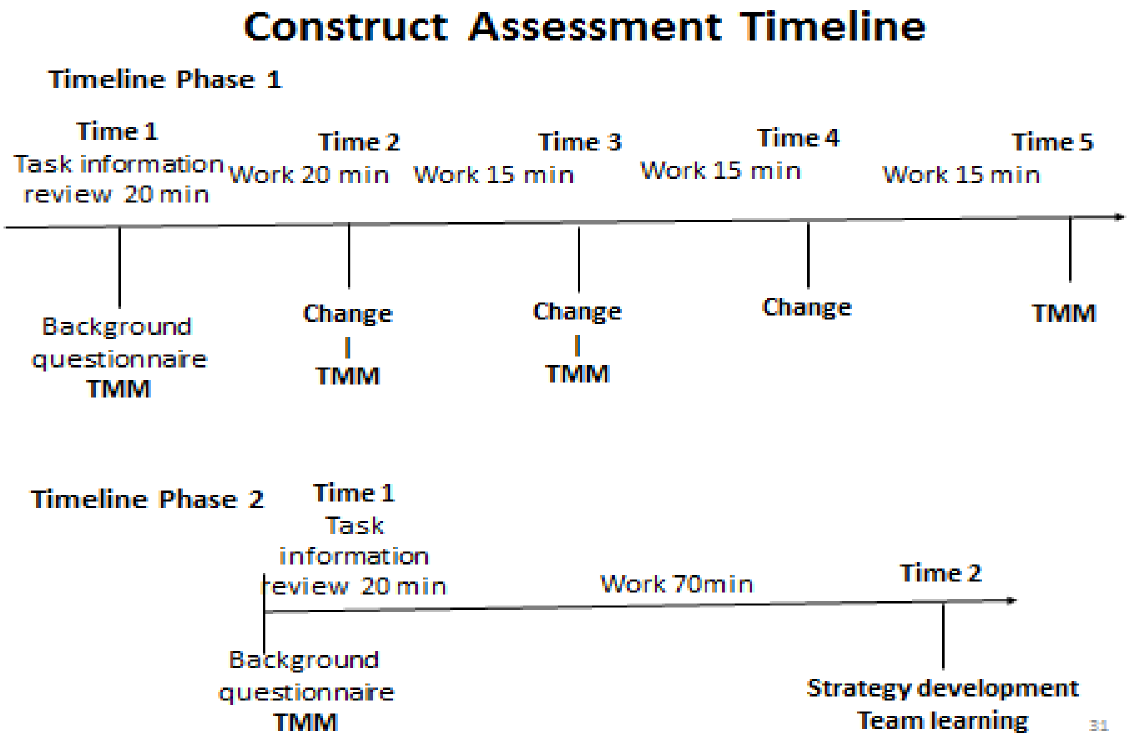
	Induction - Provide all beginning teachers with full-time mentors Recruitment pack - Recruitment packets, videos, slides, and brochures Outsourcing – Hire consultants/firm Networking - Ask the students/parents; Reestablish links with community; Staff networking with financial rewards for staff who recommend successful hires; Work with community groups and arrange local sponsorships	screening		
Means after change	Targeted outreach – try to reach diverse applicant pool – publish in special publications; attend diversity meetings; place ads in publications that focus on special emphasis groups; Including statements encouraging applications from under-represented	Eliminate discriminatory details – from applications – pictures, names, gender, date of birth, family names; remove from job description competences that are not related to the job (which	Equality training – all staff; interview personnel; antidiscrimination practices and code of conduct; manual; external teacher/consultant; seminars, learning modules - Training all school staff in equality policy matters; train	Conduct audit - psychological tests current personnel; exit surveys; selection and recruitment procedure audit; job ad audit; hire consultant for equality matters; Develop

	groups; Targeting advertising to reach under-represented groups; Promoting employment opportunities at job-fairs and open days in under-represented communities; placing advertisements in publications that are known to be popular with diverse cultural background people, advertising in a different geographical area, or using a business journal read predominantly by women; Stating in a job advertisement that applications from women or from people from a minority racial or religious group will be particularly welcome; Publishing a booklet promoting employment opportunities that exist within the organization and targeting it at female undergraduates; Setting up a careers fair or promotional event targeted at overseas nationals to encourage them to learn about the	could disadvantage a person to– e.g., language skills at a certain level if they are not a „must have" for the job); Clear and justifiable job criteria apply	interview personnel; Legal training; general diversity awareness; conflict/harassment; interview; anti-discrimination; inclusive behavior; dignity at work; undertake cross-cultural awareness training, celebrate and value diversity; ongoing review of policies, and ensure full access to the benefits of training and career development; Multicultural awareness sessions for staff; Information sessions to educate staff about strategic workforce plan and workforce diversity initiatives; Antidiscrimination practices and code of conduct sessions for awareness of all staff; Selection eliminate discriminatory procedures - Ensuring that any selection techniques, such as psychometric	equality policy - Policy statement; Training equality policy; Codes of conduct; Create manual; Strategy, vision and mission, culture statement; Develop complaints procedure; Include diversity on website – career section, about section; establish diversity council Internal communication - posters, brochures, leaflets, meetings, forums, internal newsletters, internal briefings, internal advertising campaigns on diversity matters Internal benchmarking – diversity awards

	organization and apply for employment; Developing links with community groups that work to promote the interests of people from minority or disadvantaged groups; Stating in a job advertisement that focused training will be provided for new recruits from the under-represented group – for example, to increase the opportunities for women to be equipped for into supervisory or management posts promoting flexible working practices; Participating in recruiting events that specifically reach out to diversity groups; Advertising in publications that specifically reach out to diverse groups of candidates External activities/events – special days focusing on diversity; national/regional food/cultural/religious days; conferences;		assessment, are free of any cultural bias – and do not require language skills that are not needed in the job; Adjustments to selection processes to ensure that people with diverse abilities can demonstrate their skills equitably (e.g. phone interviews instead of written applications); adjustments – applicants can access the selection room; interview times for the ones that have a family or work; support person or advocate to be present; panel members with diverse abilities; application materials available in different formats Gender diverse selection panel	Monitoring – proportions of race, gender, etc. are equivalent to the ones in the community; if one group is rejected more often and at what stage; the age profile of those that apply if it is the same as the ones hired; how many disabled apply and how many are employed; reasons why disproportionate number may apply and be rejected Adjustment to work space for disabled; Flexible working hours Documentation for every step of the R&S process

	Q&A sessions; other open public meeting on diversity; women day, Paralympics day, volunteering activities			

Study 2


Construct Assessment Timeline
Timeline Phase 1
Time 1
Task information review 20 min
Time 2
Work 20 min
Time 3
Work 15 min
Time 4
Work 15 min
Time 5
Work 15 min
Background questionnaire
TMM
Change
TMM
Change
TMM
Change
TMM
Timeline Phase 2
Time 1
Task information review 20 min
Work 70min
Time 2
Background questionnaire
TMM
Strategy development
Team learning
31

Study instructions

Instruktionen zur Studie

Willkommen, liebe Teilnehmer!

Sie wurden eingeladen an einem Experiment zur Problemlösung in Gruppen teilzunehmen.

Sie werden mit zwei weiteren Teilnehmern an einer Fallstudie arbeiten. Wir bitten Sie, Ihre Mobiltelefone und anderen elektronischen Geräte auszuschalten nachdem Sie Platz genommen haben, damit alle Teilnehmer sich auf die Aufgabe konzentrieren können. Sollten Sie während des Experiments irgendwelche Fragen haben, heben Sie Ihre Hand und ein Assistent wird zu Ihnen kommen.

Diese Studie findet in zwei Phasen statt. Indem Sie sich zur Teilnahme anmelden, willigen Sie ein an beiden Phasen teilzunehmen. Die zweite Phase der Studie wird 3 Tage nach der ersten Phase stattfinden. Sie wurden über die Termine der zwei Phasen informiert, als Sie sich für die Studie angemeldet haben. Nachdem Sie die erste Phase des Experiments heute abgeschlossen haben, wird die Assistentin Sie bitten Ihre Anwesenheit für Datum und Zeit der zweite Phase erneut zu bestätigen.

Bitte beachten Sie, dass Ihre Teilnahme an **BEIDEN** Teilen erforderlich ist.

Jeder Teil wird im Durchschnitt 1.5 bis 2 Stunden dauern.

Bevor Sie mit der Gruppenarbeit beginnen, bekommen Sie eine Gruppenidentifikationsnummer und eine persönliche Identifikationsnummer. Diese Nummern werden als Identifizierungsnummern benötigt für die verschieden Fragebögen, die Sie im Laufe der Studie ausfüllen. Die Fragebögen beziehen sich auf die Aufgabe. Bitte beachten Sie, dass alle Informationen, die Sie zur Beantwortung der Fragen geben, anonym sind, und nur für Forschungszwecke gebraucht werden. Sie werden die Fragebögen an einem PC im Forschungsraum ausfüllen. Ihnen wird ihrer Identifikationsnummer entsprechend ein individueller PC zugeordnet. Bitte nutzen Sie diesen PC um alle Fragebögen zu vervollständigen. Die Forschungsassistentin wird Ihnen Informationen geben, wie die Fragebögen auszufüllen sind. Zudem liegen Instruktionen bei den PCs aus. Falls Sie weitere Informationen zum Ablauf und der Handhabung benötigen, fragen Sie bevor Sie mit der Beantwortung der Fragebögen beginnen.

Ihre primäre Aufgabe wird es sein Informationen bezüglich eines Problems einer Organisation zu begutachten, und mit Ihrem Team Strategien zur Verbesserung vorzuschlagen, indem Sie die Informationen diskutieren und die vorhandenen Materialien nutzen. Für die Arbeit an der Fallstudie wird jedes Teammitglied ein Informationspaket erhalten, welches die Beschreibung der Fallstudie und zusätzliches Material beinhaltet, und zur Lösung der Aufgabe dient. Jedes

Teammitglied wird die Selbe Beschreibung der Fallstudie haben, jedoch ein unterschiedliches Set an Zusatzmaterialien. Sie werden ermutigt alle Ihnen vorhandenen Materialien zur Lösung der Fallstudie zu nutzen. Bevor Sie im Team an der Fallstudie arbeiten, nehmen Sie sich Zeit alle Ihnen vorhandenen Informationen durchzusehen. Nachdem Sie, jeder für sich, alle Informationen durchgelesen haben, füllen Sie den ersten Fragebogen aus. Danach können Sie mit der Bearbeitung der Aufgabe beginnen.
Die genaue Aufgabenstellung befindet sich am Ende der Fallbeschreibung. Sie werden gebeten Vorschläge zur Verbesserung des Geschäfts in einer Plan-Vorlage zu notieren. Diese Aufgabe kann von irgendeinem der Teammitglieder übernommen werden. Dieser Plan wird Ihre Arbeit dokumentieren, daher sollten sie Ihre finalen Ideen dort eintragen. Bitte notieren Sie Ihre Ideen ordentlich und gut leserlich, so dass Sie von jemandem, der den Plan evaluiert, gelesen werden können.
Ihnen werden für die Aufgabe Stifte und Papier zur Verfügen gestellt.
Nachdem Sie die Informationen gelesen und diskutiert haben, sollten Sie sich ein paar Minuten Zeit nehmen um zu planen wir Ihr Team die Aufgabe bearbeiten wird. Bedenken Sie, dass dies eine Gruppenarbeit ist. Daher ist es wichtig, dass Sie mit den anderen Teilnehmern zusammen arbeiten um das Problem zu lösen.

Sie haben 70 Minuten Zeit für diese Aufgabe. Die Assistentin wird Sie informieren, wenn die Zeit um ist. Dann sollten Sie die finale Form Ihres Teamprojekts abgeben. Danach werden Sie dann gebeten einen letzten Fragebogen zu beantworten. Im Anschluss erhalten Sie die Belohnung für die Teilnahme an der Studie

Wenn die gesamte Studie abgeschlossen ist, werden die Pläne aller Teams nach den Kriterien, die in der Aufgabenstellung abgegeben sind beurteilt. Basierend darauf wird der beste Projektplan ausgewählt. Das Team, das den besten Plan erstellt hat wird eine Belohnung von 100 Euro erhalten. Falls mehrere Pläne gleich gut abschneiden, werden wir zufällig ein Team auswählen. Wenn Sie mit Ihrem Team an diesem Contest teilnehmen möchten, werden Sie gebeten Ihre Identifikationsnummern, Ihre Gruppennummer, und das Datum und die Zeit zu der Sie am Experiment teilgenommen haben, anzugeben. Sie werden per Email informiert ob ihr Team ausgewählt wurde, nachdem die Bewertung der Pläne abgeschlossen ist.

Nachdem Sie diese Informationen zur Teilnahme gelesen und verstanden haben, können Sie mit der tatsächlichen Studie beginnen.

- ☐ Ich habe die Anweisungen gelesen und Verstanden
- ☐ Ich verstehe, dass diese Studie anonym ist und alle Informationen nur zu Forschungszwecken verwendet werden.

- Ich stimme zu, meine persönlichen Daten anzugeben, um die Belohnung für die Teilnahme zu erhalten.

Questionnaire completion instructions

Instruktionen zum Ausfüllen der Fragebögen

Klicken Sie auf den Gast Account um sich anzumelden. Öffnen Sie den Ordner Neuer Ordner auf dem Desktop.

Doppel klicken Sie auf den JRate.jar Order.

Wenn sich das Fenster öffnet werden Sie nach einem Namen für den Fragebogen gefragt. Bitte notieren Sie hier Ihre Gruppenummer und Ihre persönliche Nummer (die Ihnen zu Beginn des Experiments zugeordnet wurden), das Datum des Experiments du die Nummer des Fragebogens, den Sie ausfüllen.

Sie werden dieselbe persönliche Nummer in beiden Phasen des Experiments haben, und denselben PC benutzen (Sie werden z.B. Person 1 in Phase 1 und in Phase 2 sein). Daher behalten Sie bitte Ihre persönliche Nummer im Kopf, so dass Sie sie in der zweiten Phase des Experiments wieder nutzen können.

Das Datum des Experiments bezieht sich auf den jeweiligen Tag an dem Sie die Fragebögen ausfüllen.

Die Nummer des Fragebogens wird folgendermaßen bestimmt:

- Ist es der erste Fragebogen, schreiben Sie Q1
- Ist es der zweite Fragebogen, schreiben Sie Q2
- ……
- Ist es der nte Fragebogen, schreiben Sie Qn

Ein Beispiel:
Sie sind Person 1 in Gruppe 2, nehmen am 18.06 teil und füllen nun den dritten Fragebogen aus, dann schreiben Sie:
P1, G2,18.06,Q3

Nachdem Sie den Fragebogen wie oben benannt haben, klicken Sie OK. Danach werden Ihnen zwei Konzepte angezeigt, die im Zusammenhang mit der Studie stehen. Sie haben die folgende Aufgabe:

Bitte geben Sie an wie VERBUNDEN, VERKNÜPFT oder VERNETZT jedes Konzept mit den anderen ist.

ZU BEACHTEN: Vervollständigen Sie nur die weißen Vierecke. Zum Beispiel, im alleroberstenViereck ist gefragt wie zusammenhängend " Möglichkeiten der Produktverbreitung verbessern" und "Produktverbesserung und Innovation" sind.
Wenn Sie irgendwelche Fragen haben, wenden Sie sich bitte an den Testleiter.

1 nicht zusammenhängend
2
3
4 gewissermaßen zusammenhängend
5
6
7 extrem zusammenhängend

Nachdem Sie alle Items Beantwortet haben, sendet das Programm eine Danke-Nachricht und wird sich von selbst schließen. Lassen Sie den Ordner geöffnet für folgende Fragebögen.

Als nächstes finden Sie einen Link auf dem Desktop: https://www.surveymonkey.com/r/MMChDiss

Doppelklicken Sie auf diesen Link um den nächsten Fragebogen zu öffnen. Beantworten Sie die Fragen auf der ersten Seite mit dem Namen ‚Fragebogen 1'. Nachdem Sie diese Fragen beantwortet haben, klicken Sie auf den ‚weiter' Button. Dieser führt Sie zu einer Seite namens ‚Gruppenarbeit'. Lassen Sie auch diesen Tab nach Beantwortung der Fragen geöffnet.

Nachdem Sie auch diesen Fragenbogen beantwortet haben, können Sie zu Ihrer Gruppe zurückkehren und mit der Arbeit an der Aufgabe fortfahren.

WICHTIG: Bitte schließen Sie keine der Tabs oder Ordner, nachdem Sie die Fragebögen beantwortet haben.

Sollten Sie irgendwelche Fragen zu diesen Instruktionen haben, fragen Sie die Forschungsassistentin.

Case study Phase 1

Fallbeschreibung

Unternehmensprofil: Nicht-alkoholische Getränkeindustrie

Geschäftsführer und Präsident: Stephanie Jones, Ex-Abteilungsleiterin Betrieb

Standort: Miami, USA

Produkte: Fruchtsaft

Unternehmen

Dies ist eine fiktionale Fallstudie, die CoolBev beschreibt, ein in Miami ansässiges Unternehmen, das Fruchtsaft-Getränke herstellt, vermarktet und verkauft und dessen Ursprünge bereits 30 Jahre zurückliegen. Die Produkte werden aus einer Vielzahl verschiedener Früchte hergestellt und beinhalten sowohl einfache Fruchtsäfte, als auch Kombinationen von Fruchtsäften (Fruchtsaft-Mixgetränke). Alle Produkte bestehen zu 100% aus natürlichen Inhaltsstoffen, also aus Fruchtsaft oder Fruchtsaft Konzentrat, Wasser, natürlichen Geschmacksstoffen, und Fruchtfleisch.

Die Belegschaft von CoolBev zählt 200 Arbeitnehmer, welche hautsächlich gebürtige aus Miami stammten und nach der High-School oder dem College begonnen hatten beim Unternehmen zu arbeiten. Zu den Abteilungen zählen Human Resources, Finanzen und Buchhaltung, Forschung und Entwicklung (Produktentwicklung und Qualitätskontrolle), Betrieb, Kundenservice und Marketing. Im Unternehmen herrschte eine geringe Mitarbeiterfluktuation und daher wurden jährlich wenige neue Arbeitsverträge abgeschlossen. Beförderungen ins Management basierten hauptsächlich auf dem Dienstalter/ Seniorität.

Unternehmensgeschichte

CooBev war ein unabhängiges Unternehmen bis zum Jahre 1975, als es von einem in Chicagoer Mischkonzern aufgekauft wurde. CoolBev behielt jedoch viel von seiner organisatorischen Struktur, die den traditionellen, Familien-orientierten Hintergrund seines auf Kuba geborenen Gründers widerspiegelte. Die Angestellten waren loyal und konservativ, sowohl in ihren Ansichten als auch in ihren Arbeitsweisen. Der vorherige Geschäftsführer näherte sich den 65, er hatte bereits seine gesamte Karriere für das Unternehmen gearbeitet, angefangen als Regalauffüller. Er schätzte Tradition ebenso wie Selbst-Disziplin und Respekt vor Autorität. Vor einem Jahr ging er in Ruhestand und Stephanie Jones, ehemalige Abteilungsleiterin Betrieb, wurde zur neuen Geschäftsführerin ernannt.

Markt

Das Unternehmen hatte ein klar abgegrenztes Marktsegment, welches nach der Gründung des Unternehmens über die Jahre beibehalten wurde. Man spezialisierte sich darauf seine Produkte an Schulen und Restaurants zu verkaufen. So hatte jede Schule in Florida, Georgia, Alabama oder South Carolina einen Verkaufsautomaten in seiner Cafeteria, und tausende von Restaurants führten CoolBev Getränke in ihren Karten. Tatsächlich war CoolBev über die Jahre so stetig gewachsen, das die Muttergesellschaft, der Chicagoer Mischkonzern, sich selten in das Geschäft einmischte. Für mehr als ein Jahrzehnt war CoolBev der erfolgreichste Saftproduzent im Südosten der USA.

Stärken

Ein Schlüssel zum Erfolg waren die effizienten Systeme des Unternehmens, sowohl in der Fabrik, als auch im alltäglichen Einsatz. So gab es ein modernes – und kostspieliges- Informationstechnologiesystem, das CoolBev 1990 installiert hatte, und welches es Verkäufern im Einsatz erlaubte Produkte zu ordern, die dann schnell durch eine Flotte von CoolBev Fahrer geliefert wurden.
Außerdem, befanden sich die Labore zur Produktentwicklung und Testung im Unternehmen, und dort arbeitet eine geringe Anzahl an Mitarbeitern stetig daran den Geschmack der CoolBev Produkte, sowie die Effizienz der Fabrikprozesse zu optimieren.

Konkurrenz

Obwohl keines der neuen Start-ups einen beachtlichen Einriss in CoolBev's Marktanteil in Schulen und Restaurants verursachte, schien der Wettkampf härter zu werden. So traten jeden Monat neue Unternehmen mit anderen Angeboten in den Konkurrenzkampf um ähnliche Kunden-Zielgruppen mit ein. Manche dieser Unternehmen warben um einen Anteil des Kundenstamms des Unternehmens. Eine erste Marktanalyse zeigte, dass manche Kunden begannen Produkte anderen Unternehmen zu kaufen, weil die Produkte von CoolBev nicht überall erhältlich waren und weil die Konkurrenz abwechslungsreichere Produkte bot, zum Beispiel mit neuen Geschmacksrichtungen.
CoolBev musste einen Verlust im Marktanteil bei den 18 bis 25 jährigen verzeichnen.

Geschäftsorganisation

Es gab keine große Verflechtung zwischen den verschiedenen Abteilungen des Unternehmens. Jede Abteilung führte seine Funktionen unabhängig aus und suchte selten Input von anderen Abteilungen. Diesem Model entsprechend, hat jede Abteilung im Unternehmen gewisse Fähigkeiten, so wie die Durchführung von Forschung, Entwicklung von Werbeaktionen, oder Herstellung von Produkten.

Die Aufgabe des Produktentwicklungsteams (Team Geschmacksentwicklung und Chemiker) war es neue Produkte zu entwerfen, vom Konzept bis zum Endprodukt. Dies beinhaltetet Aufgaben die Entscheidung und Umsetzung in folgenden Bereichen betreffend: Inhaltsstoffe, Rezepterstellung, und Vortestung. Die andern Forschungs- und Entwicklungsspezialisten hatten Aufgaben, so wie: Qualitätsverbesserung, Produktivitätsverbesserung in der Herstellung, Testung am Kunden, Testung der Lagerung/Stabilität, Produktspezifizierungen, behördliche Genehmigung, und simulierte Marktanalyse.

Die meinten Ressourcen des Unternehmens flossen in die Festigung des aktuellen Marktsegments, und nicht so sehr in die Entwicklung neuer Produkte. Da das derzeitige Produktportfolio sich gut etabliert hatte, wurde außerdem wenige Bemühungen in die Verbesserung der Produkte oder des Kundenservices gesteckt. Daher wurde die Forschungs- und Entwicklungsabteilung auch eher als ‚Umsetzer' gesehen- also als eine Einheit, die tut was man ihr sagt. Leute in dieser Abteilung waren oft zermürbt. Weil ihre Talente nicht geschätzt wurden, hörten sie auf kreative Ideen einzubringen. Die meisten der Angestellten in ‚Forschung und Entwicklung' hatten viele neue Ideen, aber da das Management sich generell nicht sehr für neue Forschungsprojekte interessierte, wurden ihre besten Ideen nicht weiter verfolgt.

Veränderungen durchsetzen oder deswegen gehen

In der wechselnden Getränkeindustrie konnte das Unternehmen am treffendsten als ruhiger und geordneter Arbeitsplatz beschrieben werden. Angestellte bei CoolBev waren konservativ, und sehr höflich, mit einer formalen Garderobe - alles Charakteristiken der Unternehmenskultur, die die Angestellten sehr schätzten. Die Belegschaft war dem Geschäft verpflichtet, und für ihre Verlässlichkeit bekannt.

Ein neu eingestellter Abteilungsleiter im Marketing, Edward Jenkins, versuchte einige Veränderungen im Unternehmen durchzusetzen, aber ohne Erfolg. Er hatte einen zwangloseren Arbeitsstil und eine liberalere Einstellung verglichen mit den anderen Angestellten, die sich davon scheinbar in ihrem Arbeitsrhythmus und ihren Werten gestört fühlten. Er glaubte, dass die früheren Erfolge von CoolBev eher daraus entstanden zur richtigen Zeit am richtigen Ort gewesen zu sein – und durch den fehlenden Wettbewerb. Daher müsse das Unternehmen einige Dinge im Betrieb ändern und innovative Ideen hervorbringen, um auch in wechselhaften Zeiten zu bestehen. Er versuchte diese Veränderungen als Führungsperson voran zu bringen, indem er Arbeitsneuerungen und Verbesserungen vorschlug. So schlug er dem Abteilungsleiter Vertrieb vor neue Kanäle zur Produktvertrieb zu nutzen, wie zum Beispiel Flughäfen, Strände oder Kinos/Kunst Galerien. Aber seine Ideen wurden mit der Begründung, dass sie nicht ausführbar und umsetzbar wären. Des Weiteren versuchte er eine neue Marketing Initiative zu starten. In der Vergangenheit hatte CoolBev minimal geworben, und niemals im Fernsehen. Tatsächlich war alle Werbung im Unternehmen entworfen worden, und bestand hauptsächlich aus Postern am Ort des Einkaufs. Es gelang Jenkins den Geschäftsführer zu überzeugen einige wenige Geldmittel dafür zur Verfügung zu stellen. Damit beauftragte er eine Firma, die bekannt für ihre gute TV-Werbung war, um den Wiedererkennungswert des Produkts zu verbessern. Aber der Vertrag mit der Marketing Firma hielt nicht lange, da der Geschäftsführer mit den Ideen nicht einverstanden war. Er glaubte, dass Kreativität und Marketing nicht so essentiell seien wie Themen, die den tatsächlichen Arbeitsprozess betrafen und, dass Produktivität nicht stark von der Werbung fürs Produkt abhinge. Nach diesem Vorfall begann der Geschäftsführer Jenkins zu misstrauen. Ein letzter Versuch von Innovation endete mit Jenkins Entlassung, nachdem er und ein Wissenschaftler für Forschung und Entwicklung über ein Jahr heimlich versucht hatten fünf neue Produkte zu entwickeln. Jenkins arbeitete später für einen Konkurrenten von CoolBev, bei dem er seine Ideen umsetzen konnte, einschließlich der Produktion neuer Geschmacksrichtungen, die später zu den bestverkauften Produkten gehörten.

Einigen Wissenschaftlern zufolge, die für das Unternehmen arbeiteten, schien Kreativität vom Unternehmen nicht geschätzt zu werden. Im Allgemeinen waren die Leute damit zufrieden immer wieder dieselben Dinge zu tun – Dinge anders anzugehen war nicht die Art von CoolBev. Tatsächlich schien es, als wüsste das Führungspersonal nichts mit kreativen Angestellten anzufangen – außer sie zu vertreiben.

Aufgabenstellung

Der neue Geschäftsführer führte ein internes Gutachten durch und fand die folgenden Probleme mit dem momentanen System des Unternehmens:

CoolBev hatte eine stagnierende Leistung, was sich darin zeigte, dass das jährliche Einkommen seit zwei Jahren bei 40 Millionen Dollar lag und der Gewinn nicht gestiegen war. Das Unternehmen schien mit der sich verändernden Marktstruktur und den gewachsenen Anforderungen nicht mithalten zu können. Vor dem Hintergrund fehlender Innovation und wachsenden Wettbewerbs, machte die Elterngesellschaft Druck und forderte akkurate Vorhersagen, die die Bemühungen des Unternehmens zeigen sollten, so wie Budgetprognosen, Ausgaben, und Personalveränderungen.

Sie wurden beauftragt mit dem Geschäftsführer einige der Probleme des Unternehmens anzugehen. Sie sind aufgefordert einen integrierten Plan zu entwickeln, der die Probleme von CoolBev adressiert. Sie sollen eine Liste mit Unternehmensstrategien erstellen, die darauf abzielt die Hauptproblemfelder so wie sie aus den vorliegenden Informationen hervor gehen, zu verbessern. Das Unternehmen fordert, dass die Strategien in maximal zwei Jahren umgesetzt werden können. Es stellt für das Projekt ein Budget von 100.000$ zur Verfügung. Außerdem können Sie eine zusätzliche Reserve von Geldmitteln in Höhe von 50.000$ nutzen. Diese sollten aber nur genutzt werden, wenn Sie unbedingt zusätzliches Budget brauchen um Ihren Plan zu entwickeln. Als zusätzliche Ressourcen können Sie die Angestellten des Unternehmens oder externe Angestellte mit einbeziehen. Des Weiteren sollen Sie die objektiven Resultate, die das

Unternehmen bei erfolgreicher Implementierung der Strategien erzielen könnte, angeben. Wenn Sie Ihre Strategien entwickeln geben Sie außerdem den ungefähren Zeitrahmen für die Implementierung, so wie die benötigten Kosten oder Ressourcen an.

Strategie – alle Maßnahmen die durchgeführt werden müssen und Beschreibungen jeder Maßnahme, so dass die Projektangestellten verstehen können was wie getan werden muss (Bitte geben Sie 6 - 15 Maßnahmen an wenn Sie Ihren Plan entwickeln)

Resultat: Eine kurze, klare Aussage, die in messbaren Begriffen das beabsichtigte Ergebnis der vorgeschlagenen Verbesserungsstrategie angibt (z.B. % Anstieg in Verkaufszahlen, Anzahl an neuen Produkten, % neuer Kunden in einem Segment etc.)

Ressourcen und Zeitplan – geschätzte Kosten oder Materialressourcen, die benötigt warden um die Strategien umzusetzen und der ungefähre Zeitplan zur Umsetzung der Strategien im Unternhemnen (z.B. 6 Monate, 1000 euro)

Bitte geben Sie die Strategien in vollständigen Sätzen wieder, so dass jemand, der Ihren Plan bewertet, die Absichten versteht und nachvollziehen kann wie die Strategien umgesetzt werden sollen.

Strategien	Ressourcen und Zeitplan	Objektive Resultate
1.		
2.		
3.		
4.		
5.		
6.		
7.		
……		

Bewertung der Leistung

Während der Bearbeitung der Aufgabe können neue Informationen oder Anforderungen auftauchen. Sie sollten die neuen Informationen in Ihre aktuellen Ziele integrieren und mögliche Veränderungen in Ihren Plan einarbeiten.

Sowohl die Effizienz und Effektivität der Strategien, als auch deren Potential zur Verbesserung der momentanen Geschäftslage, werden gleich gewichtet in die finale Bewertung des Projekts eingehen. Ihr Plan wird von Fachleuten aus dem Bereich ‚Unternehmensentwicklung und organisatorischer Wandel' bewertet. Sie werden Punkte für Ihren Plan bekommen, die sich auf die Kriterien der Effizienz, Effektivität und Originalität beziehen, mit gleicher Gewichtung jedes Kriteriums.

- Effizienz (Leistungsfähigkeit) – können die Strategien innerhalb einer gewissen Zeit und mit einer gewissen Menge an Ressourcen umgesetzt werden?
- Effektivität (Wirkungsgrad)– werden die Strategien die Probleme des Unternehmens lösen?
- Originalität – tragen die Handlungsschritte etwas Neues zum Unternehmen bei?

Role materials

Role 1

Zusatzmaterialien – Role 1

Die folgenden Informationen sollen bei der Bearbeitung der Aufgabe helfen. Die Graphen, Tabellen, und Diagramme vertiefen die Informationen aus der anfänglichen Beschreibung der Fallstudie oder repräsentieren zusätzliche Informationen. Jedes Teammitglied hat verschiedene Informationen bezüglich des Geschäfts. Sie werden dazu ermutigt sich gegenseitig zu befragen um aufgabenrelevante Informationen auszutauschen wenn Sie Lösungsvorschläge durchdenken.

Ertragskraft des Unternehmens

Die folgenden Graphen zeigen die Verkaufsleistung und Ertragskraft des Unternehmens der letzten fünf Jahre, und den Anteil am Fruchtsaft-Getränke Markt der letzten drei Jahre. Der Marktanteil zeigt das totale Marktvolumen der verschiedenen Fruchtsaftproduzenten innerhalb der letzten drei Jahre. Den Daten entnimmt man zum Beispiel, dass die etablierten Konkurrenten einen gleich bleibenden Marktanteil in 2012 und 2013 verbuchten, sich ihr Marktvolumen aber im Vergleich zu anderen Unternehmen im Jahre 2014 erhöhte. Die Daten stammen aus finanziellen Berichten des Rechnungswesens und jährlichen industriellen Statistiken.

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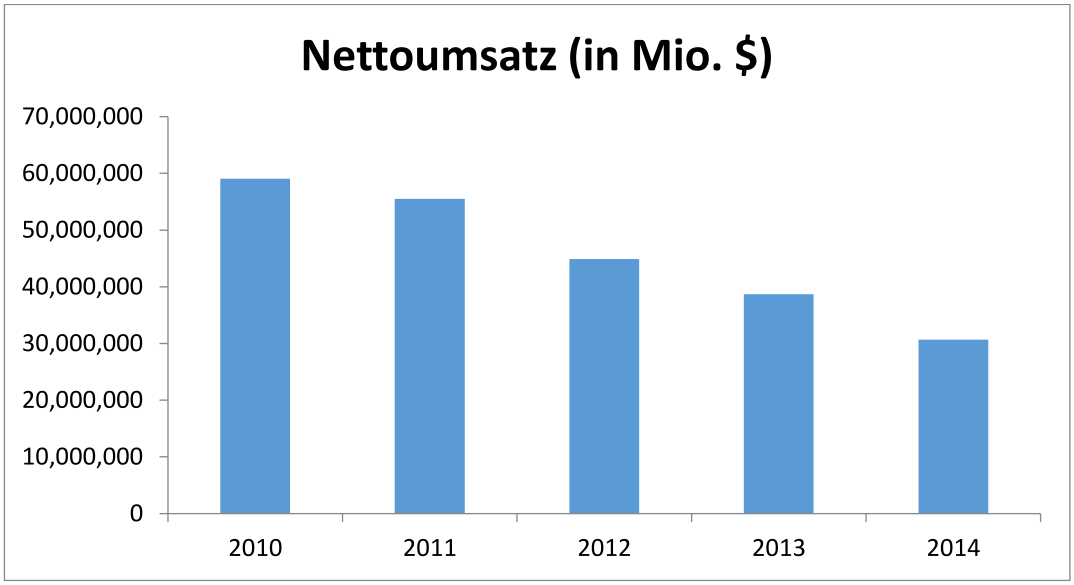
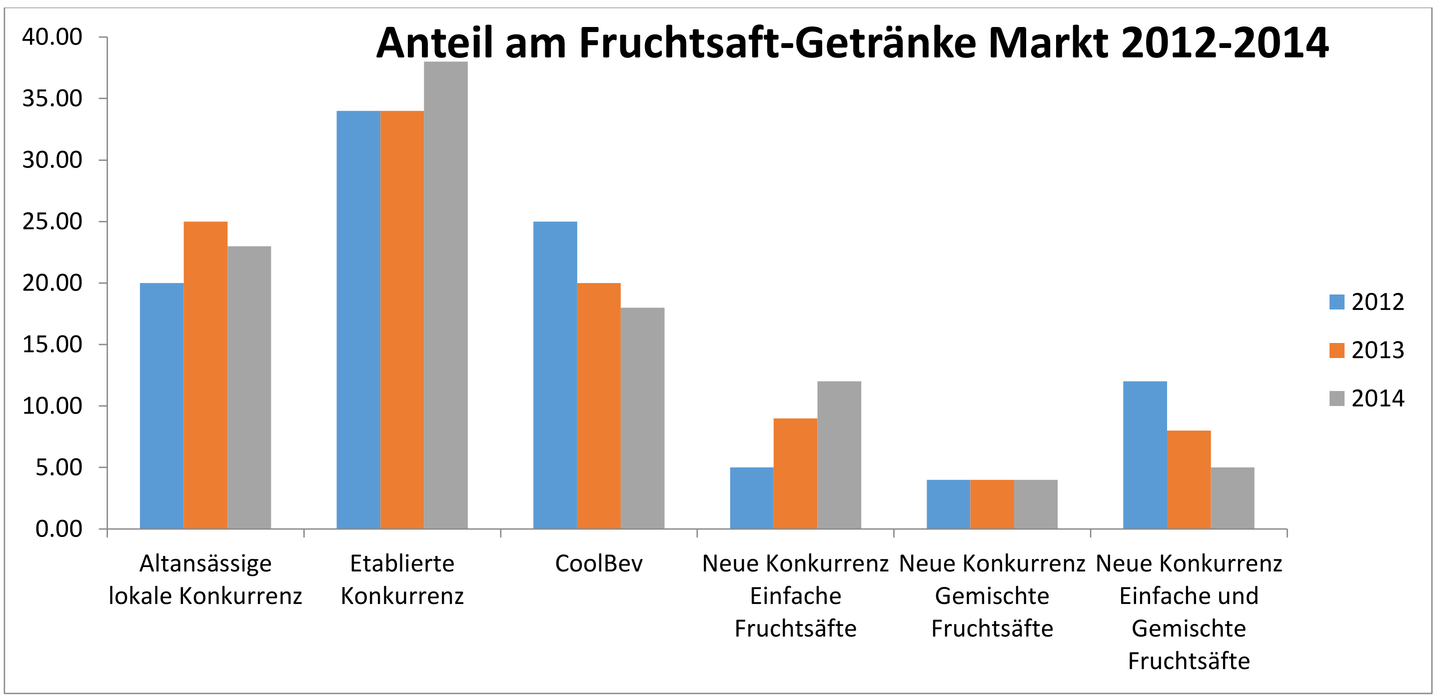

Nettoumsatz (in Mio. $)
70,000,000
60,000,000
50,000,000
40,000,000
30,000,000
20,000,000
10,000,000
0
2010
2011
2012
2013
2014


Anteil am Fruchtsaft-Getränke Markt 2012-2014
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Altansässige lokale Konkurrenz
Etablierte Konkurrenz
CoolBev
Neue Konkurrenz Einfache Fruchtsäfte
Neue Konkurrenz Gemischte Fruchtsäfte
Neue Konkurrenz Einfache und Gemischte Fruchtsäfte
2012
2013
2014

Kundenbefragung zum Kaufverhalten

Die folgende Tabelle zeigt die Ergebnisse einer Marktanalyse der Marketing Abteilung in 2014. Das Ziel der Analyse war es, die momentanen und potentiellen Trends unter Verbrauchern zu untersuchen.

Wo nehmen Sie den Großteil an Saft zu sich?	
Unterwegs	66%
Zuhause	34%
Ich trinke Saft für gewöhnlich:	
Zum Frühstück	28.1%
Als Snack	15.0%
Nach dem Sport	6.3%
Mit einer Mahlzeit	49.8%
Andere	8.7%
Würden Sie Fruchtsaft kaufen wenn Ihre Lieblingsmarke nicht verfügbar ist?	
Nein	42.4%
Ja	27%
Ich entscheide im Laden was ich kaufe	30.6%
Woher nehmen Sie Informationen zum Fruchtsaftangebot?	
Zeitung und Magazine	10%
Freunde oder Bekannte	30%
Webseiten	5%
Fernseher	55%

Werte des Unternehmens

Mitarbeiter Zuerst

Die meisten unserer außergewöhnlichen Mitarbeiter arbeiten bereits seit Beginn für uns. Wir haben stets das Wohl unserer Mitarbeiter an erste Stelle gesetzt, und konnten so über die Jahre eine engagierte, uns verpflichtete und produktive Belegschaft beibehalten.

Betriebliche Stabilität

Unseren fortschrittlichen Herstellungs-, Bestellungs- und Verteilungssysteme ermöglichen es uns auf die Bedürfnisse der Kunden schnell und effizient einzugehen.
Wir entwickeln verbessern unsere Systeme mit der neusten Technologie und nach wissenschaftlichen Trends, um sicher zu stellen, dass unsere Kunden rechtzeitig die beste Qualität erhalten.

Verbindlichkeit gegenüber Kunden und Händlern

Wir versuchen stets unseren Kunden langfristige Werte zu vermitteln, indem auf ihre Bedürfnisse eingehen. Durch unsere schnellen Lieferungssysteme, unsere fairen Preise und Rabatte, und unsere umfassenden Kooperationen mit verlässlichen Händlern, sichern wir höchste Qualität und Zufriedenheit für alte und neue Kunden.

Wohlstand durch Gewinn und Wachstum

Die primären finanziellen Ziele des Unternehmens, sind es Gewinn und Cashflow zu maximieren, und Vermögen in Wachstumsinitiativen zu stecken, die einen langfristigen Wert für Aktionäre haben.

Role 2
Zusatzmaterialien – Role 2

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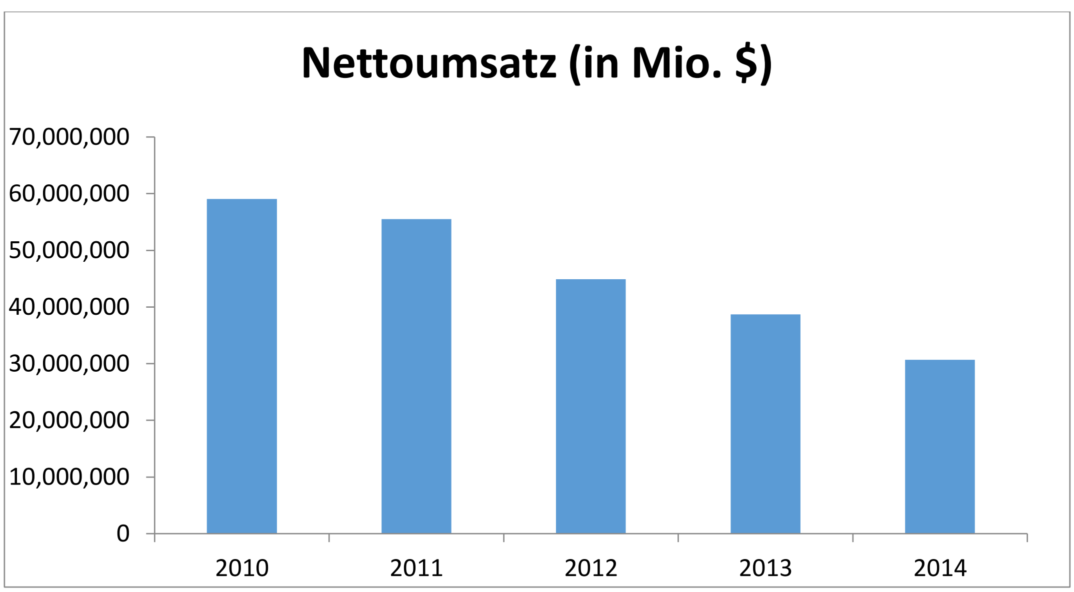
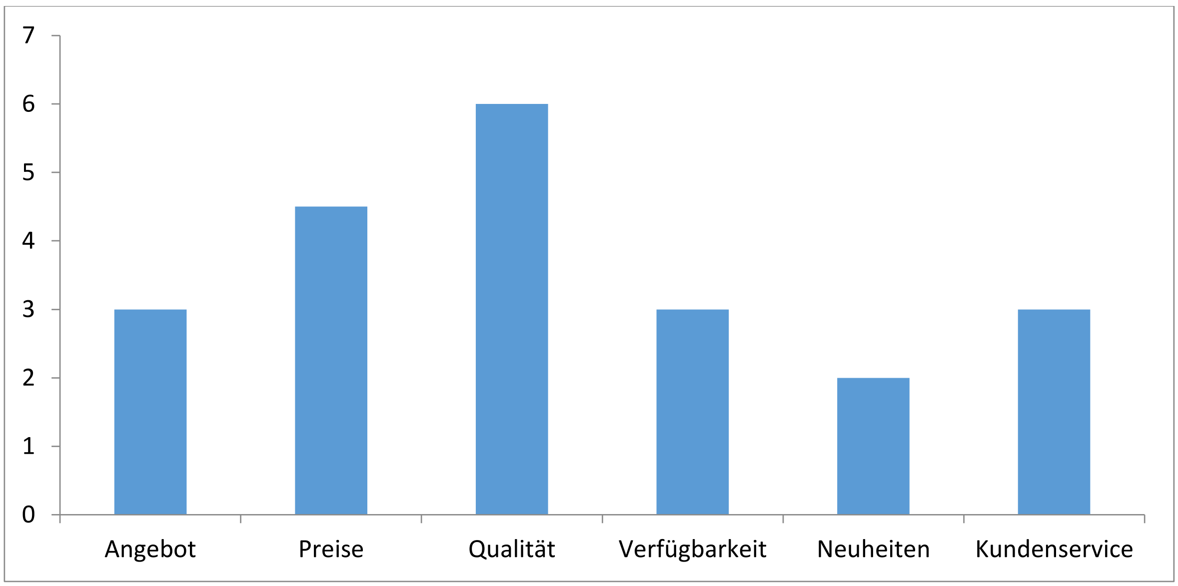


Befragung der Kunden

Das folgende Diagramm präsentiert die Antworten der Befragung zur Kundenzufriedenheit. Sowohl Vertragskunden, als auch Ad-hoc-Kunden wurden gebeten folgende Frage zu beantworten: Wie zufrieden sind Sie mit den folgenden Aspekten von CoolBev Produkten und geschäftlichen Vorgängen? Die Antworten wurden auf einer Skala von 1 (sehr unzufrieden) bis 7 (sehr zufrieden) gegeben. Zum Beispiel bedeutet der durchschnittliche Wert von 6 auf der Skala zum Preis, dass die meisten Kunden überdurchschnittlich zufrieden mit den Saftpreisen waren. Der Mittelwert der Skala ist 3.5, daher bedeutet jede Antwort über 3.5 eine überdurchschnittliche Zufriedenheit und jede Antwort unter 3.5 eine unterdurchschnittliche Zufriedenheit. 78% der Kunden des Unternehmens nahmen an der Befragung teil.



Allgemeine Daten zu Unternehmen und Industrie

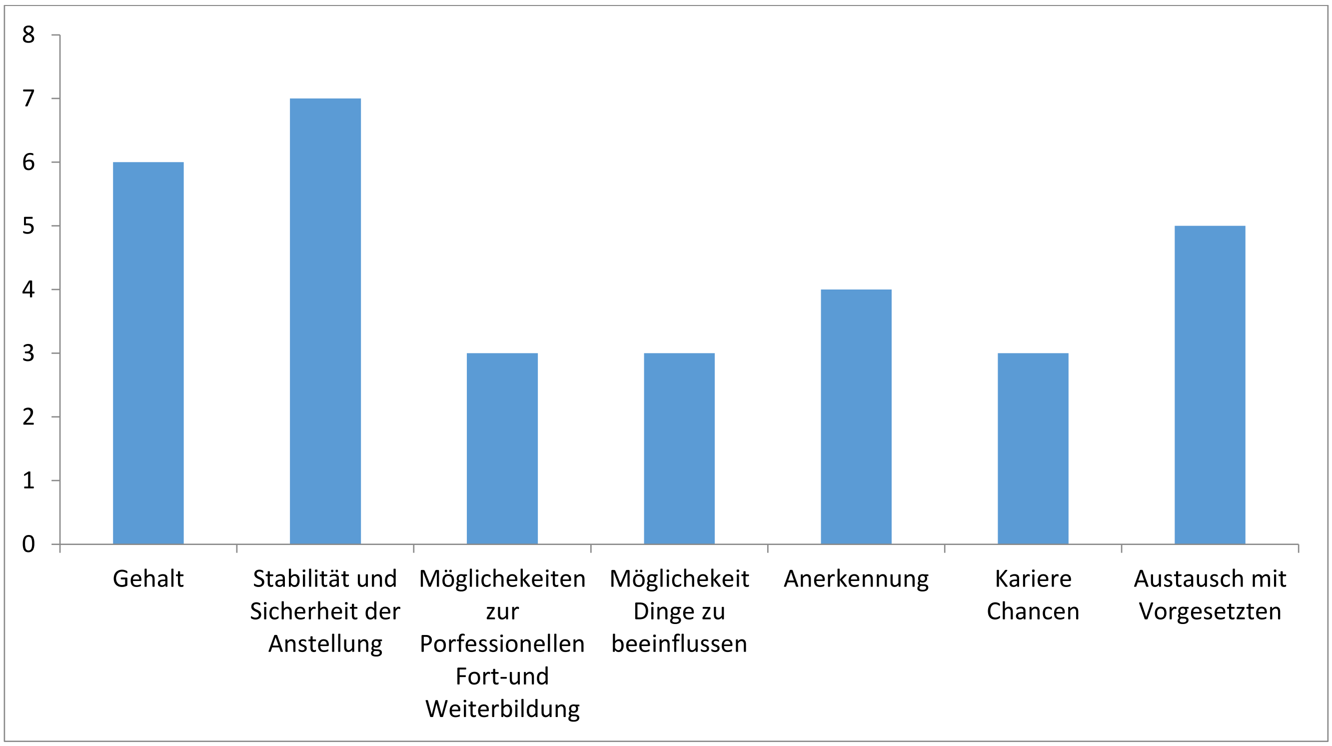
Produkte

Fruchtsaft enthält nur die natürlichen Inhaltsstoffe, die in Früchten oder Gemüse enthalten sind, also Fruchtsaftkonzentrat, Wasser, natürliche Geschmacksstoffe, und Fruchtfleisch. Unabhängig davon, ob der Saft aus Konzentrat stammt oder nicht, er wird einer leichten Pasteurisierung unterzogen, bevor er verpackt wird, um zu garantieren, dass der Verbraucher ein sicheres, qualitativ hochwertiges Produkt ohne ungewollte Mikro-Organismen bekommt. Die Produkte werden aus einer Vielzahl an Früchten hergestellt, unter denen diese die am meisten verwerteten Früchte sind:

Frucht	Anteil in Saftprodukten in Prozent
Apfel	23,30
Kokosnuss	4,60
Mango	7,10
Orange	8,30
Ananas	5,50
Gemischte Früchte	15,40
Andere Früchte	35.8

Befragung der Angestellten

Das folgende Diagramm repräsentiert die Ergebnisse der jährlichen Befragung zur Mitarbeiter Zufriedenheit (Jahr 2013). Es zeigt die Antworten der Angestellten auf die Frage: Wie zufrieden sind Sie mit den folgenden Aspekten Ihrer Arbeit bei CoolBev? Die Antworten wurden auf einer Skala von 1 (sehr unzufrieden) bis 7 (sehr zufrieden) gegeben. Zum Beispiel bedeutet der durchschnittliche Wert von 6 auf der Skala zum Gehalt, dass die Mitarbeiter überdurchschnittlich zufrieden mit ihren Gehältern sind. Der Mittelwert der Skala ist 3.5, daher bedeutet jede Antwort über 3.5 eine überdurchschnittliche Zufriedenheit und jede Antwort unter 3.5 eine unterdurchschnittliche Zufriedenheit. 87% der Belegschaft des Unternehmens nahmen an der Befragung teil.



Role 3
Zusatzmaterialien – Role 3

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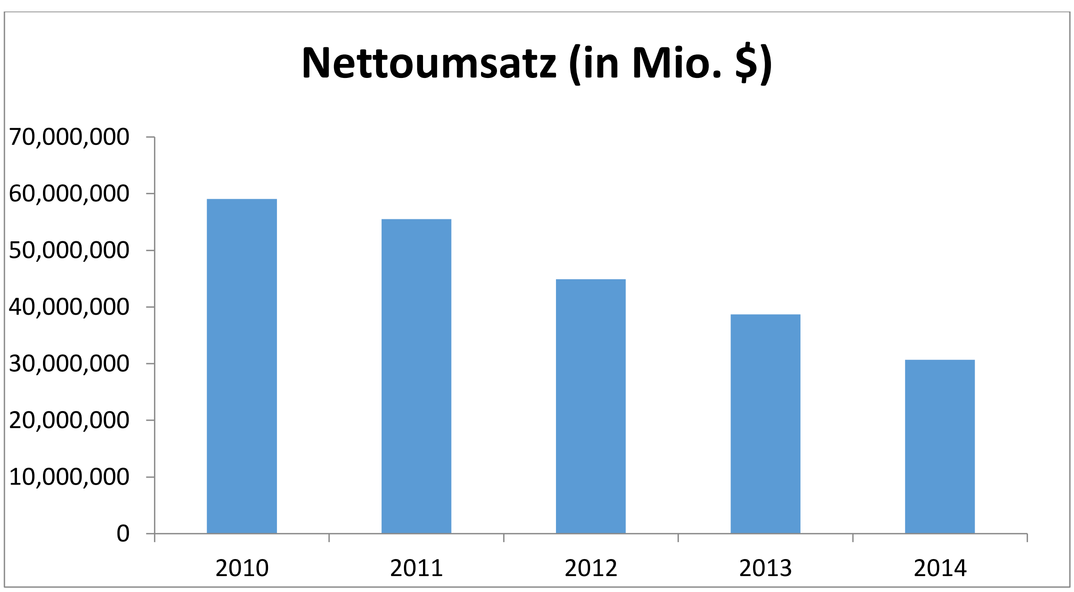


Ertragskraft der Produkte

Die folgende Tabelle zeigt die Produktlinien die von CoolBev im Jahre 2013 produziert und vertrieben wurden, kategorisiert nach der Art der Produkte und nach der Verpackung. Die Art der Produkte listet die zwei Haupttypen an Saft, die vom Unternehmen produziert werden – einfacher Fruchtsaft und gemischter Fruchtsaft. Die Produkte sind außerdem nach ihrer Verpackungsart (Flaschen, Dosen, und Trinkpäckchen), und nach Größe (125mL bis 2L) organisiert.

Die Spalten bezüglich des prozentualen Anteils an Säften, repräsentieren die Menge an produzierten Säften. Zum Beispiel bedeuten 50% an 200mL Flaschen in der Kategorie ‚Einfache Säfte', und 50% an 200mL Flaschen in der Kategorie ‚Gemischte Säfte', dass das Unternehmen die Produktion von 200mL Flaschen gleich zwischen einfachen und gemischten Säften aufteilt. Wo hingegen 60% an 500mL Flaschen in der in der Kategorie ‚Einfache Säfte', und 40% an 500mL Flaschen in der Kategorie ‚Gemischte Säfte' bedeuten, dass das Unternehmen mehr 500mL Flaschen an einfachen Säften produziert, als an gemischten Säften. Die Spalte ‚Verkauf' stellt dar, wie viel Prozent des kompletten Verkaufs im Jahre 2013 ein Produkt ausmacht. Zum Beispiel bedeutet 1% Verkauf an 200mL Flaschen von einfachen Säften, dass diese Produkte vom gesamten Verkauf (100%) nur 1% ausmachen.

Produktlinien				
Daten für 2013				
	Prozent Anteil an Einfachen Säften	**Verkauf (%)**	**Prozent Anteil an Gemischten Säften**	**Verkauf (%)**
Flaschen:				
200 mL	50	1	50	5
500 L	60	9	40	5
1 L,	70	12	30	1
1.25 L	70	3	30	0
1.5 L	70	8	30	1
2 L	70	15	30	0
Dosen:				
700 mL	100	3	-	-
Trinkpäckchen :				
125 mL	5	1	95	10
150 mL	20	1	80	8
200 mL	20	2	80	15

Demografische Merkmale der Kunden

Der folgende Graph zeigt die Kundensegmentierung bezüglich Saftprodukte entsprechend dem Alter. Sie basiert auf einer Marktanalyse des Kunden Profils, welche von Marketing und Verkauf im Jahre 2013 und 2014 durchgeführt wurde. Die Daten zum Kundenalter stammen aus Verträgen und aus einer Befragung zum Kaufverhalten der Produkte des Unternehmens. Daten sind in etwa für 70 Prozent der Kunden, mit denen CoolBev Verträge hat, vorhanden.

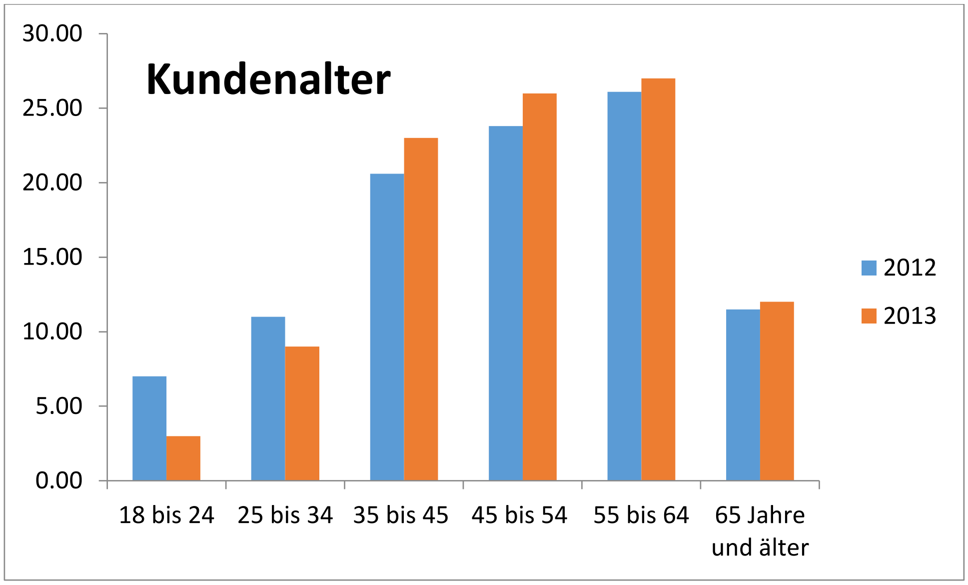
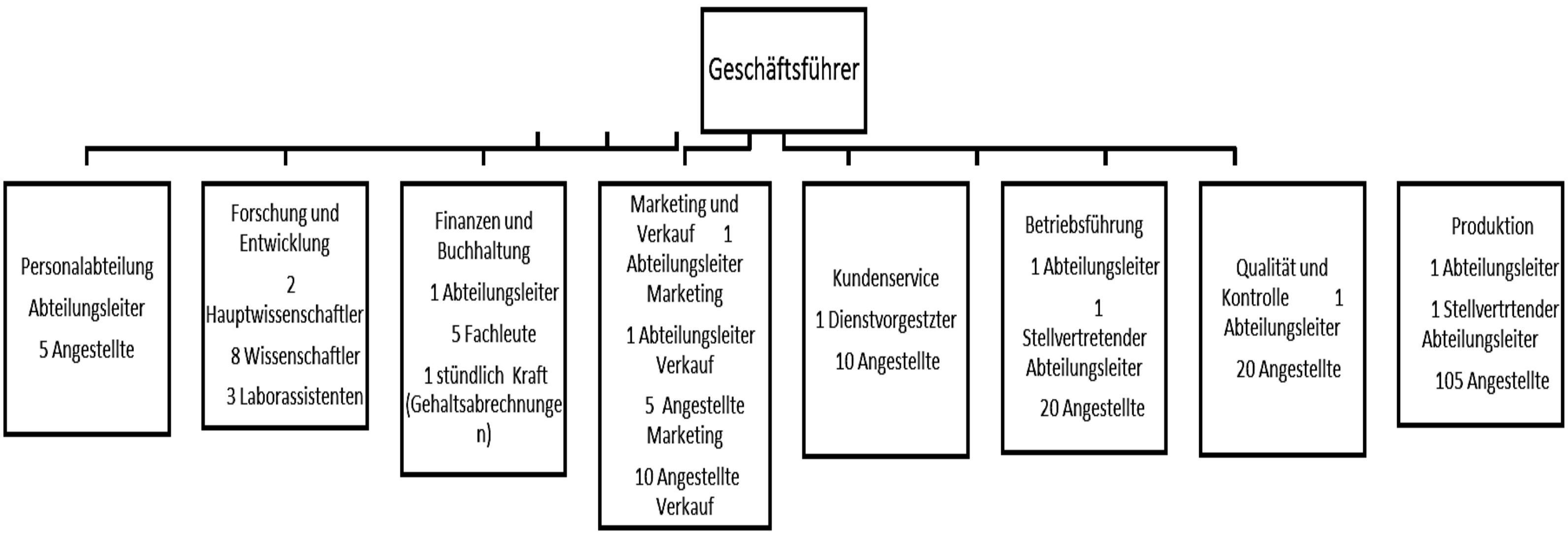


Schaubild Organisationsstruktur

Das folgende Diagramm zeigt die organisatorische Struktur im CoolBev Unternehmen. Das Unternehmen hat eine funktionale Struktur, bei der jede Abteilung ihren eigenen Betrieb verwaltet, aber auch mit anderen Abteilungen in Kontakt ist um das Geschäft zu koordinieren. Der Titel der Abteilung, sowie die Mitarbeiteranzahl sind für jede Abteilung dargestellt.



Changes

Änderungen

Nehmen Sie sich ein paar Minuten Zeit um die folgenden Informationen zu verarbeiten. Beachten Sie sie im Hinblick auf die Aufgabenstellung und die Vorgehensweise Ihres Teams bis jetzt.

Sie erhalten einen Brief von der Führung der Muttergesellschaft, in dem steht, dass das Unternehmen die Hälfte seiner Belegschaft entlassen muss, wenn es in den nächsten sechs Monaten keine Verbesserung in Verkaufszahlen, Gewinn und Marktexpansion gibt. Es wird ernsthaft in Betracht gezogen das Unternehmen zu schließen und zu verkaufen. Die Geschäftsführung verlangt eine schnelle Antwort mit Lösungsstrategien von Ihnen. Daher müssen Sie Ihre Verbesserungsvorschläge für das Unternehmen anpassen und die neue Situation mit einbeziehen.

Änderungen

Nehmen Sie sich ein paar Minuten Zeit um die folgenden Informationen zu verarbeiten. Beachten Sie sie im Hinblick auf die Aufgabenstellung und die Vorgehensweise Ihres Teams bis jetzt.

Das Verkaufsteam informiert Sie darüber, dass das Unternehmen gerade einen Hauptkunden (große Restaurantkette) verloren hat, der die Verträge mit dem Unternehmen nicht verlängern wollte, und Absprachen mit einem der Hauptkonkurrenten getroffen hat. Ihren Quellen zufolge lag das an dem besseren Preisangebot der Konkurrenz und den originelleren Produkten, aber diese Informationen sind nicht hundertprozentig sicher. Die Neuigkeiten über die Handlung des Großkunden verbreiten sich jedoch schnell und nun sieht das Unternehmen möglicherweise weiterem Kundenverlust entgegen. Sie müssen dementsprechende Maßnahmen ergreifen um die Situation des Unternehmens zu anzupassen.

Änderungen

Nehmen Sie sich ein paar Minuten Zeit um die folgenden Informationen zu verarbeiten. Beachten Sie sie im Hinblick auf die Aufgabenstellung und die Vorgehensweise Ihres Teams bis jetzt.

Die bekanntesten Wissenschaftler des Unternehmens kündigten und sind jetzt bei einem konkurrierenden Unternehmen beschäftigt. Dorthin nahmen sie die Rezepte der bestverkauften Trinkpäckchen, die nicht patentiert worden waren, mit. Es gibt nur wenige Angestellte, die wissen welche die Hauptinhaltsstoffe dieser Produkte waren. Außerdem hat aggressives werben eines andern Unternehmens dazu geführt, dass einige Mitglieder des Marketing Teams, die besonders viel Wissen über die Kundenbedürfnisse bezüglich neuer Produkte hatten, das Unternehmen verlassen haben. Sie hatten geplant, die Produktlinie zu erweitern, aber dies ist nun schwieriger umzusetzen. Daher müssen Sie den Plan zur Verbesserung des Unternehmens der Situation anpassen.

Case study Phase 2

Fallbeschreibung

Unternehmen: Orchard Hotelkette
Geschäftsführer: Jeffrey Edwards
Kategorie: Mid-Rate Hotel Chain
Zielgruppe: Kunden aus dem Geschäftsbereich oder Kunden mit Kurzzeit-Aufenthalten aus dem Freizeitbereich*
Kategorie**: 3-Sterne**
Anzahl Hotels: 8
Etagen pro Hotel: 6
Anzahl Betten: durchschnittlich 160 (40 Doppelzimmer, 40 Zweibettzimmer, 80 Einzelzimmer)
Anzahl an Konferenzräumen pro Hotel: 10
Durchschnittlicher Zimmerpreis: 60-250 Dollar
Belegschaft: durchschnittlich 80 Mitarbeiter pro Hotel
Restaurant: Ja (Frühstück, Mittagessen, Abendessen)
Öffnungszeiten Rezeption: 14 Stunden täglich
Lage: Nordamerika: Denver (2 Hotels), Philadelphia (3 Hotels), Seattle (3 Hotels)
Muttergesellschaft: Spring Hotels und Resorts

* Typischerweise spezialisiert ein Hotel sich auf ein bestimmtes Kundensegment. Das Kundensegment im Geschäftsbereich besteht aus Geschäftsreisenden, so wie selbstständigen Geschäftsleuten, Angestellten von Unternehmen, oder Angestellten von Behörden, die reisen um Geschäftsfragen zu klären. Das Kundensegment im Freizeitbereich besteht aus Alleinreisenden und Familien, die Zeit in der Gegend verbringen, oder auf der Durchreise sind. Gründe für die Reise sind zum Beispiel Sightseeing, Erholung oder der Besuch von Freunden und Verwandten.

Unternehmen

Dies ist eine fiktive Fallstudie über Orchad, eine kleine Hotelkette von 8 Hotels, die bezahlbare Unterbringungen in günstiger Lage für preisbewusste Geschäftsreisende anbietet. Die Hotels sind im Herzen dreier Nordamerikanischer Städte in Gewerbegebieten angesiedelt. Die Auswahl an Zimmern beinhaltet Einzel-, Zweibett-, und Doppelzimmer, und Konferenzräume. Die Räume haben einen geschäftsmäßigen, professionellen Stil, sind nicht sehr geräumig, aber sehr funktionell. Alle Zimmer sind ausgestattet mit einem Telefon, einem Wecker, einem Fernseher, und einer Breitband-Internetverbindung. Einige Zimmer verfügen außerdem über einen Schreibtisch.

Das Hotel ist das ganze Jahr über geöffnet. Im Durchschnitt sind 80 Angestellte beschäftigt, die überwiegend schon für das Unternehmen arbeiten, seit das erste Hotel öffnete. Dem Unternehmen gelang es eine ungewöhnliche Kontinuität in seiner Belegschaft und eine geringe Mitarbeiterfluktuation beizubehalten, und das in einer Industrie, in der die Mitarbeiterfluktuation typischerweise um die 30% pro Jahr betrugen. Die Unternehmensabteilungen bestehen aus der

Betriebsführung, Speisen und Getränke, Verkauf und Marketing, Finanzen und Buchhaltung, Personalführung, Qualität und Kontrolle, Technik und Instandhaltung. Die meisten derzeitigen Abteilungsleiter wurden aufgrund ihrer Dienstzeit befördert.

Unternehmensgeschichte

Die Hotelkette hat eine Jahrzehnte lange Geschichte im professionellen Angebot von Geschäftsaufenthalten. Das Geschäft startete in den 1980ern, als die Spring Group, ein Mischkonzern, der im Bereich Hotels, Restaurants, Reiseservice, und Hotel Design tätig ist, einige ehemalige Geschäftsgelände aufkaufte. 1980 eröffneten die ersten zwei Hotels in Seattle, gefolgt von zwei weiteren Hotels in Denver im Jahre 1985. Das Unternehmen schloss ein Hotel in Seattle im Jahre 1990, und eröffnete drei weitere in Philadelphia. 1995 wurden dann zwei neue 3-Sterne Hotels in Seattle eröffnet, die sich, anders als die anderen Hotels, auf Freizeitreisende anstatt auf Geschäftsreisende spezialisierten. Der derzeitige Geschäftsführer, welcher eine fundamentale Rolle bei der Unternehmensgründung hatte, ist nach 30 Jahren, in denen er das Hotel geführt und dessen Wachstum vorangetrieben hatte, kurz davor in den Ruhestand zu gehen. Er war früher einmal Geschäftsmann gewesen und schätze Dinge wie Professionalität, Respekt, und ein hohes Maß an Verantwortung in allen Geschäftsangelegenheiten. Diese Werte hatten auch seine Abgestellten von ihm erlernt. Ihnen waren strenge Regeln und Standards für jeden Aspekt der Hotelführung vermittelt worden, welche sie diszipliniert und genau umsetzten, um eine Ähnlichkeit in allen Hotels zu erzeugen.

Markt

Von Anfang an, seit die ersten Hotels eröffnet hatten, schloss das Unternehmen offensichtlich begrenzte Vereinbarungen, vorzugsweise mit großen oder mittelgroßen Unternehmen und mit Angestellten aus gewissen Bereichen der Regierung. Das Unternehmen zog, fast ohne jegliches Geld in Marketing zu investieren, Kunden an, hauptsächlich aufgrund der günstigen Publicity durch Weiterempfehlungen oder einen loyalen Kundenstamm. Für mehr als ein Jahrzehnt war es die erfolgreichste Hotelkette im Bereich Geschäftsreisen im ganzen Norden. Orchad hatte stabile jährliche Einnahmen, und Belegungeraten, daher mischte die Muttergesellschaft Spring Hotels und Resorts sich wenig in die Geschäfte von Orchad ein.

* Belegungsrate – Anzahl der belegten Zimmer geteilt durch die Anzahl der vorhandenen Zimmer

Stärken

Ein Schlüssel zum Erfolg war ein effizientes technisches System des Unternehmens, welches automatisch Daten zu bereits vorhandenen Gästen aus dem Business Bereich sammelte, wie Zeiten der häufigsten Besuche, Zimmer und Catering Präferenzen, Ausgaben während des Besuchs und Länge des Aufenthalts.

Dieses System, dass 1998 installiert wurde, erlaubte es den Angestellten im Bereich ‚Verkauf' wiederholten Gästen personalisierte Angebote zu senden, und damit jedes Quartal (alle drei Monate) oder jedes Jahr neue Kunden zu sichern. Das System betraf allerdings nur die Geschäftsreisenden, nicht die Freizeitreisenden. Außerdem hatten die Designer und das Team für die Verbesserungen von Arbeitsabläufen ihre Büros im Hauptsitz des Unternehmens, wo sie an der besseren Raumnutzung, und an der Effizienz von Service und Arbeitsabläufen arbeiteten.

Konkurrenz

Keine der neuen Konkurrenten bedrohte die Position von Orchad im Bereich Geschäftsreisen, aber der Wettkampf wurde von Jahr zu Jahr härter. Alle drei Monate eröffneten neue 3-Sterne Business und Freizeithotels und jedes warb mit verschiedenen Angeboten um dasselbe Kundensegment. Wie zu erwarten beabsichtigten einige der Unternehmen Verträge mit Orchad's derzeitigen Kunden abzuschließen. Eine erste Marktanalyse zeugte, dass manche Firmenkunden anfingen Abkommen mit neuen Hotels trafen, da diese mehr Angebote hatten, wie zum Beispiel spezielle Vergünstigungen für Gruppenreisen, Getränke und Snacks auf dem Zimmer, extra designte Zimmer mit Büroschreibtischen; Angebote über die Orchad nicht verfügte, da sie nicht viel änderten über die Jahre. Zusätzlich verbuchte Orchad einen Verlust an Marktanteilen unter Kunden zwischen 40 und 49 Jahren.

Tatsächlich war eines der bestverkauften Service-Pakete eines konkurrierenden Unternehmens von vier Angestellten aus Orchads Verkauf und Marketing Abteilung entwickelt worden. Sie hatten ein neues Angebot-Paket entworfen, das alle Kunden ansprechen sollte und neue Kombinationen aus gewissem Service (Getränke im Zimmer, Sporteinrichtungen, Städtetouren) und speziellen Angeboten mit Ermäßigungen enthielt. Als sie ihre Ideen der Geschäftsführung vorstellten, wurden diese abgelehnt, mit der Begründung, dass diese Veränderungen unnötig und kostspielig seien, und eventuell Kunden Vertreiben könnten. Zusätzlich bekamen die Angestellten negative Arbeitszeugnisse, da sie Zeit in eine nicht-autorisierte Aufgabe gesteckt hatten.

Geschäftsorganisation

Die Abteilungen im Unternehmen waren teils integriert. Generell unterschied man zwischen Front Office Abteilungen (Kunden- und Öffentlichkeitsbezogener Bereich des Hotels) und Back Office Abteilungen (Personalbereich und interne Infrastruktur des Hotels). Die meisten der Back Office Abteilungen hatten ihren Sitz neben der Hauptverwaltung des Unternehmens in Denver. Daher bekamen sie nicht viel mit von den täglichen Betrieblichen Problemen, denen sich das Hotelpersonal ausgesetzt sah.

Die Vertriebs und Marketing Abteilung hatte die Verantwortung für steigende Einnahmen, steigenden Marktanteil und Unternehmenswachstum, so wie für das Marketing, einschließlich Werbung und Events. Die Verantwortung der Angestellten im Vertrieb war es die Reise-Pakete an Einzelkunden oder Gruppen zu verkaufen. Aufgrund des stabilen Kundenstamms war ihre Arbeit darauf beschränkt, ehemalige Kunde zu kontaktieren und ihnen die jährlichen oder vierteljährlichen Angebote zu präsentieren. Sie spezialisierten sich auf Unternehmen und Behörden und selten auf Kunden aus dem Freizeitbereich. Die Arbeit des Marketing Personals bestand in der Verfassung vierteljährlicher und jährlicher Berichte und in der Entwicklung von Informationsbroschüren für die bestehenden Kunden, und nicht so sehr in der Entwicklung von Kampagnen um neuen Kunden zu werben. Obwohl das Marketing Personal am besten über die neuen Markttrend und über die Konkurrenz Bescheid wusste, hatten sie im Unternehmen nicht viel zu sagen.

Die meisten Ressourcen des Unternehmens wurden in die Verfestigung des Business-Marktsegments gesteckt, und nicht in die Ausweitung auf andere Kunden (wie zum Beispiel Freizeitreisende). Daher wurde die Vertriebs und Marketing Abteilung nur als ‚Umsetzer' gesehen – das heißt als eine Abteilung die tut was man ihr sagt. Das führte dazu, dass die Angestellten sich oft zermürbt fühlten. Die meisten hatten nämlich viele Ideen zur Verbesserung im Service, Werbung von neuen Kunden und Unternehmensexpansion, aber weil die Vorgesetzten nicht an neuen Projekten interessiert waren, wurden ihre Ideen nicht umgesetzt und ihr Talent nicht wertgeschätzt.

Veränderungen durchsetzen oder deswegen gehen

In der wechselnden Hotelindustrie konnte das Unternehmen am treffendsten als ruhiger und geordneter Arbeitsplatz beschrieben werden. Angestellte bei Orchad waren sehr professionell in ihrer Garderobe und ihrem Auftreten, und hatten eine respektvolle und verantwortungsvolle Einstellung - alles Charakteristiken, die die Geschäftsreisenden sehr schätzten. Die Belegschaft war dem Geschäft verpflichtet, und in jeglicher Hinsicht sehr verlässlich. Alle seit Langem beschäftigten Angestellten hielten sich höchst genau an die Hotelstandards und vorgeschriebenen Abläufe und alle neuen Angestellten mussten diese Standards respektieren- Neuerungen und Verbesserungen waren allgemein nicht willkommen, außer wenn sie von den obersten Vorgesetzten vorgeschlagen wurden. Die hohe Standardisierung wurde über die Jahre als eine der Stärken des Unternehmens betrachtet, obwohl einige Angestellte es im Zuge der Servicepersonalisierung mittlerweile als eine Last sahen.

Einige der neuen Angestellten aus Vertrieb und Marketing, sowie der neue Abteilungsleiter Marketing, sahen, dass das Unternehmen zunehmend Verluste einbuchte, und dass es nicht auf dem hart umkämpften Markt bestehen wird, wenn es nicht an die veränderte Marktsituation anpasst. Dies erfordere Neuerungen, die bedeuten würden, dass Systeme, Prozesse und Personal in der Lage wären auf verschiedene Situationen zu reagieren, und dass sie weniger Regeln nutzen und mehr Autonomie hätten. Die Abteilung versuchte daher den Wandel anzugehen und stellte eine Arbeitsgruppe zusammen, die basierend auf eigenen Daten und Vorhersagen aus der Industrie, sowie auf der Erfahrung der Angestellten aus Front Office Abteilungen, Ideen zur Verbesserung sammeln sollte. Da die Arbeitsgruppe den Trend fand, dass 20 bis 30 Jährige mehr reisten, schlug sie vor mehr Bemühungen in das Werben dieser kundengruppe zu stecken. Aber das Management fand das Hotel sei besser für Geschäftsreisende geeignet und sah keinen Anlass das Geschäft auf andere Kundensegmente auszuweiten. Die Arbeitsgruppe schlug außerdem einige Neuerungen im Service vor, um die Reiseerfahrung der Gästen zu verbessern, wie zum Beispiel Veränderungen der Räume und Rabattaktionen, aber das Management ging auch diesen Ideen nicht nach, da sie für unnötig gehalten wurden.

Ein letzter strategischer Zug war der Vorschlag einer neuen Marketing Kampagne zum Imagewechsel des Unternehmens. Da das Unternehmen einen stabilen Kundenstamm hatte, war die Werbung üblicherweise direkt an den Kunden gerichtet oder lief über gewisse Unternehmen und Restaurants. Die Marketing Abteilung wollte eine breitere Kampagne starten, die mehr potentielle Kunden erreichen sollte. Sie entwickelten die Idee zusammen mit Werbeberatern weiter, und wollten das Angebot der Hotelkette durch die Werbung auf Online Plattformen, und im Fernsehen, unter neuen Kunden verbreiten. Die Ideen wurden schnell von Geschäftsführer und Management verworfen, da sie der Meinung waren, dass Kreativität und Marketing nicht wichtig seien, und dass der Unternehmenserfolg nicht davon abhinge.

Ein letzter Versuch das Unternehmen zu verändern wurde heimlich von einer gruppe Marketing Angestellter unternommen, die ein neues Paket entwickelten, das originellen Service und Angebote für Gruppenreisen beinhaltete. Diese Eigeninitiative wurde von den Vorgesetzten nicht willkommen geheißen und endete mit der Entlassung einiger Angestellter. Für das Management demonstrierte die Kündigung eine Lehre für andere Angestellte nicht unaufgefordert an der Veränderung des Unternehmens zu arbeiten. Nach diesem Vorfall kündigten einige andere Angestellte aus Vertrieb und Marketing freiwillig. Sie fanden das Unternehmen sei kein kreativer Arbeitsplatz, und dass das Management Veränderungsvorschläge nicht schätzte.

Aufgabenstellung

Nachdem die Hotelkette Orchad für 30 Jahre Marktführer in der Hotelbranche war, sah da Unternehmen vor 4 Jahren Umsatzeinbrüchen entgegen. Die Anzahl der Nächte, die Gäste im Hotel verbrachten, begann zu sinken, im Vergleich zu vorherigen Jahren. Die Muttergesellschaft forderte Zeichen der Verbesserung der Lage, in den Verkaufszahlen und dem Kostenaufwand, und Personalveränderungen, und drohte damit sonst das Budget zu verringern und Hotels zu schließen. Das Level an Neuerungen und Verbesserungen der letzten Jahre, so wie die steigende Konkurrenz auf dem Markt war problematisch, so dass das Unternehmen offenbar nicht mit den sich verändernden Marktstrukturen und Anforderungen mithalten konnte.

Sie wurden beauftragt mit dem Geschäftsführer einige der Probleme des Unternehmens anzugehen. Sie sind aufgefordert einen integrierten Plan zu entwickeln, der die Probleme von Orchad adressiert. Sie sollen eine Liste mit Unternehmensstrategien erstellen, die darauf abzielt die Hauptproblemfelder so wie sie aus den vorliegenden Informationen hervor gehen, zu verbessern. Das Unternehmen fordert, dass die Strategien in maximal zwei Jahren umgesetzt werden können. Es stellt für das Projekt ein Budget von 100.000$ zur Verfügung. Außerdem können Sie eine zusätzliche Reserve von Geldmitteln in Höhe von 50.000$ nutzen. Diese sollten aber nur genutzt werden, wenn Sie unbedingt zusätzliches Budget brauchen um Ihren Plan zu entwickeln. Als zusätzliche Ressourcen können Sie die Angestellten des Unternehmens oder externe Angestellte mit einbeziehen. Des Weiteren sollen Sie die objektiven Resultate, die das Unternehmen bei erfolgreicher Implementierung der Strategien erzielen könnte, angeben. Wenn Sie Ihre Strategien entwickeln geben Sie außerdem den ungefähren Zeitrahmen für die Implementierung, so wie die benötigten Kosten oder Ressourcen an.

Strategie – alle Maßnahmen die durchgeführt werden müssen und Beschreibungen jeder Maßnahme, so dass die Projektangestellten verstehen können was wie getan werden muss (Bitte geben Sie 6 - 15 Maßnahmen an wenn Sie Ihren Plan entwickeln)

Resultat: Eine kurze, klare Aussage, die in messbaren Begriffen das beabsichtigte Ergebnis der vorgeschlagenen Verbesserungsstrategie angibt (z.B. % Anstieg in Verkaufszahlen, Anzahl an neuen Produkten, % neuer Kunden in einem Segment etc.)

Ressourcen und Zeitplan – geschätzte Kosten oder Materialressourcen, die benötigt warden um die Strategien umzusetzen und der ungefähre Zeitplan zur Umsetzung der Strategien im Unternhemnen (z.B. 10 Monate, 500 euro)

Bitte geben Sie die Strategien in vollständigen Sätzen wieder, so dass jemand, der Ihren Plan bewertet, die Absichten versteht und nachvollziehen kann wie die Strategien umgesetzt werden sollen.

Strategien	Ressourcen und Zeitplan	Objektive Resultate
1.		
2.		
3.		
4.		
5.		
6.		
……		

Bewertung der Leistung

Sowohl die Effizienz und Effektivität der Strategien, als auch deren Potential zur Verbesserung der momentanen Geschäftslage, werden gleich gewichtet in die finale Bewertung des Projekts eingehen. Ihr Plan wird von Fachleuten aus dem Bereich ‚Unternehmensentwicklung und organisatorischer Wandel' bewertet. Sie werden Punkte für Ihren Plan bekommen, die sich auf die Kriterien der Effizienz, Effektivität und Originalität beziehen, mit gleicher Gewichtung jedes Kriteriums.

- Effizienz (Leistungsfähigkeit) – können die Strategien innerhalb einer gewissen Zeit und mit einer gewissen Menge an Ressourcen umgesetzt werden?
- Effektivität (Wirkungsgrad)– werden die Strategien die Probleme des Unternehmens lösen?
- Originalität – tragen die Handlungsschritte etwas Neues zum Unternehmen bei?

Role materials

Role 1
Zusatzmaterialien – Role 1

Die folgenden Informationen sollen bei der Bearbeitung der Aufgabe helfen. Die Graphen, Tabellen, und Diagramme vertiefen die Informationen aus der anfänglichen Beschreibung der Fallstudie oder repräsentieren zusätzliche Informationen. Jedes Teammitglied hat verschiedene Informationen bezüglich des Geschäfts. Sie werden dazu ermutigt sich gegenseitig zu befragen um aufgabenrelevante Informationen auszutauschen, wenn Sie Lösungsvorschläge durchdenken.

Ertragskraft des Unternehmens

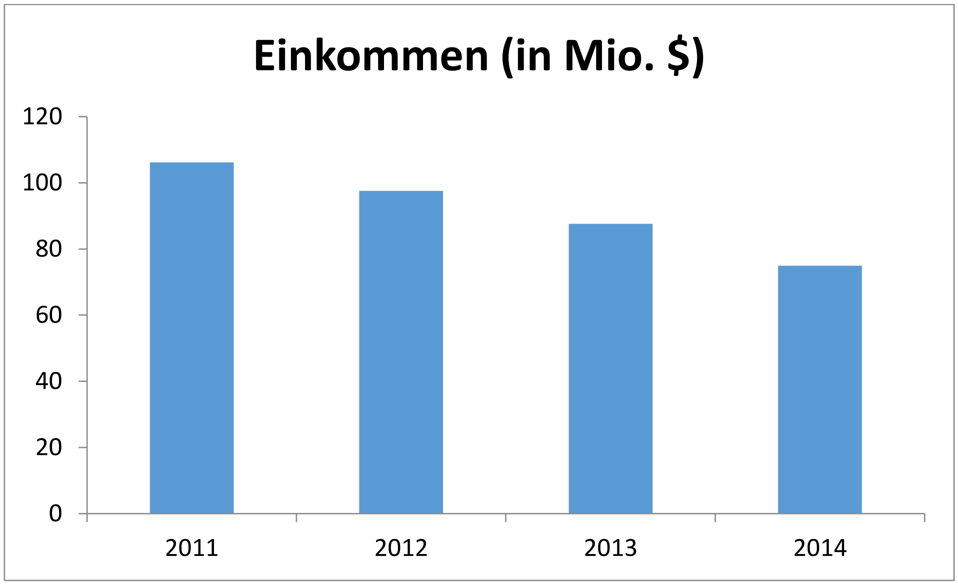
Die folgenden Graphen zeigen die Verkaufsleistung und Ertragskraft des Unternehmens der letzten vier Jahre, und die Belegungeraten der Hotels der letzten drei Jahre. Der Graph zur Belegungsrate repräsentiert die Rate der belegten Zimmer im Verhältnis zu den vorhandenen Zimmern in einem Jahr in Prozent für alle großen Unternehmen der Hotelbranche in der Umgebung von Orchad Hotels. Zum Beispiel zeigen die etablierten Konkurrenten von Orchad einen Anstieg in den Belegungsraten in den Jahren von 2012 bis 2014. Die Daten stammen aus finanziellen Berichten des Rechnungswesens und jährlichen industriellen Statistiken.

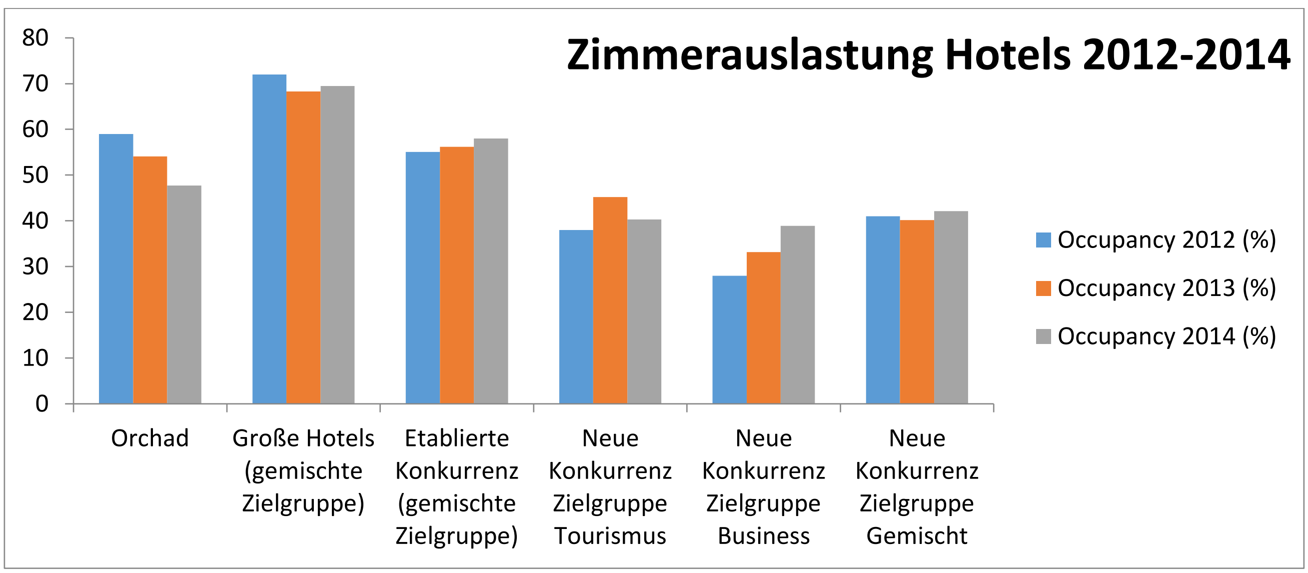
Terminologie

Belegungsrate/Zimmerauslastung – Anzahl der belegten Zimmer geteilt durch die Anzahl der vorhandenen Zimmer

DEFINITION von 'Nettoumsatz'

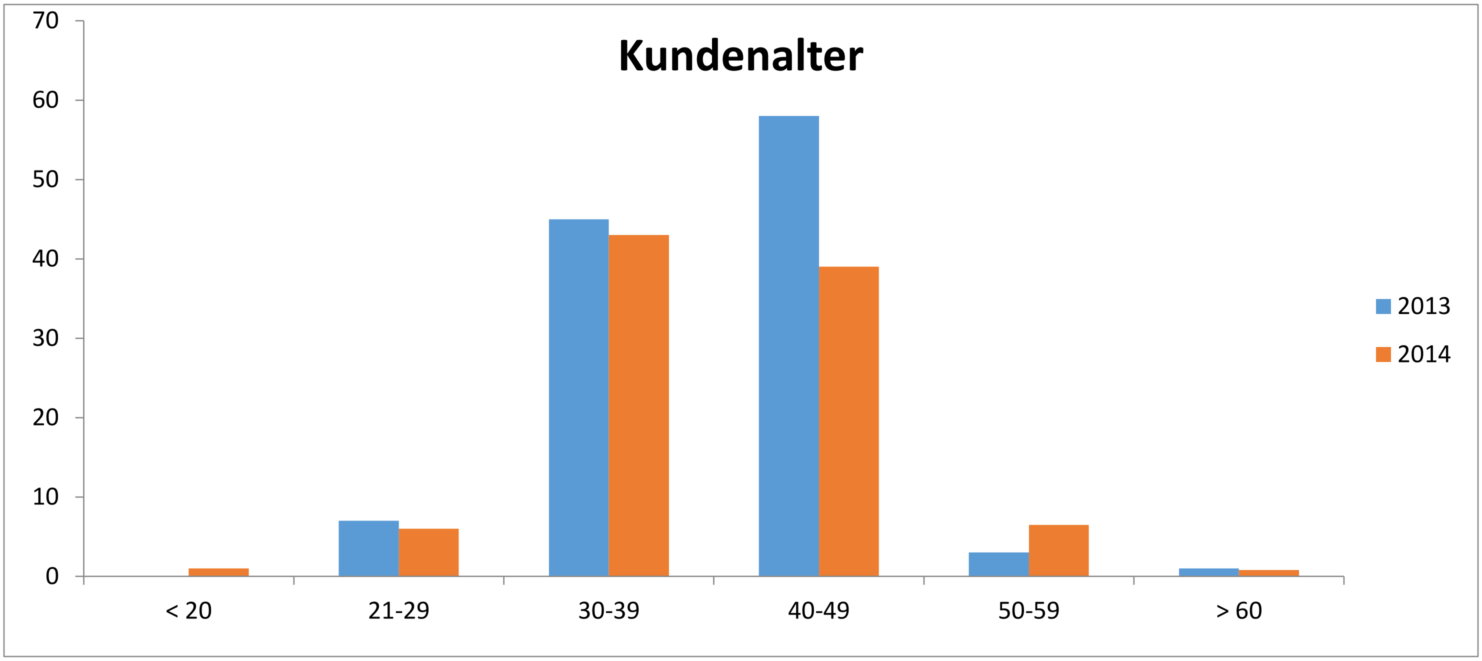
Umsatz abzüglich Umsatzsteuer, Erlösschmälerungen, Nachlässen und ähnlichen Umsatzminderungen bzw. Gutschriften. Die Umsatzzahl, die in Finanzaufstellungen festgehalten wird, ist der Nettoumsatz.





Demografische Merkmale der Kunden

Der folgende Graph zeigt die Kundensegmentierung der Hotelgäste entsprechend dem Alter. Sie basiert auf einer Marktanalyse des Kunden Profils, welche von Marketing und Verkauf im Jahre 2013 und 2014 durchgeführt wurde. Die Informationen zum Kundenalter stammen aus Angaben, die Hotelgäste beim Check-in machten und aus einer Befragung bezüglich der Intention in Zukunft ein Zimmer bei Orchad zu reservieren. Daten sind in etwa für 85 Prozent der Kunden, die im Jahre 2013 und 2014 ein Orchad Hotel besuchten, vorhanden.


Kundenalter
70
60
50
40
30
20
10
0
< 20
21-29
30-39
40-49
50-59
> 60
2013
2014

Werte des Unternehmens

Loyalität

Wir legen Wert darauf unsere wiederholten Geschäftspartner und Kunden zu halten, und wollen die Kundenloyalität in einem hart umkämpften Markt weiter stärken, indem wir qualitative Unterbringung in günstiger Lage zum Besten Preis anbieten.

Professionalität

Wir halten uns kompromisslos an wirtschaftliche Standards. Das betrifft unsere tägliche Geschäftsführung, unsere Richtlinien bezügliche Personal und Versorgungskette und unsere internen Methoden.

Sich um die Mitarbeiter kümmern

Die Langlebigkeit unseres Teams ist Beweis dafür, dass unsere einzigartige Unternehmenskultur ein positives Klima erzeugt. Wir respektieren unsere Arbeitsumwelt und behandeln uns, unsere Leute, unsere Hotels und unsere Gäste mit Wertschätzung.

Integrität

Wir handeln ehrlich und halten uns sowohl individuell, als auch kollektiv an unsere Verpflichtungen und Werte. Wir führen unser Geschäft nach ethischen Standards und erlegen uns die höchsten Standards auf.

Role 2
Zusatzmaterialien – Role 2

Die folgenden Informationen sollen bei der Bearbeitung der Aufgabe helfen. Die Graphen, Tabellen, und Diagramme vertiefen die Informationen aus der anfänglichen Beschreibung der Fallstudie oder repräsentieren zusätzliche Informationen. Jedes Teammitglied hat verschiedene Informationen bezüglich des Geschäfts. Sie werden dazu ermutigt sich gegenseitig zu befragen um aufgabenrelevante Informationen auszutauschen, wenn Sie Lösungsvorschläge durchdenken.

Ertragskraft des Unternehmens

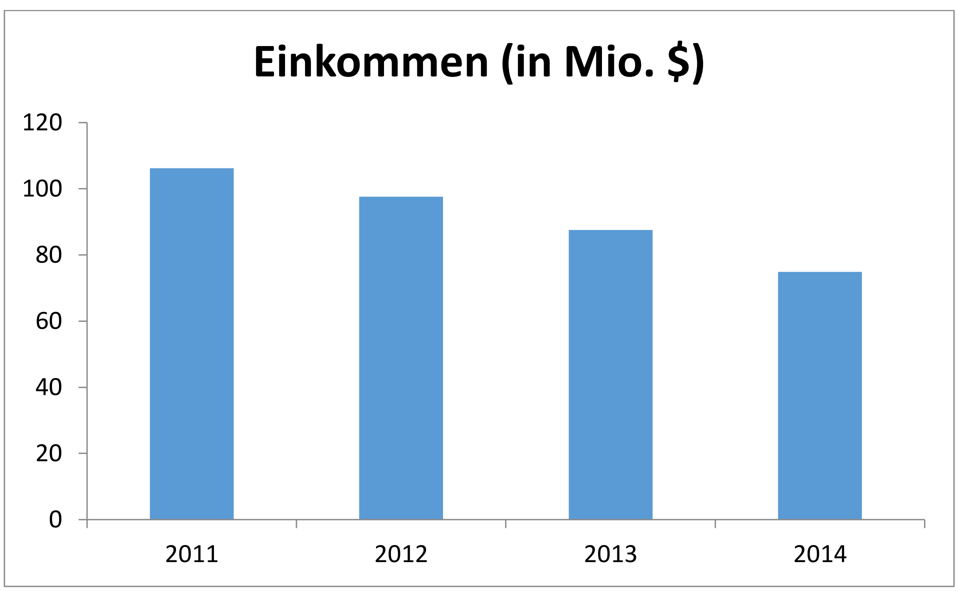
Die folgenden Graphen zeigen die Verkaufsleistung und Ertragskraft des Unternehmens der letzten vier Jahre, und die Belegungeraten der Hotels der letzten drei Jahre.

Terminologie

Belegungsrate/Zimmerauslastung – Anzahl der belegten Zimmer geteilt durch die Anzahl der vorhandenen Zimmer

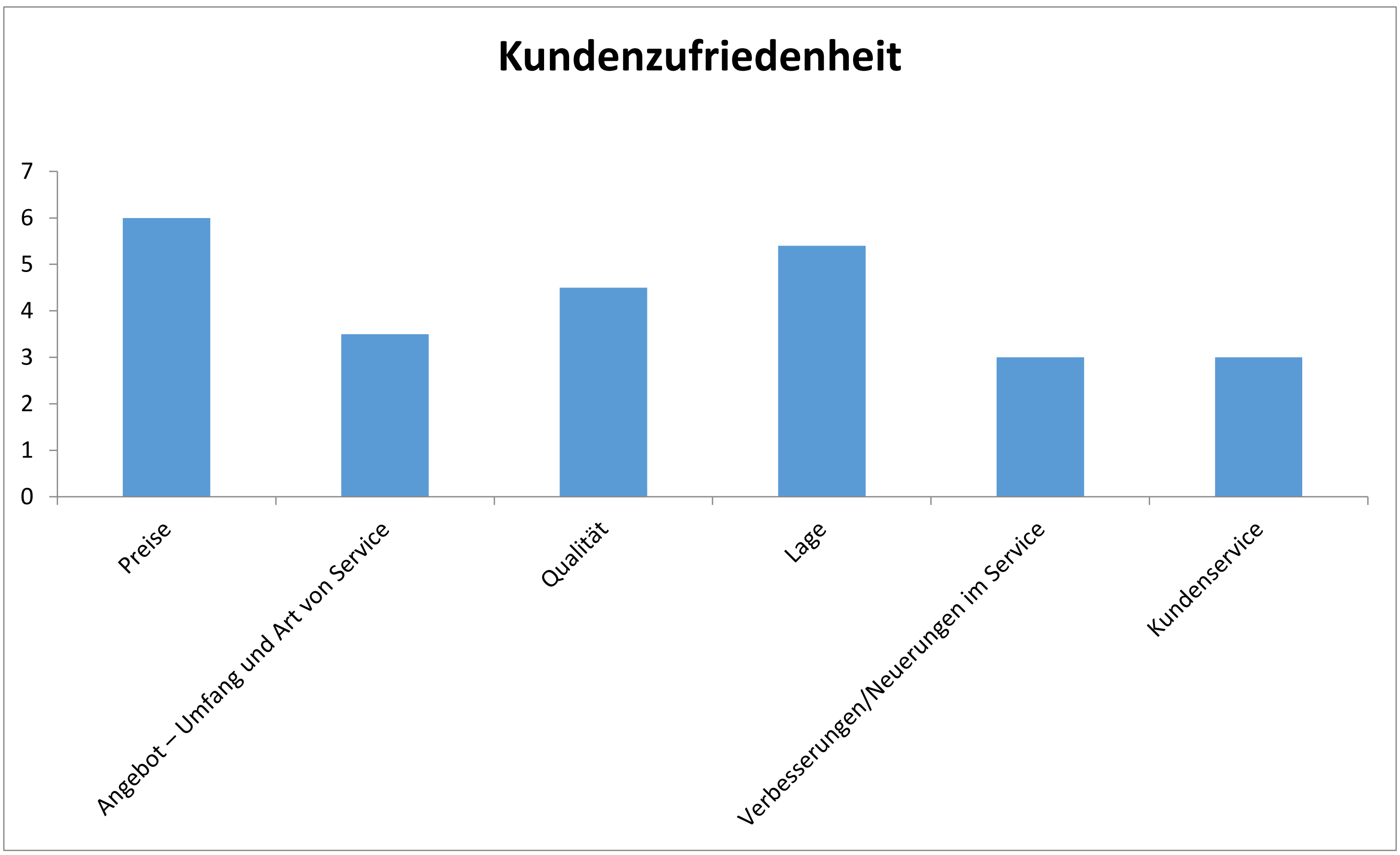
DEFINITION von 'Nettoumsatz'

Umsatz abzüglich Umsatzsteuer, Erlösschmälerungen, Nachlässen und ähnlichen Umsatzminderungen bzw. Gutschriften. Die Umsatzzahl, die in Finanzaufstellungen festgehalten wird, ist der Nettoumsatz.



Befragung der Kunden Kundenzufriedenheit

Das folgende Diagramm präsentiert die Antworten der Befragung zur Kundenzufriedenheit. Hotelgäste an allen Standorten der Orchad Hotelkette wurden gebeten folgende Frage zu beantworten: Wie zufrieden sind Sie mit den folgenden Aspekten des Betriebs von Hotels der Orchad-Kette? Die Antworten wurden auf einer Skala von 1 (sehr unzufrieden) bis 7 (sehr zufrieden) gegeben. Zum Beispiel bedeutet der durchschnittliche Wert von 6 auf der Skala zum Preis, dass die meisten Kunden überdurchschnittlich zufrieden mit den Preisen des Hotels waren. Der Mittelwert der Skala ist 3.5, daher bedeutet jede Antwort über 3.5 eine überdurchschnittliche Zufriedenheit und jede Antwort unter 3.5 eine unterdurchschnittliche Zufriedenheit. 68% der



Hotelgäste, die ein Orchad Hotel im Jahre 2013 besuchten, nahmen an der Befragung teil.

Ertragskraft des Unternehmens

Die folgende Tabelle repräsentiert die Belegungsrate in jedem Hotel der Orchad Hotelkette über einen Zeitraum von 2 Jahren und sortiert nach Kundentyp (Geschäftsreisende/Freizeitreisende). Sie zeigt wie viel Prozent der zur Verfügung stehenden Räume in jedem Hotel, insgesamt und von den verschiedenen Kundentypen in den Jahren 2013 und 2014 belegt wurden. Zum Beispiel lässt sich für Hotel 1 in Denver im Jahre 2013 ablesen, dass 72% aller verfügbaren Zimmer belegt waren, 50% von Geschäftsreisenden und 22% von Freizeitreisenden.

		2013			**2014**		
Hoteltyp nach Kundensegment		**Insgesamt**	**Geschäfts-reisende**	**Freizeit-reisende**	**Insgesamt**	**Geschäfts-reisende**	**Freizeit-reisende**
	Denver						
Business	Hotel 1	72	50	22	65	45	20
Business	Hotel 2	75	52	23	67	48	19
	Philadelphia						
Business	Hotel 3	45	28	17	38	23	15
Business	Hotel 4	72	52	22	64	46	18
Business	Hotel 5	67	47	20	59	41	18
	Seattle						
Business	Hotel 6	68	15	53	58	12	46
Freizeit	Hotel 7	71	13	58	64	11	53
Freizeit	Hotel 8	29	12	17	25	10	15

Allgemeine Daten zu Unternehmen und Industrie

Raumtypen

Standard Einzelzimmer: Maximale Belegung: 1 Gast. Die Räume sind klein und für einen kurzen Aufenthalt angemessen.
Standard Zweibettzimmer: 2 Einzelbetten. Maximale Belegung: 2 Gäste
Kleines Doppelzimmer: 1 kleines Doppelbett. Maximale Belegung: 2 Gäste

Hotel Kategorien

Ein 1-Sterne Hotel bietet einen begrenzten Umfang an Annehmlichkeiten und Service, hält sich aber an einen hohen Standard an Sauberkeit. Ein 2-Sterne Hotel bietet eine gute Unterbringung, mit besser ausgestatteten Zimmern, jedes mit Telefon und anschließendem privaten Badezimmer. Ein 3-Sterne Hotel hat größere Zimmer, und verfügt über hochklassigere Dekorationen und Möblierung. Es verfügt außerdem über eine oder mehrere Bars oder Lounges. Ein 4-Sterne Hotel ist sehr viel komfortabler und größer und bietet exzellente Küche, Zimmerservice und andere Annehmlichkeiten. Ein 5-Sterne Hotel bietet luxuriöse Räumlichkeiten, den größtmöglichen Gästeservice, und verfügt über ein Schwimmbad und Räumlichkeiten für Sport.

Hotel Typen

Mittelklassehotel: - Hotels der Mittelklasse sprechen das größte Kundensegment unter Reisenden an. Diese Art Hotel bietet keinen hochklassigen Service, und hat entsprechende Angestellte. Gäste, die gerne in solchen Hotels übernachten, sind Geschäftsreisende, Alleinreisende und Familien. Die Kosten sind geringer als in luxuriöseren Hotels und es werden weniger Service, kleinere Räume und ein kleineres Angebot an Freizeitaktivitäten geboten.

Hotelketten: - Diese Art von Unternehmen setzen für gewöhnlich gewisse Standards, Regeln und Richtlinien fest, um abweichende Aktivitäten der einzelnen Hotels zu beschränken. Im Allgemeinen gilt: Je zentralisierter die Organisation, desto stärker ist die Kontrolle über die einzelnen Hotels. Manche Ketten haben viel Kontrolle über Dinge wie Architektur, Management und Standards, während andere sich nur auf das Marketing und den zentralen Verkauf konzentrieren.

Business Hotels: - Diese Hotels stellen die größte Gruppe an Hoteltypen dar, und wenden sich mit ihrem Angebot hauptsächlich an Geschäftsreisende, weshalb sie häufig in Geschäftsgegenden liegen. Obwohl die Haupt-Zielgruppe Geschäftsreisende sind, finden auch andere Reisende diese Hotels attraktiv, wie zum Beispiel Alleinreisende, Reisegruppen oder kleine Konferenz/Tagungsgruppen.

Role 3
Zusatzmaterialien – Role 3

Ertragskraft des Unternehmens

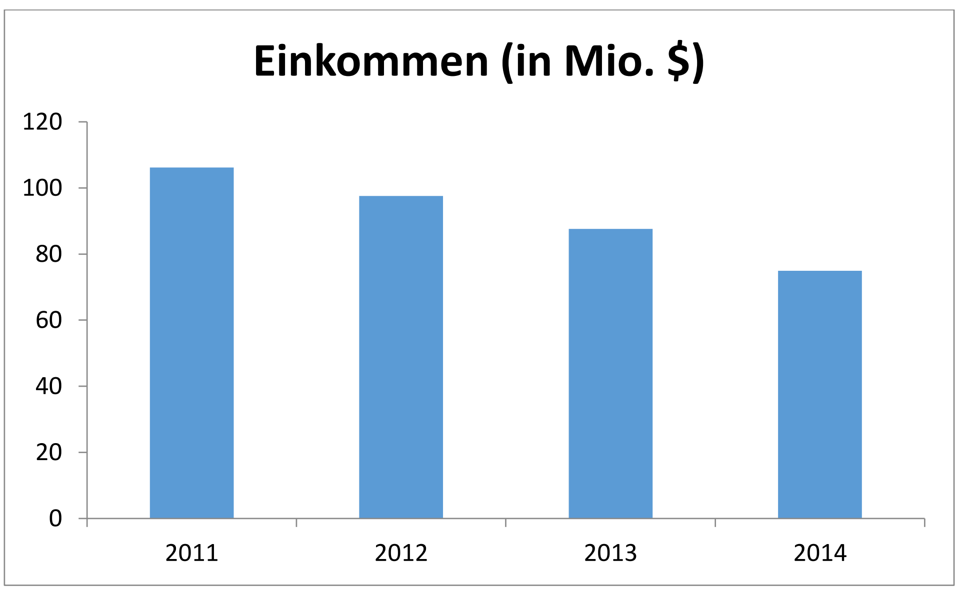
Die folgenden Graphen zeigen die Verkaufsleistung und Ertragskraft des Unternehmens der letzten vier Jahre, und die Belegungeraten der Hotels der letzten drei Jahre. Der Graph zur Belegungsrate repräsentiert die Rate der belegten Zimmer im Verhältnis zu den vorhandenen Zimmern in einem Jahr in Prozent für alle großen Unternehmen der Hotelbranche in der Umgebung von Orchad Hotels. Zum Beispiel zeigen die etablierten Konkurrenten von Orchad einen Anstieg in den Belegungsraten in den Jahren von 2012 bis 2014. Die Daten stammen aus finanziellen Berichten des Rechnungswesens und jährlichen industriellen Statistiken.

Terminologie

Belegungsrate/Zimmerauslastung – Anzahl der belegten Zimmer geteilt durch die Anzahl der vorhandenen Zimmer

DEFINITION von 'Nettoumsatz'

Umsatz abzüglich Umsatzsteuer, Erlösschmälerungen, Nachlässen und ähnlichen Umsatzminderungen bzw. Gutschriften. Die Umsatzzahl, die in Finanzaufstellungen festgehalten wird, ist der Nettoumsatz.



Servicebedürfnisse der Kunden

Die folgende Tabelle präsentiert die Ergebnisse einer Marktanalyse, die von der Marketing Abteilung im Jahre 2014 durchgeführt wurde. Das Ziel der Analyse war es, die momentanen und potentiellen Trends unter Kunden zu untersuchen.

Welche der folgenden Bereiche sollte das Unternehmen verbessern? (1 – braucht keine Verbesserung; 7 – braucht Verbesserung)	Geschäfts-reisende	Freizeit-reisende
Konferenzräume/Möglichkeiten für Meetings	6	2
Spezielle Angebote (z.B. Touren, Rabatte, Bonusaktionen)	5	6
Familienangebote	2	6
Gruppenangebote	6	6
Wochenendangebote	3	7

Befragung der Kunden zur Planung von Reisen

Die folgende Tabelle zeigt die Ergebnisse einer Marktanalyse der Marketing Abteilung im Jahre 2014. Das Ziel der Analyse war es, die momentanen und potentiellen Trends unter Kunden zu untersuchen.

		Geschäfts-reisende	Freizeit-reisende
Wo suchen Sie gewöhnlich nach Information bezüglich Ihrer Unterbringung? (%)	Zeitungen und Magazine	5	5
	Internet (z.B. spezialisierte Portale sowie Expedia und Tripadvisor)	10	39
	Freunde und Bekannte	10	18
	Reisebüro	6	20
	Ich verlasse mich auf Newsletter von vormals besuchten Hotels	25	3
	Ich frage direkt vor Ort	2	12
	Mein Unternehmen kümmert sich um meine Unterbringung	42	3
		100	100
Würden Sie ein anderes Hotel wählen, wenn Ihr Lieblingshotel ausgebucht wäre? (%)	Ja	28	68
	Nein	72	32

Befragung der Angestellten

Das folgende Diagramm repräsentiert die Ergebnisse der jährlichen Befragung zur Mitarbeiter Zufriedenheit (Jahr 2013). Es zeigt die Antworten der Hotelangestellten auf die Frage: Wie zufrieden sind Sie mit den folgenden Aspekten Ihrer Arbeit bei der Hotelkette Orchad? Die Antworten wurden auf einer Skala von 1 (sehr unzufrieden) bis 7 (sehr zufrieden) gegeben. Zum Beispiel bedeutet der durchschnittliche Wert von 5 auf der Skala zum Gehalt, dass die meisten Mitarbeiter überdurchschnittlich zufrieden mit ihren Gehältern sind. Der Mittelwert der Skala ist 3.5, daher bedeutet jede Antwort über 3.5 eine überdurchschnittliche Zufriedenheit und jede Antwort unter 3.5 eine unterdurchschnittliche Zufriedenheit. 80% der Belegschaft (Angestellte aus allen Orchad Hotels) nahmen an der Befragung teil.

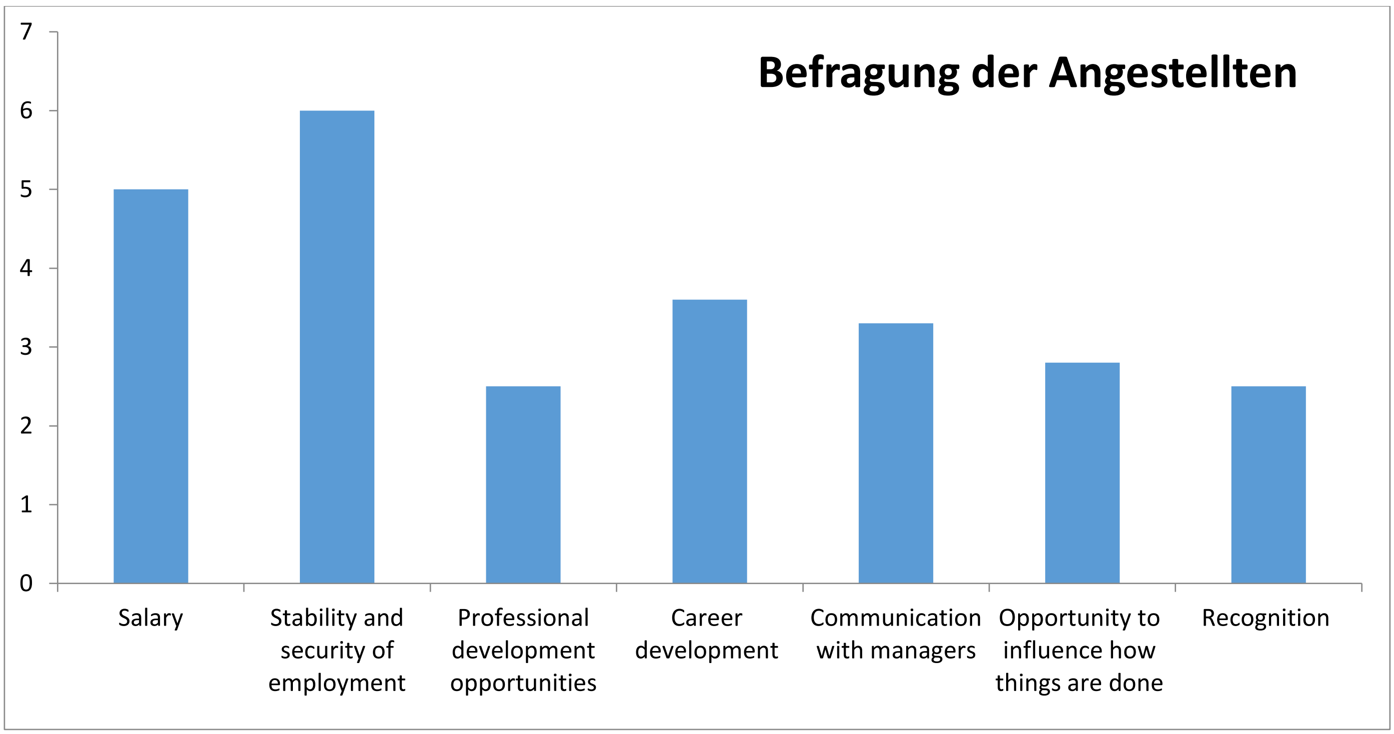
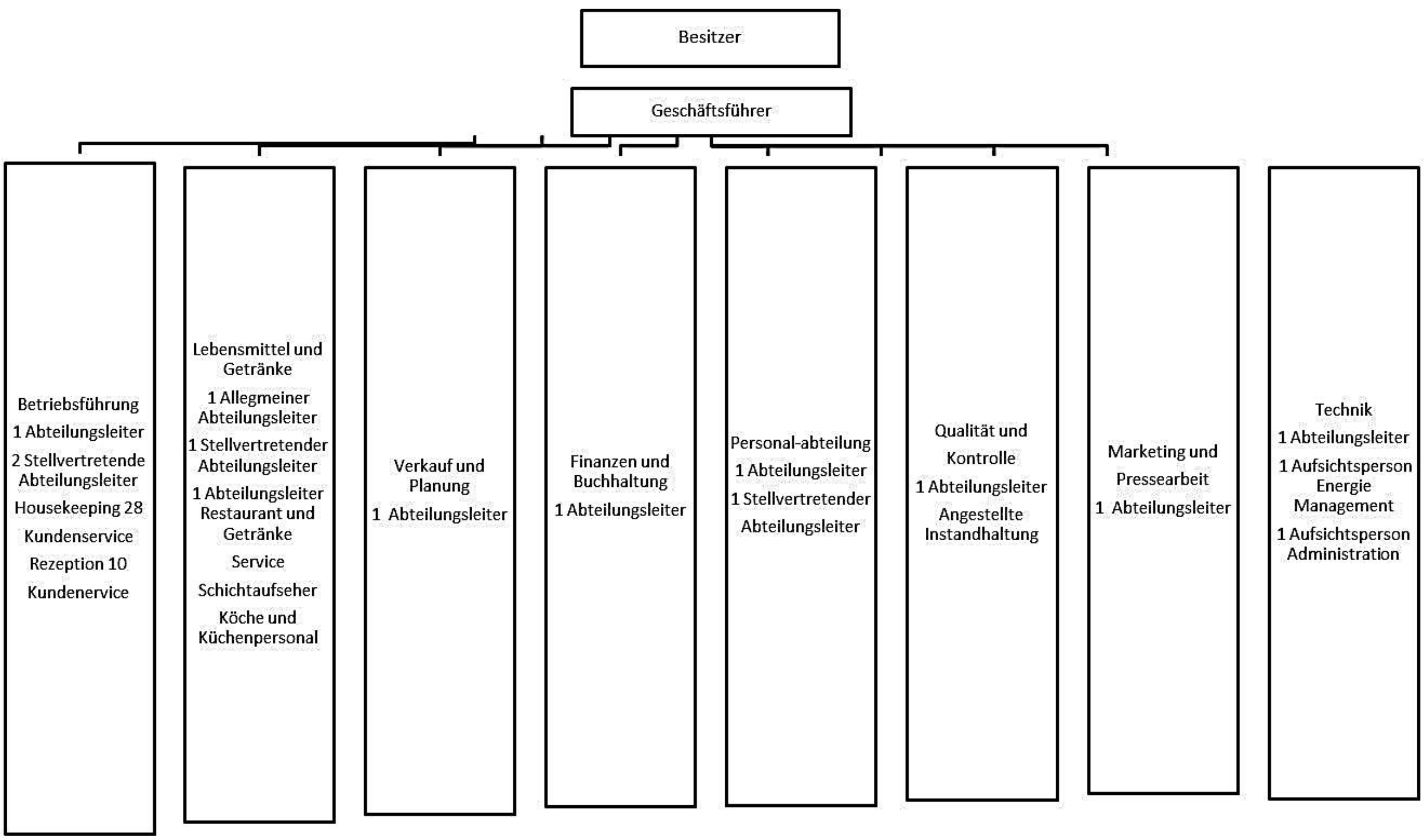


Schaubild Organisationsstruktur

Das folgende Diagramm zeigt die organisatorische Struktur im Orchad Hotel. Das Unternehmen hat eine funktionale Struktur, bei der jede Abteilung ihren eigenen Betrieb verwaltet, aber auch mit anderen Abteilungen in Kontakt ist um das Geschäft zu koordinieren. Der Titel der Abteilung, sowie die Mitarbeiteranzahl sind für jede Abteilung dargestellt.



Work plans

Case study 1

VERBESSERUNGSPLAN

Maßnahmen: Bitte geben Sie 6 - 16 Maßnahmen an wenn Sie Ihren Plan entwickeln
Budget: 100.000 €
Zeitrahmen des Projekts: 2 Jahre ab Projektbeginn
Ihr Plan wird durch externe Projektmanager bewertet, die mit Projekten dieser Art vertraut sind
Begriffserklärungen
Strategie – alle Maßnahmen die durchgeführt werden müssen und Beschreibungen jeder Maßnahme, so dass die Projektangestellten verstehen können was wie getan werden muss (Bitte geben Sie 6 - 15 Maßnahmen an wenn Sie Ihren Plan entwickeln)
Resultat: Eine kurze, klare Aussage, die in messbaren Begriffen das beabsichtigte Ergebnis der vorgeschlagenen Verbesserungsstrategie angibt (z.B. % Anstieg in Verkaufszahlen, Anzahl an neuen Produkten, % neuer Kunden in einem Segment etc.)
Ressourcen und Zeitplan – geschätzte Kosten oder Materialressourcen, die benötigt warden um die Strategien umzusetzen und der ungefähre Zeitplan zur Umsetzung der Strategien im Unternhemnen (z.B. 6 Monate, 1000 euro)
Bitte geben Sie die Strategien in vollständigen Sätzen wieder, so dass jemand, der Ihren Plan bewertet, die Absichten Ihres Teams versteht und nachvollziehen kann wie die Strategien umgesetzt werden sollen.
Bewertung der Leistung
Sowohl die Effizienz und Effektivität der Strategien, als auch deren Potential zur Verbesserung der momentanen Geschäftslage, werden gleich gewichtet in die finale Bewertung des Projekts eingehen. Ihr Plan wird von Fachleuten aus dem Bereich ‚Unternehmensentwicklung und organisatorischer Wandel‘ bewertet. Sie werden Punkte für Ihren Plan bekommen, die sich auf die Kriterien der Effizienz, Effektivität und Originalität beziehen, mit gleicher Gewichtung jedes Kriteriums.

 Effizienz (Leistungsfähigkeit) – können die Strategien innerhalb einer gewissen Zeit und mit einer gewissen Menge an Ressourcen umgesetzt werden?

 Effektivität (Wirkungsgrad)– werden die Strategien die Probleme des Unternehmens lösen?

 Originalität – tragen die Handlungsschritte etwas Neues zum Unternehmen bei?

VERBESSERUNGSPLAN COOLBEV UNTERNEHMEN		
STRATEGIEN	RESSOURCEN UND ZEITPLAN	OBJEKTIVE RESULTATE
1.		
2.		
3.		
4.		
5.		

VERBESSERUNGSPLAN COOLBEV UNTERNEHMEN		
STRATEGIEN	RESSOURCEN UND ZEITPLAN	OBJEKTIVE RESULTATE
6.		
7.		
8.		
9.		
10.		

VERBESSERUNGSPLAN COOLBEV UNTERNEHMEN		
STRATEGIEN	RESSOURCEN UND ZEITPLAN	OBJEKTIVE RESULTATE
11.		
12.		
13.		
14.		
15.		
16.		

Case study 2

VERBESSERUNGSPLAN
Maßnahmen: Bitte geben Sie 6 - 16 Maßnahmen an wenn Sie Ihren Plan entwickeln
Budget: 1000.000 €
Zeitrahmen des Projekts: 2.5 Jahre ab Projektbeginn
Ihr Plan wird durch externe Projektmanager bewertet, die mit Projekten dieser Art vertraut sind
Begriffserklärungen
Strategie – alle Maßnahmen die durchgeführt werden müssen und Beschreibungen jeder Maßnahme, so dass die Projektangestellten verstehen können was wie getan werden muss (Bitte geben Sie 6 - 15 Maßnahmen an wenn Sie Ihren Plan entwickeln)
Resultat: Eine kurze, klare Aussage, die in messbaren Begriffen das beabsichtigte Ergebnis der vorgeschlagenen Verbesserungsstrategie angibt (z.B. % Anstieg in Verkaufszahlen, Anzahl an neuen Produkten, % neuer Kunden in einem Segment etc.)
Ressourcen und Zeitplan – geschätzte Kosten oder Materialressourcen, die benötigt warden um die Strategien umzusetzen und der ungefähre Zeitplan zur Umsetzung der Strategien im Unternhemnen (z.B. 10 Monate, 5000 euro)
Bitte geben Sie die Strategien in vollständigen Sätzen wieder, so dass jemand, der Ihren Plan bewertet, die Absichten Ihres Teams versteht und nachvollziehen kann wie die Strategien umgesetzt werden sollen.
Bewertung der Leistung
Sowohl die Effizienz und Effektivität der Strategien, als auch deren Potential zur Verbesserung der momentanen Geschäftslage, werden gleich gewichtet in die finale Bewertung des Projekts eingehen. Ihr Plan wird von Fachleuten aus dem Bereich ‚Unternehmensentwicklung und organisatorischer Wandel‘ bewertet. Sie werden Punkte für Ihren Plan bekommen, die sich auf die Kriterien der Effizienz, Effektivität und Originalität beziehen, mit gleicher Gewichtung jedes Kriteriums.

 Effizienz (Leistungsfähigkeit) – können die Strategien innerhalb einer gewissen Zeit und mit einer gewissen Menge an Ressourcen umgesetzt werden?

 Effektivität (Wirkungsgrad)– werden die Strategien die Probleme des Unternehmens lösen?

 Originalität – tragen die Handlungsschritte etwas Neues zum Unternehmen bei?

VERBESSERUNGSPLAN ORCHAD UNTERNEHMEN		
STRATEGIEN	RESSOURCEN UND ZEITPLAN	OBJEKTIVE RESULTATE
1.		
2.		
3.		
4.		
5.		

VERBESSERUNGSPLAN ORCHAD UNTERNEHMEN		
STRATEGIEN	RESSOURCEN UND ZEITPLAN	OBJEKTIVE RESULTATE
6.		
7.		
8.		
9.		
10.		

VERBESSERUNGSPLAN ORCHAD UNTERNEHMEN		
STRATEGIEN	RESSOURCEN UND ZEITPLAN	OBJEKTIVE RESULTATE
11.		
12.		
13.		
14.		
15.		
16.		

Questionnaires Phase 1

Team mental model Phase 1

Fragebogen

Unten finden Sie mehrere Konzepte, die mit der Fallstudie an der Ihr Team arbeitet im Zusammenhang stehen.
Bitte geben Sie an wie VERBUNDEN, VERKNÜPFT oder VERNETZT jedes Konzept mit den anderen ist.
BEACHTE: Vervollständigen Sie nur die weißen Vierecke. Zum Beispiel, im allerobersten Viereck ist gefragt wie zusammenhängend " Möglichkeiten der Produktverbreitung verbessern" und " Produktverbesserung und Innovation" sind. Wenn Sie irgendwelche Fragen haben, wenden Sie sich bitte an den Testleiter.

1 nicht zusammenhängend
2
3
4 gewissermaßen zusammenhängend
5
6
7 extrem zusammenhängend

	Möglichkeiten der Produktverbreitung verbessern	Produktverbesserung und Innovation	Produktmarketing verbessern	Training und Weiterbildung von Angestellten	Änderung der Unternehmensstruktur und –Kultur	Kundensegment erweitern	Kundenloyalität erhöhen	Produktlinien aus dem Betrieb nehmen	Finanzielle Probleme – Stagnierenden Erträge	Verkleinerung des Unternehmens/Stellenabbau	Von Wettbewerb geprägte Wirtschaftsbedingunge
Möglichkeiten der Produktverbreitung verbessern											
Produktverbesserung und Innovation											
Produktmarketing verbessern											
Training und Weiterbildung von Angestellten											
Änderung der Unternehmensstruktur und –Kultur											
Kundensegment erweitern											
Kundenloyalität erhöhen											
Produktlinien aus dem Betrieb nehmen											
Finanzielle Probleme – Stagnierenden Erträge											
Verkleinerung des Unternehmens/Stellenabbau											
Von Wettbewerb geprägte Wirtschaftsbedingungen											

Items:

Möglichkeiten der Produktverbreitung verbessern
Produktverbesserung und Innovation
Produktmarketing verbessern
Training und Weiterbildung von Angestellten
Änderung der Unternehmensstruktur und –Kultur
Kundensegment erweitern
Kundenloyalität erhöhen
Produktlinien aus dem Betrieb nehmen
Finanzielle Probleme – Stagnierenden Erträge
Verkleinerung des Unternehmens/Stellenabbau
Von Wettbewerb geprägte Wirtschaftsbedingungen

Background questionnaire

1. **Bitte geben Sie eine Antwort auf folgende Fragen:**

- Gruppennummer:
- Geschlecht:
- Alter:
- Nationalität:
- Derzeitiges Studium:
- Laufendes Semester:
- Höchster Abschluss:
-
- Ich habe eine Bachelor/Master Abschluss in:
- Ungefährer aktueller Notendurchschnitt
- Abitur Abschlussnote:
- Ich habe bereits als bezahlte(r) Angestellte(r) gearbeitet (Anzahl an Jahren):

2. **Ich habe bereits praktische Erfahrungen (durch Praktikum, Ausbildung oder Anstellung) in folgenden Bereichen erlangt - Bitte wählen Sie alle die zutreffen:**

- ☐ Management
- ☐ Marketing
- ☐ Kundenservice
- ☐ Forschung und Entwicklung
- ☐ Herstellung/Produktion
- ☐ Personalverwaltung
- ☐ Finanzen und Buchhaltung
- ☐ Transport und Lagerung
- ☐ Unterbringung (z.B. Hotels)
- ☐ Gastronomie (z.B. Restaurants)
- ☐ Kunst, Unterhaltung und Erholung
- ☐ Kommunikation und Pressarbeit
- ☐ Andere (Bitte spezifizieren)

3. **Während meines Studiums habe ich Kurse in folgenden Bereichen belegt – Bitte wählen Sie alle die zutreffen:**
   - ☐ Marketing
   - ☐ Business
   - ☐ General Management
   - ☐ Strategisches Management
   - ☐ Betriebsführung (Operations management)
   - ☐ Personalführung
   - ☐ Finanzen und Buchhaltung
   - ☐ Kommunikation und Pressarbeit

4. **Ich habe die folgenden Tätigkeiten bereits im Rahmen eines akademischen Projekts oder eines Jobs durchgeführt:**

Ich habe gar keine Erfahrung mit diesen Tätigkeiten-1 7-Ich habe sehr viel Erfahrung mit diesen Tätigkeiten

Marktforschung - Marktforschungsstudien bezüglich Kunden, wirtschaftliche Rahmenbedingungen, und Wettbewerb initiieren und/oder die Ergebnisse analysieren	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Pläne zur Vermarktung/Werbestrategien entwickeln	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Finanzielle Daten und Berichte analysieren	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Daten über Angestellte analysieren (Bewertungen, Leistungsscores, Befragungen)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Organisationsanalyse entwerfen oder beteiligt sein	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Produkte oder Serviceleistungen entwickeln und/oder entwerfen	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Produkte, Service oder Unternehmen	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7

präsentieren, bewerben und verkaufen

5. **Haben Sie im Rahmen Ihrer akademischen Ausbildung oder eines Jobs bereits gearbeitet mit:**

Graphen, Tabellen, Diagramme

☐ **1-Wenig oder gar keine Erfahrung-1** ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ **7- Sehr viel Erfahrung**

6. **Haben Sie bereits für einen Kurs an Fallstudien gearbeitet die sich mit Betriebswirtschat, Führung oder Vermarktung beschäftigten?**

☐ **Ja**
☐ **Nein**

Wenn ja, geben Sie bitte die Anzahl an Kursen a

7. **Haben Sie bereits für einen Kurs mit einer Gruppe von Studierenden an Fallstudien gearbeitet die sich mit Betriebswirtschat, Führung oder Vermarktung beschäftigten (also in einem Teamprojekt)?**

☐ **Ja**
☐ **Nein**

Wenn ja, geben Sie bitte die Anzahl an Kursen a

8. **Geben Sie an in welchem Ausmaß die folgenden Aussagen auf Sie zutreffen:**

Überhaupt nicht-1 7-Sehr

Ich interessiere mich für Bereiche der Unternehmenswirtschaft (z.B. Marktwachstum, Diversifikation, Unternehmensgründung, Ressourcenmanagement, Produktlinien, Personalführung)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Ich interessiere mich für Bereiche des Marketings (z.B. Werbung, Produktimage, Produktdesign, Branding (Markenbildung), Produktpositionierung, Entwicklung von Verkaufsstrategien, Kundenbefragung, Marktsegmentierung)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Ich habe Interesse an einer Karriere in der Wirtschaft.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Ich habe Interesse an einer Karriere in Marketing.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7

Ich diskutiere oft über wirtschaftliche Themen mit meinen Freunden oder Bekannten.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Ich diskutiere oft über Themen aus dem Bereich Marketing mit meinen Freunden oder Bekannten	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7

9. Geben Sie an inwieweit Sie Erfahrung mit der Arbeit in den folgenden Arten von Teams haben:
Wenig oder gar keine Erfahrung-1 7-Sehr viel Erfahrung

Akademische Projektgruppen (Gruppenaktivitäten mit Fachkollegen in Tutorien oder Übungen)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Produktionsgruppen (z.B. Produkte herstellen)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Servicegruppen (wiederholte Durchführung von Geschäften mit Kunden)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Führungsgruppen (Koordination und Führung der Leistung einer Einheit)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Projektgruppen (technische Planung, neue Produkt- oder Serviceentwicklung)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Beratungsgruppen (speziell zur Lösung eines Problems in einer Einheit oder Abteilung, zur Verbesserung der Arbeitsqualität)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Andere (Bitte spezifizieren)							

Questionnaire Time 2 – after 20 minutes of work

1. Team goal commitment (Hollenbeck et al., 1989)

Geben Sie an in welchem Ausmaß die folgenden Aussagen auf Ihr Team zutreffen:
Trifft nicht zu-1 7-trifft in hohem Maße zu

1. Es fällt unserem Team schwer das Ziel der Aufgabe ernst zu nehmen.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
2. Es ist unserem Team egal ob wir das Ziel der Aufgabe erreichen.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
3. Unser Team ist sehr engagiert das Ziel der Aufgabe zu erreichen.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
4. Es wäre leicht Teammitglieder davon zu überzeugen das Ziel dieser Aufgabe zu verwerfen.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7

2. **Team efficacy**

Wie sehr treffen die folgenden Aussagen auf Ihr Team zu?
Trifft nicht zu-1 7-trifft in hohem Maße zu

5. Mein Team ist zuversichtlich, dass es das Projekt erfolgreich abschließen kann.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
6. Mein Team hat Vertrauen in seine Fähigkeit die Schwierigkeiten des Projekts zu bewältigen.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
7. Mein Team ist überzeugt, dass es in der Lage ist die Anforderungen des Projekts zu bewältigen.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
8. Mein Team glaubt, dass es die Projektaufgaben gut erfüllen wird, auch wenn diese komplexer werden.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
9. Mein Team ist überzeugt, dass es effiziente Strategien entwickeln kann um mit den Anforderungen umzugehen.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
10. Mein Team ist sich sicher, dass es umsetzbare Lösungsvorschläge für das Projekt entwickeln kann.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
11. Mein Team glaubt die Arbeit so organisieren zu können, dass sie den Anforderungen des Projekts entspricht.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

Questionnaires Time 4 – at the end of the task

1. **Task complexity (Maynard & Hakel, 1997)**

Bitte geben Sie an, wie sehr Sie folgenden Aussagen zustimmen:
1-Stimme nicht zu 7-Stimme zu

34. Ich finde diese Aufgabe war komplex	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
35. Diese Aufgabe war geistig anstrengend	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
36. Diese Aufgabe erforderte eine Menge Nachdenken und Problemlösen	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
37. Ich finde diese Aufgabe war anspruchsvoll	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
38. Ich finde diese Aufgabe war schwierig	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

2. **Task uncertainty**

In welchem Maße treffen die folgenden Aussagen zu?
Trifft nicht zu-1 7-trifft in hohem Maße zu

39. Die Anforderungen änderten sich mehrmals während unserer Arbeit an der Aufgabe	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
40. Wir erlebten große Veränderungen in den Arbeitsanforderungen	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
41. Wir rechneten damit, dass die Arbeitsanforderungen sich ändern, während wir daran arbeiten	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

3. Task ambiguity

Welche Aussage beschreibt am besten die Problemstellung an der Sie arbeiteten?

- ☐ Das Problem war relative gut definiert, einfach zu verstehen und einfach zu lösen
- ☐ Das Problem war relativ schlecht definiert, hat für Verwirrung gesorgt, und war schwierig zu lösen

Bitte bewerten Sie auf der zur Verfügung gestellten Skala das Ausmaß, in dem Sie jeder der unten stehenden Aussagen zustimmen.

43.Es gab zu viele Informationen zu berücksichtigen.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
44.Die auszufüllenden Fragebogen waren verwirrend.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
45.Es fiel mir schwer, die Informationen der Materialien dieser Studie zu verstehen.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
46.Ich fand die Materialien dieser Studie nützlich.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
47.Ich hatte den Eindruck, dass ich mehr Informationen benötigte, um korrekte Entscheidungen zu treffen.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
48.Ich habe keine Verbindungen zwischen den Informationen in den Materialien erkannt.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

4. Team familiarity

8. Wie gut kennen Sie Ihre Teammitglieder bei dieser Aufgabe? Bitte wählen Sie eine der folgenden Aussagen:

- ☐ 1 Wir haben uns nie vorher getroffen
- ☐ 2 Kaum
- ☐ 3 Sie oder er ist ein Bekannter
- ☐ 4 Sie oder er ist ein Freund
- ☐ 5 Sie oder er ist ein enger Freund

Team mental model phase 2

Fragebogen

Unten finden Sie mehrere Konzepte, die mit der Fallstudie an der Ihr Team arbeitet im Zusammenhang stehen.
Bitte geben Sie an wie VERBUNDEN, VERKNÜPFT oder VERNETZT jedes Konzept mit den anderen ist.
BEACHTE: Vervollständigen Sie nur die weißen Vierecke. Zum Beispiel, im allerobersten Viereck ist gefragt wie zusammenhängend “ Möglichkeiten der Produktverbreitung verbessern” und “ Produktverbesserung und Innovation” sind. Wenn Sie irgendwelche Fragen haben, wenden Sie sich bitte an den Testleiter.
1 nicht zusammenhängend
2
3
4 gewissermaßen zusammenhängend
5
6
7 extrem zusammenhängend

	Verbesserungen und Neuerungen im Service	professionelle Weiterentwicklung von Angestellten	starker Wettbewerb	sinkender Profit	Schließung von Hotels	gezielte Marketing-Kampagne	Veränderung oder Erweiterung des Zielmarktes	Kundenloyalität	Veränderung der Unternehmensstruktur und -kultur	Kundenanziehung	differenziertes Angebot für Kunden	Verkleinerung des Unternehmens
Verbesserungen und Neuerungen im Service												
professionelle Weiterentwicklung von Angestellten												
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differenziertes Angebot für Kunden												
Verkleinerung des Unternehmens												

Items:

Verbesserungen und Neuerungen im Service
professionelle Weiterentwicklung von Angestellten
starker Wettbewerb
sinkender Profit
Schließung von Hotels
gezielte Marketing-Kampagne
Veränderung oder Erweiterung des Zielmarktes
Kundenloyalität
Veränderung der Unternehmensstruktur und -kultur
Kundenanziehung
differenziertes Angebot für Kunden
Verkleinerung des Unternehmens

Control questions

1. Haben Sie Ihre Teammitglieder getroffen seit Sie an der letzten Aufgabe gearbeitet haben?

☐ Ja
☐ Nein

2. Haben Sie mit Ihren Teammitgliedern außerhalb des Experiments über die Aufgabe, an der Sie in der letzten Phase gearbeitet haben?

☐ Ja
☐ Nein

Questionnaire Time 2 – at the end of the task

4. Goal commitment (Hollenbeck et al., 1989)

Geben Sie an in welchem Ausmaß die folgenden Aussagen auf Ihr Team zutreffen:

	Trifft nicht zu-1 7-trifft in hohem Maße zu
1. Es fällt unserem Team schwer das Ziel der Aufgabe ernst zu nehmen.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
2. Es ist unserem Team egal ob wir das Ziel der Aufgabe erreichen.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
3. Unser Team ist sehr engagiert das Ziel der Aufgabe zu erreichen.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
4. Es wäre leicht Teammitglieder davon zu überzeugen das Ziel dieser Aufgabe zu verwerfen.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

5. Task complexity (Maynard& Hakel, 1997)

Bitte geben Sie an, wie sehr Sie folgenden Aussagen zustimmen:

	1-Stimme nicht zu 7-Stimme zu
34. Ich finde diese Aufgabe war komplex	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
35. Diese Aufgabe war geistig anstrengend	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
36. Diese Aufgabe erforderte eine Menge Nachdenken und Problemlösen	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
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38. Ich finde diese Aufgabe war schwierig	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

6. Task uncertainty

In welchem Maße treffen die folgenden Aussagen zu?

Trifft nicht zu-1 7-trifft in hohem Maße zu

39. Die Anforderungen änderten sich mehrmals während unserer Arbeit an der Aufgabe	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
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7. Task ambiguity

Welche Aussage beschreibt am besten die Problemstellung an der Sie arbeiteten?

☐ Das Problem war relative gut definiert, einfach zu verstehen und einfach zu lösen
☐ Das Problem war relativ schlecht definiert, hat für Verwirrung gesorgt, und war schwierig zu lösen

Performance instructions and rating

General Instructions

7. Read all the information included in the study materials, including the case study description, the roles, the plan, the change (note that not all groups received the change) – a summary of this information is included in the document but the original materials should be reviewed as well to ensure familiarity with the level of detail required for an informed assessment.
8. Read first the performance rating sheet, note all definitions, subdimensions, and items included.
9. Read through each plan once before rating and pay attention to – the actions described, the resources used, the timeframe, the outcomes.
10. After reading the plan once, you may start rating their solutions based on the dimensions provided in the rating sheet. When rating each dimension, read the element to which it refers in order to offer your rating (e.g., when completeness of actions is the dimension rated, read the dimension description and items first, afterwards read the strategies stated in the plan relating them mentally to the dimension items, and then give your rating for each item **across all** strategies described in the plan. Note the scale when giving your rating – when less than half of the actions can be best described by the dimension items, then offer the corresponding score. Some strategies may be better represented by the items, while some not. When you offer your rating remember that you are rating the overall plan. Thus for a plan consisting of overall complete actions, one incomplete action will not lower the score considerably – see rating scale)
11. Rate one plan at a time for all dimensions.
12. The scores must be in numeric form.
13. There will be two ratings, one for phase 1 and one for phase 2. The same requirements apply to both.

Key issues Phase 1 Case Study:

Company:

- Fruit juice company
- Stable workforce and low turnover
- Organizational culture – values: tradition, conservatism, self-discipline, respect for authority, formality, politeness, reliability
- Stable customer segment
- Sustained success on the market
- Efficient distribution operations
-

Business:

- Increasing competition
- Decreasing customer demand
- Loss market share per category
- Low product innovation and variation
- Rejection of new business ideas by management

Organization:

- Hierarchical functional structure, low interdependence between departments
- Unbalanced departmental contribution – new product development

Resistance to change:

- Work innovation
- Product improvements
- Company image
- Customer outreach

Objectives:

Primary:

- **Regain and consolidate market position**
- Increase sales

Sub-goals (goals stemming from primary objectives):

- Retain existing customers and attract new customers
- Develop and introduce new products and services
- Revitalize company by changing the company culture and/or structure to reflect innovative orientation, integration and cooperation among units (departments)
- Improve company image

Key issues Phase 2 Case Study:

Company:

- Hotel mini-chain business category
- Stable workforce and low turnover
- Organizational culture – values: professionalism, respect, responsibility, reliability, commitment to the business
- Stable customer segment

- Sustained success on the market
- Efficient sales operations

Business:

- Increasing competition
- Decreasing customer demand
- Loss market share per category
- Low product innovation and variation
- Rejection of new business ideas

Organization:

- Functional structure, moderate interdependence between departments
- Unbalanced departmental contribution – sales and marketing
- Work according to standard operating procedures, individual autonomy and initiative not encouraged

Resistance to change:

- Customer market redefinition
- Product and service innovations
- Company image
- Product marketing
- Voluntary staff turnover due to constraining culture and strategy

Objectives:

Primary:

- Adapt to the changing market structure and demands
- Increase sales

Sub-goals (goals stemming from primary objectives):

- Retain existing customers and attract new customers
- Variations and innovations in products and services
- Employee empowerment and reward for initiative
- Organizational culture - Interdepartmental integration and openness

Performance requirements Phase 1

The new CEO made an internal assessment and found the following problems with the company current system:

CoolBev had a stagnant performance in that annual revenues were stuck at $40 million and profits hadn't risen for two years straight. The company seemed to not be able to keep up with the changing market structure and demands. Against this backdrop of stalling innovations and increasing competition, there was pressure by the parent company for the provision of accurate forecasts regarding company improvement efforts, including budget projections, expenses, and personnel changes.

Issues:

- Stagnant performance
- Stalling innovation
- Increasing competition

You have been commissioned as a taskforce of external consultants who will be working with the CEO and an internal taskforce to address some of the company problems. You are required to develop an integrated plan to address these CoolBev problems. You are required to provide a list of company strategies aiming to improve the key areas determined based on the information you were provided with. Further, you are required to specify the objective outcomes that the company may hope to achieve if it implements these strategies. When developing your strategies, also mention the estimate timeframe for implementation and the costs or resources that may be required to implement the strategies.

Requirement:

- Improvement strategies
- Time
- Budget
- Outcomes

Strategy - all activities that will be performed in the project and descriptions of each activity to ensure that project staff will understand how the work is to be done (please list between 6-15 actions when developing your plan)

Outcome: An outcome is the brief, clear statement identifying in measurable terms the intended result of the proposed improvement strategies (e.g. % increase in sales, X number of new products, % new customers in a segment etc.)

Resources and timeframe – estimated costs or material resources needed to implement the actions and estimated timeframe to implement the actions within the company (e.g., 6 months, 2 weeks)

Throughout your work, new information or requirements may become available. You have to integrate new information with your current goals and incorporate any changes into your plan.

The efficiency and effectiveness of your actions, as well as the potential to improve the current company business will be equally weighted in the final assessment of the project. Your plan will be rated by professionals in the organizational development and change area. You will receive a score for your plan that corresponds to the criteria of **efficiency, effectiveness, and innovativeness**, with an equal distribution for each criterion.

- Efficiency – can the actions be implemented within a given timeframe and using an amount of resources?
- Effectiveness – will the actions solve the company problems?
- Innovativeness – are the actions adding something new to the business?

Performance requirements Phase 2

After 30 years during which it headed the business hospitality market, the Orchad hotel chain met sales declines about four years ago. The number of nights spent by guests in hotels started to decrease compared to previous years. The parent company demanded that Orchad shows signs of improvement, including sales, budget expenditure, and personnel changes urgently or they will cut down the budget and start closing hotels. The level of improvements and innovations in each hotel was also problematic as was the increasing competition, thus the company seemed to not be able to keep up with the changing market structure and demands.

Issues:

- Decrease hotel occupancy
- Sales declines
- Lack of innovations
- Changing market demands

You have been commissioned as a taskforce of external consultants who will be working to address some of the company problems. You are required to develop an integrated plan to address these Orchad problems. Your task is to develop a list of company strategies aiming to improve the key areas determined based on the information you were provided with. Further, you are required to specify the objective outcomes that the company may hope to achieve if it implements these strategies. When developing your strategies, also mention the estimate timeframe for implementation and the costs or resources that may be required to implement the strategies.

Requirement:

- Improvement strategies
- Time
- Budget
- Outcomes

Strategy - all activities that will be performed in the project and descriptions of each activity to ensure that project staff will understand how the work is to be done (please list between 6-15 actions when developing your plan)

Outcome: An outcome is the brief, clear statement identifying in measurable terms the intended result of the proposed improvement strategies (e.g. % increase in sales, X number of new services, % new customers in a segment etc.)

Resources and timeframe – estimated costs or material resources needed to implement the actions and estimated timeframe to implement the actions within the company (e.g., 6 months, 2 weeks)

Performance rating procedures

The efficiency and effectiveness of your actions, as well as the potential to improve the current company business will be equally weighted in the final assessment of the project. Your plan will be rated by professionals in the organizational development and change area. You will receive a score for your plan that corresponds to the criteria of efficiency, effectiveness, and innovativeness, with an equal distribution for each criterion.

- Efficiency – can the actions be implemented within a given timeframe and using an amount of resources?
- Effectiveness – will the actions solve the company problems?
- Innovativeness – are the actions adding something new to the business?

Rating scale

– Rate the extent to which the following propositions characterize the statements described in the team's plan (with respect to strategies, resources, outcomes, as case, based on dimension descriptions)

1 - none or almost no action

2 - very few actions

3 – less than half of the actions

4 - half of the actions

5 - more than half of the actions

6 – many but not all

7 - almost all actions

There is only one example for low, medium, and high level of characteristic defined, but note that to rate the group's work with the corresponding level most of the proposed solutions would have to have the same level of the attribute. For example, if 2 of 8 strategies can be described as incomplete (see below) then the team's plan should be rated with 6 or higher on completeness.

1. **Efficiency** – refers to how well they use the resources available in developing the plan; the task requires that they develop a list of suggestions taking into account the investments required to implement those strategies. Efficiency is about doing things in an optimal way, using the proper amount of resources such as money and time. It could be the wrong thing to do, but it was done optimally.

2.1.General - There is a detailed plan (including time schedules, milestones, budget etc.) for the completion of the project:							

1. There is a detailed budget for the project. [most of the actions proposed include an estimation of the budget, specific or general, broken down or as overall expense]							
2. There is a detailed timeframe for the project. [they mentioned the time interval or duration needed to implement the strategies or the starting date or the ending date; the interval takes precedence such that when they mention most of the time the starting or ending times but not the interval (e.g., 6 months) they obtain a lower score]							

2.2. Appropriateness of timeframe – the interval that they specified for the implementation of the strategies is feasible within the organizational and larger environment constraints (i.e., considering the amount of work to be done, obtaining access to resources, putting the proper mechanisms and processes in place, obtaining feedback on actions).

Example

1 - integrate departments and create project groups - 3 months – business reorganization considering the amount of effort and personnel involved, adjustments to the new organizations, etc, should take more time
3- change hotel from business to leisure - 6 months - almost realistic, more likely 8-12 months
7 - hire employees in marketing and media communication - 5 months – appropriate timeframe to advertise position and recruit personnel

1. Is the timeframe specified realistic for the implementation of the plan actions?							

2.3 Appropriateness of resources – refers to the budget they specified for developing and implementing the proposed actions; indicates an awareness and knowledge of the likely costs associated with the implementation of the strategies, including materials, personnel, processes, adjacent costs (e.g., administrative, operational) that can impact the budget required; an optimal budget would thus reflect a realistic estimation of all these costs (without referring to them in specific). When rating, assess their strategy and consider what elements may be related to their implementation that may impact total budget – for instance, would it require a large workforce, are there expensive materials needed, would specialized assistance be needed. Use your best judgement and note that this is just an estimation of the level of realism and awareness implied in their solution, i.e. it does not have to match real costs entirely.

Example

1 – close down hotel 8 - no costs - there are high costs involved in closing down businesses
3 – 100.000 $ to change hotel 8 from leisure to business – requires significant investment in

changing the infrastructure, internal components, staff, etc which should amount to more than this 7 – close down a hotel and restructure other 2 - 500.000$ - considerable investment in modifying the space, include staff costs, feasible estimation							
1. Are the resources specified realistic to achieve the implementation of the plan actions?							
3. Usefulness/Relevance: The extent to which the actions proposed are feasible and appropriate for addressing the problems. The strategies that they propose must be clearly related to the task they are required to complete; there is a set of requirements and clear information with respect to the business issues for which they have been employed. Thus all the strategies that refer directly to the business problems are relevant for the organizations. Less relevant actions are tangential to the priorities, do not address the goals directly, and cannot be tied to any specific problem but tend to be more general-purpose strategies. Nice to have but not need to have. **Example** 1 - redistribute positions - more workers in the marketing and fewer in production – the text does not mention that they have too few workers in the marketing area and too many in the production nor due the materials suggest so (considering that in any business the operation department employees will outnumber other departments' staff) 3 - hire new employees for the business hotel - may not be relevant if the cause of low performance is not the current employees but their level of development 7 - change organizational structure to matrix especially for marketing and product – cross-departmental project work in these areas may boost business development; if they mention transition to matrix structure generally then it is not relevant because the whole business would not benefit this change							
1. Actions serve the purposes described in the plan statement and case description.							
2. Solutions display knowledge of existing company facts and context and satisfy the requirements specified in the problem statement.							
3. The actions satisfy real company needs.							
4. Fully satisfying the company's objectives takes precedence over other objectives.							
5. Read the following items and rate the extent to which the problems addressed in the actions are important for the school current problems (are the actions proposed better described by items on the left than those on the right): Significant – insignificant Essential – inessential							

Necessary – unnecessary Important – unimportant							
4. Implementability - Refers to whether the solutions that they propose can actually be implemented given the time and resources constraints; can the realization of the desired outcome be visualized; are there actual ways in which the solution could be implemented given the company's context, internal and external environment; is the solution realistic with respect to demands placed on the organization for its implementation; can it be characterized as a realistic solutions or departs to the realm of the inventive where a modality to implement it is difficult to visualize. **Example** 1 – job rotation between front and back office – personnel have very different training thus it may be difficult to realize the exchange without the employees being able to learn in short time the specifics of the job they are doing which is based on education and specialized training 3 – hire a mediator between management and employees so that these can better share their innovative ideas 7 - develop a new product based on market analysis							
1. The actions, as they are specified in the plan, can be translated into realized actions, put into practical effect.							
2. Solutions are reality oriented.							
3. Read the following items and rate the extent to which the actions proposed are better described by items **on the left** than on the right: Feasible – infeasible Operable – inoperable Workable – unworkable Functional – nonfunctional Usable – unusable							
5. Value-added: **Value created and captured – cost of creating that value** The extent to which actions significantly contribute to the improvement of the organizational systems; increases or is likely to increase organizational effectiveness or business performance thus justifying the investments; serve to reduce or solve current problems in a direct and specific manner and contribute to the successful long-term effectiveness of the company – by implementing the strategies the company is likely to earn short- and long-term performance increments; compare the current business and organizational context with the future context which can be reached by implementing the strategies proposed – what is added vs. what is – is it relevant, is it likely to create new value; the goal is to have the value of the end-product, service							

or organizational change exceed the cost of producing the product or providing the service or implementing the organizational change. At the business level, value-add contributions include such measurable roles and activities as: saved money, satisfied customers, increased sales, or significantly reduced time or steps necessary to complete a work process. At the organizational level, they include employee satisfaction, retention, performance, efficient organizational integration, culture or climate improvements with long-term benefits.

Example

1 – job rotation between front and back-office – to the extent that this is implementable, it would require the company a great deal of effort to train the employees changing positions into each other's role since they are trained in completely different areas
3 – company intranet for the workers to share their ideas – may be efficient to improve communication but since not all workers have access or use electronic communication in their daily jobs, the value added is questionable
7 - training and development of employees especially with respect to services; patent products

1. The extent to which actions add value more than if they were not implemented or beyond other actions**.**							
2. Actions go beyond the standard expectations and provide something "more" to the client or users.							
3. The results of implementing the actions represent a definite improvement in performance over the way clients used to perform these activities.							
4. The actions better influence the delivery of other organizational processes.							

6. Impact - Refers to business (i.e., product and market related) and organizational related strategies that bear the potential to cause significant shifts in company internal affairs or external position. The extent to which actions proposed induce fundamental changes and create a departure from existing practices in the organization.

Example

1 – improve services - 24 h reception – requires only the hiring of additional personnel; unlikely to have great impact on the organization or business profits
3 – ask for customer feedback – may be source for new business ideas but unlikely to create major shifts
7 - change company culture - creativity, autonomy, open communication, empower R&D – mostly radical changes from standardization and rigidity

1. By implementing the actions, a change in the status quo would be likely to result.							
2. In order to develop and introduce the new actions, the organizational structure/ the organizational processes / the organizational culture has to							

be significantly changed.							
3. The implementation of the actions proposed will place much demand on the organization.							
4. The implementation of the actions will cause much disruption.							
5. The implementation of the actions proposed will require much coordination effort.							
6. Many different groups will be involved in the implementation of actions proposed.							
7. The consequences of the actions proposed would be great.							
7. Originality/Uniqueness - Must generate surprise, not typically what you would think of given the context of the task; infrequency of the usefulness, uncommonness, or statistical occurrence; unique, not generated by any other group; differs from novelty (see below) in that an idea may be original but not add value – novelty consists of originality and value-added where the need for the strategy proposed is obvious from an organizational standpoint; on the other hand originality does not assume value – an idea may be unusual but bring little benefit to the company; original ideas are not straightforward, they cannot be inferred based on the information available, are not obvious, they are not the first thing that comes to mind, presuppose considerable reorganization of existing knowledge **Example** **1 –** close down a hotel because it is not producing any profit; extend the reception opening hours **3 –** offer customers reward or discount for filling out feedback form **7 –** create internet page where customers can create their products and these can be rated and then added to the portfolio when they gather many positive ratings; decrease the number of rooms by uniting two rooms							
1. The extent to which the actions proposed are unique and elicit surprise on the part of the evaluator.							
2. The actions proposed represent a unique, unusual, original, surprising and unexpected vs. usual, ordinary, commonplace, customary, and expected approach to the problem.							
8. **Novelty** – The degree of extrapolation from the stimulus context (the problem scenario presented). The degree of novelty of the solution. Solution adds to existing knowledge. Solution develops new knowledge. They go beyond inferences based on the existing information, combine and translate the information into new meanings; cannot trace action to the information in the text, build on but go beyond it; propose new concepts, new meanings, reorganization of knowledge, reframing. **Example** **1 –** employ external marketing company to develop creative advertisement - information was included in the case study							

3 – commercials in different locations **7** – promote product at competitions and offer free product for a period of time							
1. The group approached the problem in a novel, imaginative, unpredictable, or innovative manner.							
2. The group went beyond the stimulus materials provided to include additional material and experiences.							
3. The group included a large amount of information that is new to the group.							
4. The actions proposed suggest new ways of looking at existing problems.							
5. The actions proposed open up a new conceptualization of the issue.							
6. The actions proposed offer ideas for solving apparently unrelated problems.							
7. The solution indicates a radically new approach.							
8. The solution offers a fundamentally new perspective on possible solutions.							
9. Outcomes An outcome is the brief, clear statement identifying in measurable terms the intended result of processes and services of the unit. Outcomes focus on the specific performance stakeholders are expected to demonstrate when the unit achieves its goal. Must be specific, to show what they will obtain, to be relevant for the task (see action relevance) and to be derived from or consistent with the actions that they propose **Example** 1 – reduce costs – vague; improve company creativity --> better work climate – not relevant for the task and it is not derived from action proposed 3 – new contracts with cafeterias 7 – 13% increase in sales in the specific customer segment 18-34 age							
1. Elaboration – outcome described in sufficient detail for the stakeholders to have a clear perspective on the areas that will be improved, how, and how much.							
2. Relevance for the task – outcomes address the goals, problems, requirements, and needs of the school (example inappropriate – attract more students to the school; appropriate – attract more teachers to apply to the school).							
3. Specificity - The extent to which the outcomes described are specific, measurable, attainable, relevant/results oriented and time bound.							
4. Long-term/Short-term focus - does the outcome speak to long or short term school effectiveness (e.g., long-term – sustainable sales for the next 3 years; short-term - increase sales for the next 3 months).							

Note the **Novelty** dimension. The suggested actions may draw more on the case study and other information provided, draw on this information and go beyond it, or be to a considerable extent new to the group. In order for you to make the judgment of novelty, please read in detail the information provided in the materials. Participants use information in the case study, role information, plan description to help them suggest actions (and, when case, information in the changes). Thus, although some of the actions may appear novel, you may find them in the information available. To help you further make the judgment of novelty, note the categories table referring to existent information. Read the categories before making any judgment of action novelty, to enable you to determine to what extent the actions suggested are novel. Note for instance:
Marketing strategies as advertising on TV, online on specialized websites as expedia and tripadvisor would build on the information included in the case study to a large extent; extend technical system to leisure customers, change hotel 6 to leisure from business, and extend the product line to different shops and locations - supermarkets, café's, restaurants would go beyond the information in the case study but not radically; organize juice sampling day at schools universities to determine which product has the potential to attract a large customer market or promote product at competitions and offer free product for a period of time would go beyond the information in the case study to a large extent.

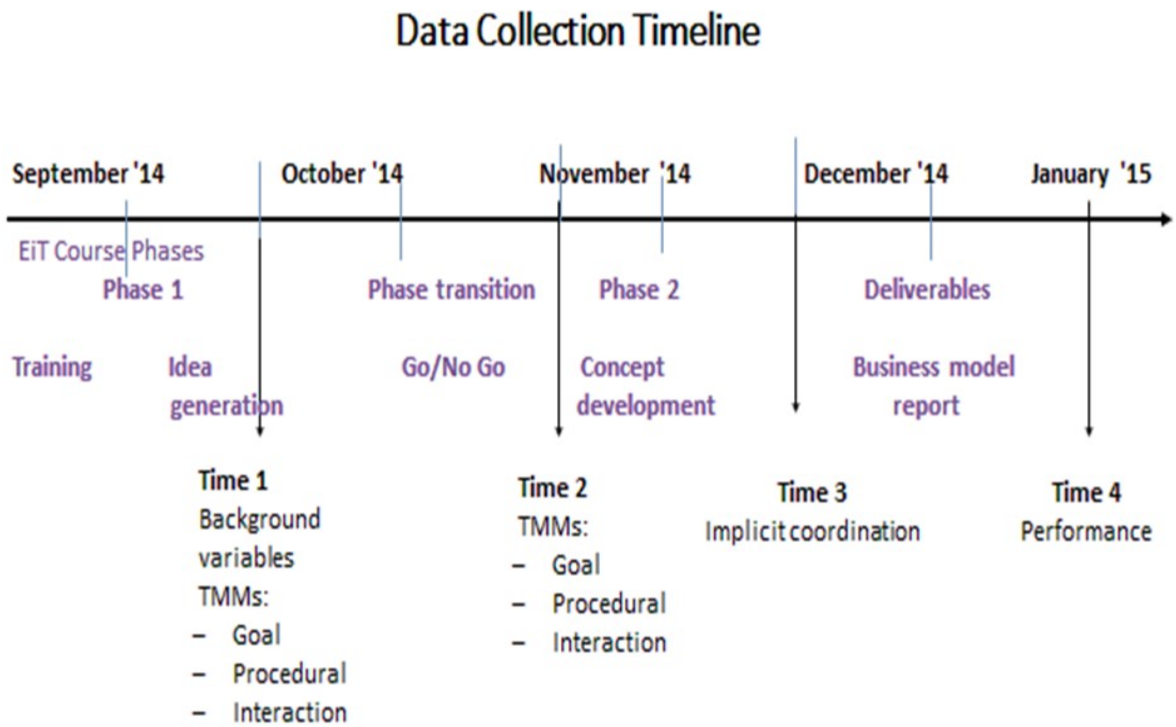
Strategies categories – information existent in the text

1. Products and services	
Case study 1	Case study 2
Product composition: - 100% natural ingredients i.e. fruit juice or fruit juice concentrate, - types of fruit used in the production of the juices	Room equipment - All rooms are equipped with telephone, an alarm clock, a TV, and broadband Internet connectivity. Some rooms include a work desk. Room space – not very spacious Room type – single, double, twin Competition - variation in their services offer, for example special rates to encourage group travel, accessible drinks or snacks, and specially designed rooms with work desks Proposed new combinations of adjacent services (drinks in the room, sport facilities, city tours) and special rates with bonuses and discounts for leisure and business group travelers. Proposed innovations and service improvements Proposed improvements to rooms and adjacent offers and discounts Proposed innovative services and group travel offers
2. Product distribution	
Schools and restaurants Vending machines in cafeterias Proposed new product distribution channels, such as distributing the products on the airport, on the beaches, or at cinemas/art galleries	Customer referrals Loyal customer base - personalized offers to repeat business customers Quarterly and annual reports and informative brochures for the executives and existing customers and not that

Customers purchase of product with a meal and when not at home Customer opinion that products not easily accessible	much informational packages or campaigns for new customers
3. Business operations	
Complex information technology system for product orders and distribution Product development and testing labs where small staff focused on improving the flavors and the efficiency of the company's factory processes.	Technological sales automation application which kept track of existing customers in the business category Process improvement team and designers – focused on improving the company's spaces and the efficiency of the company's processes and services.
4. Marketing (offers, customer segment)	
Usually point-of-purchase posters Proposed TV commercials Customers obtain information about products from television	Advertised directly to the customers or by using preferred points of contact such as certain businesses and restaurants. Proposed to advertising on different channels including online media, television and flash offers in entertainment facilities Customer search for information on specific channels as specified in the table
5. Organization culture	
calm and civilized conservative formal polite reliability Creativity and marketing issues were not as essential as actual work Creativity seemed to not be appreciated within the company. Generally, people were happy to do the same things When creative employees joined the company, management didn't know what to do with them—apart from forcing them out the door.	stable and civilized professional respectful and responsible attitude highly reliable religiously adhered to the hotel standards and procedures Individual autonomy and initiative not encouraged Employee ideas not listened to
6. Organization – structure – integration, other forms of organization	
Not much integration between the different departments Each department carried out its functions independently, and rarely sought input from the other Each function in a company has a special set of skills Unbalanced departmental contribution – new product development: the Research and Development department in the organization was considered to be only an implementer	Front office – back office division - back house - removed from most of the day-to-day operational problems faced by the operational staff. Unbalanced departmental contribution – the Sales and Marketing department in the organization was considered to be only an implementer

7. **Business structure – hotels, lines of beverages**	
Unprofitable juice lines – bottle size, packaging	High level of standardization - increasing trends in service personalization Unprofitable hotels Profitable hotels but for the wrong customer segment
8. **Customers**	
Stable customer segment Decrease sales in 18-24 and 25-34 customer age segment Customer dissatisfaction with offer, accessibility, novelty and customer service	Stable customer segment Loss in market share in the 40-49 year old bracket. 20-30 age segment travel more Different improvement needs for business and leisure customers (as specified in table)
9. **Employees**	
Stable workforce and low turnover Employee dissatisfaction with professional development opportunities, opportunity to influence how things are done, career development Research and development people were often demoralized; they stopped looking for creative ideas; their best ideas were not pursued.	Stable workforce and low turnover Employee dissatisfied with professional development opportunities, career development, opportunity to influence how things are done, recognition Sales and Marketing - many ideas for service improvement, customer attraction, and company expansion but because management was not interested in new projects their ideas were not pursued which made them feel their talents were not appreciated; demoralized

Study 3


Data Collection Timeline
September '14
October '14
November '14
December '14
January '15
EiT Course Phases
Phase 1
Phase transition
Phase 2
Deliverables
Training
Idea generation
Go/No Go
Concept development
Business model report
Time 1
Background variables
TMMs:
– Goal
– Procedural
– Interaction
Time 2
TMMs:
– Goal
– Procedural
– Interaction
Time 3
Implicit coordination
Time 4
Performance

Study cover page

Informed Consent

[This is a consent form that includes all of the required information that research participants are required to know before giving consent. Please read this consent document carefully before you decide to participate in this study.]

My name is Andra Toader, I am a PhD candidate within the IMPRS Uncertainty program jointly conducted by the Max Planck Institute of Economics and Friedrich Schiller University, Jena, Germany. The Interdisciplinary doctoral program combines approaches from Economics, Law, and Psychology to explain human decisions under uncertainty more effectively and to better design institutional responses. My thesis proposes to identify and analyze the factors that influence the effectiveness of interdisciplinary teams in organizational and institutional environments. Part of the degree involves a research project or thesis, as described further.

Identification of Project: Investigation of the Factors that Influence the Effectiveness of Interdisciplinary Project Teamwork

Purpose of the Research: The research project will study Interdisciplinary teams working on innovative projects to determine the factors critical for team success, and to create formal models that can inform future team design and team training. You are invited to participate in this study because you are a student in the **Experts in Teams course at the University of Southern Denmark**, which has as a cornerstone Interdisciplinary teamwork.

Procedure: The first part of the project consists of a monthly survey on teamwork experiences, which you will receive starting September 2014. The survey, containing single, multiple-choice, and open-ended questions, will ask you about your **motivation, communication, team interactions and events experienced** during different phases of your EiT project. You'll receive the first survey on **September 17th**. The next three surveys will be sent **mid-October, mid-November, and mid-December**. You will receive an email notification one day before being sent the actual survey. You will receive a participation reminder when you have not managed to complete the survey within three days of the first survey email. **The surveys should take approximately 20-30 minutes to complete and can be done at your convenience**. Your responses will be collected electronically, via a web page accessed through the email link which I will provide. As of October, I may also collect your responses directly, by means of a paper-and-pencil survey instead of an online survey.

Usefulness of study and participant benefits: By taking part in this research, you will be helping the researcher to identify methods and processes employed by Interdisciplinary teams in the project development process, with the purpose of improving the quality and effectiveness of teamwork.

Participant Rights: Participating in this study is **completely voluntary**. Doing so will help further the scientific study of teamwork effectiveness. This does not stop you from changing your mind if you wish to withdraw from the project. If you agree to participate, please indicate your agreement through the consent form on the next page.

Confidentiality: Your answers are **completely confidential** and will be released only as summaries in which no individual answers can be identified (for example, “85% of students stated that . . . .”). No indicators of your identity will appear in the thesis. All names and personal data submitted will be transformed into numeric and alphanumeric labels, without any reference to you or any of the other study participants.

If you have any questions about this study, please contact me at:

Andra Toader

PhD Candidate IMPRS Uncertainty, Psychology FSU Jena

Email: andra.toader@uni-jena.de

Bachstr. 18k, Room 212, 07743 Jena, Germany

Informed consent

This consent form is to facilitate the gathering of information for a PhD thesis. The research is looking at the team processes and behaviors that facilitate diverse project team effectiveness.

I confirm that I understand the purpose of the research and the study procedures.

I am participating voluntarily.

I give permission for data to be used for analysis and reporting.

I understand that I may ask questions at any time and can withdraw my participation without prejudice.

I understand that anonymity will be ensured in the write-up by disguising my identity.

If you click agree, it is implied that you have read the information above about the research, your rights as a participant, and give your voluntary consent. You may print out a copy of this informed consent form to keep.

Please tick one box:

- ☐ I agree to participate in the project
- ☐ I do not agree to participate in the project

Questionnaires

Background questionnaire

Please answer the following questions about your education and experience. (Please skip questions that do not apply).

EiT theme:

Group number:

Name:

How many members are in your team, including yourself?

Email address:

Gender:

Age:

Nationality:

Native language (if not Danish):

Highest degree:

Total number of years of education (include schooling years, university years, and other institutional training years):

Approximate average academic grade for the past academic year attended:

Prior studies (IF CASE):I hold another Bachelor's degree in:

____

I have taken specialization and/or qualification courses in (include workshops, seminars, skill development courses **other** than academic ones):

____

I have worked as a salaried employee for (specify number of years):

____

I have been self-employed in the past:

- ☐ Yes
- ☐ No

I am currently self-employed:

- ☐ Yes
- ☐ No

At your current job or the job for which you worked the longest if currently not employed, were you tasked with the coordination of a temporary project:

- ☐ Does not apply
- ☐ Yes
- ☐ No

At your current job or the job for which you worked the longest if currently not employed, did you hold an official leadership position (e.g., team leader, manager):

- ☐ Does not apply
- ☐ Yes
- ☐ No

I have gained practical experiences (through internships, apprenticeship or working as an employee) in the fields of - select all that apply:

- ☐ Management
- ☐ Marketing/customer service
- ☐ Accounting/ controlling
- ☐ Engineering
- ☐ Research and Development
- ☐ Manufacturing/Production
- ☐ Human resources

Rate extent to which you have experience working in the following types of teams (select all that apply):

- ☐ Academic project groups (peer group activity in lab classes, tutorials)
- ☐ Production groups (e.g., manufacturing products)
- ☐ Service groups (conduct repeated transactions with customers – telecommunications, maintenance)
- ☐ Management teams (coordinate and direct performance of a unit)
- ☐ Project groups (engineering, new product or service development)
- ☐ Advisory groups (created specifically to solve a problem in a unit or department, to improve quality of work)

Have you worked before with the members of your EiT team?

- ☐ None
- ☐ Some
- ☐ All

Did you have the idea for the group project before the group first formed?

- ☐ Yes
- ☐ No

Control variables

Please rate the extent to which these statements apply to you:

1. Goal commitment (Hollenbeck et al., 1989)

	1 - Does not apply 7 - Applies completely
1. It's hard to take this project's goals seriously	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
2. Quite frankly, I don't care if I achieve the goals for this project or not	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
3. I am strongly committed to pursuing this project's goals	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
4. It wouldn't take much to make me abandon this project's goals	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
5. I think this project's goals are a good goals to shoot for	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

3. Goal orientation (Button et al., 1996)

	1-Disagree 2 3 4 5 6 7-Agree
I enjoy it when others in the class are aware of how well I am doing on an assignment	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
I prefer tasks where I can prove my ability to others	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
I prefer to avoid situations where I might perform poorly.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
Avoiding a show of low ability is more important to me than learning a new skill	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
When I don't understand something I prefer to avoid asking what might appear to others to be 'dumb questions' that I should know the answer to already	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
I try to figure out what it takes to prove my ability to others	☐ ☐ ☐ ☐ ☐ ☐ ☐
I enjoy challenging and difficult tasks where I'll learn new skills	☐ ☐ ☐ ☐ ☐ ☐ ☐
I'm concerned about taking on a task if my performance would reveal that I have low ability	☐ ☐ ☐ ☐ ☐ ☐ ☐
I prefer situations that require a high level of ability and talent	☐ ☐ ☐ ☐ ☐ ☐ ☐
I would rather prove my ability on a task that I can do well at than try a new task	☐ ☐ ☐ ☐ ☐ ☐ ☐
I am willing to select a challenging work task that I can learn a lot from	☐ ☐ ☐ ☐ ☐ ☐ ☐
I often look for opportunities to develop new skills and knowledge	☐ ☐ ☐ ☐ ☐ ☐ ☐
I'm concerned with showing that I can perform better than my colleagues	☐ ☐ ☐ ☐ ☐ ☐ ☐
I would avoid taking on a new task if there was a chance that I would appear rather incompetent to others	☐ ☐ ☐ ☐ ☐ ☐ ☐
For me, development of my ability is important enough to take risks	☐ ☐ ☐ ☐ ☐ ☐ ☐
I often read materials related to my specialization area to improve my ability	☐ ☐ ☐ ☐ ☐ ☐ ☐

4. Self-efficacy

	1-Does not apply 2 3 4 5 6 7-Applies completely
I am confident that I can solve the planning task successfully	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
I am confident in my ability to cope with the challenges in the planning task	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
I am confident in my capability to manage the requirements of this task	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

I believe that will perform well in the task even if the task becomes more complex	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
I am confident that I can develop efficient strategies to deal with the task requirements	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
I am certain that I can develop implementable solutions for this task	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
I believe that I can organize my work to fit the demands of the task	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

4. **Team orientation (Driskell, Salas & Hughes, 2010)**

Please rate the extent to which these statements apply to you:

1-Does not apply 2 3 4 5 6 7-Applies completely

If given the choice, I would prefer to work as part of a team rather than work alone	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
I find that working as a member of a team increases my ability to perform effectively	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
I generally prefer to work as part of a team	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
For most tasks, I would rather work alone than as part of a group	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
I can usually perform better when I work on my own	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
I prefer to complete a task from beginning to end with no assistance from others	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
I would rather take action on my own than to wait around for others' input	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

5. Team communication frequency

How often did your team communicate during this phase of work:

	1-Infrequently or not at all 7-Very frequently
Face to face meetings	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
Telephone or computer mediated communication (e.g., skype)	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
Email or other written communication forms	

6. Team interdependence (Campion, Medsker, & Higgs, 1993)

How much do you agree with the following statements?

	1 – Disagree 2 3 4 5 6 – Agree
I cannot accomplish my tasks without information or materials from other members of my team	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
Other members of my team depend on me for information or materials needed to perform their tasks	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
Within my team, jobs performed by team members are related to one another	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
My work goals come directly from the goals of my team	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
My work activities on any given day are determined by my team's goals for that day	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
I do very few activities for this project that are not related to the goals of my team	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

7. Team mental models:

a. Goal TMM

What are your team's goals or priorities for this project?

____

____

b. Procedural TMM

How do you need to execute the tasks to achieve your goals? Specifically, what's the process to get work done? What's the procedure to get the work done?

____

____

c. Interaction TMM

How has your team established how members make contributions to the project?

____

____

8. **Team implicit coordination**

Think about your previous phase of work and rate the extent to which the following statements apply to how your team worked in this period:

1 - Does not apply 6 - Applies completely

Members passed information to one another relevant to the task in a timely and efficient manner	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Members communicated information about their status, needs, and objectives as often as needed (and not more)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Team members offered project relevant information before it was requested	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7

9. Team performance

1. How would you rate the novelty of this product?	0 (nothing new or original about the product proposal, just existing solutions and knowledge represented in a new way)-100 (the product proposal is entirely new and original
2. How would you rate the market potential of this product?	0 (the product proposal will not be sold or be sufficiently profitable to bring onto the market)-100 (the product proposal will most likely be sold and be profitable to bring onto the market)
3. How would you rate the usefulness of this product?	0 (the product proposal does not sufficiently meet the needs and wishes of the relevant target group)-100 (the product proposal is completely in tune with the needs and wishes of the relevant target group)

Declaration of Ethical Conduct

I, Andra Toader, PhD candidate at Friedrich Schiller University and the International Max Planck School for Adapting Behavior in a Fundamentally Uncertain world hereby declare that I am aware of the doctoral code of conduct of the Friedrich Schiller University and that I have abided by the ethical guidelines during the preparation of my dissertation.

I have composed the dissertation myself, I have not used in my dissertation written or verbal sources without explicitly stating this in the dissertation citations.

I have received no paid services for the choice and assessments of the materials and the production of the manuscript. The research support that I received is acknowledged in the dissertation.

I have not used the services of a doctoral consultant and no third party has received direct or indirect monetary benefits for the work related to the dissertation.

The dissertation has not been submitted as an examination paper for a state or another scientific examination.

I have not submitted any part of the work described in this dissertation to another university or faculty.

Jena, 15.05.2016

Andra Toader

Curriculum Vitae

Personal information

Surname:	Andra-Florina
Name:	Toader
Place of birth	Braila, Romania
Nationality	Romanian
Academic information	
07.2013-06.2016	Doctoral candidate at the Friedrich Schiller University, Psychology Institute and the International Max Planck Research School on Adapting Behavior in a Fundamentally Uncertain World, Jena, Germany
09.2011-06.2013	**Master of Arts, Organizational Psychology and Human Resources** University of Bucharest, Faculty of Psychology and Educational Sciences, Psychology Department, Bucharest, Romania
09.2008-06.2011	**Bachelor of Arts, Psychology** University of Bucharest, Faculty of Psychology and Educational Sciences, Psychology Department, Bucharest, Romania

Jena,
Andra Toader

CURRICULUM VITAE

TOADER F. ANDRA, M.Sc.
Psychology
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EDUCATION

Doctor of Philosophy, Psychology **Expected July 2016**
Friedrich Schiller University, Psychology Institute and the International Max Planck Research School on Adapting Behavior in a Fundamentally Uncertain World, Jena, Germany
Dissertation Title: The Environment-Cognition Fit Perspective in Determining Team Adaptive Performance

Master of Arts, Organizational Psychology and Human Resources **June 2013**
University of Bucharest, Faculty of Psychology and Educational Sciences, Psychology Department, Bucharest, Romania
Thesis Title: Organizational Socialization Content as a Mediator of the Relationship Between Person-Organization Fit and Organizational Turnover Intention
Grade: 10/10

Bachelor of Arts, Psychology **June 2011**
University of Bucharest, Faculty of Psychology and Educational Sciences, Psychology Department, Bucharest, Romania
Examination: Organizational Psychology
Grade: 8.50/10

RESEARCH INTERESTS

Organizational and team adaptive performance
Team cognition emergence and development
Longitudinal change assessment and analysis

MANUSCRIPTS COMPLETED OR IN PREPARATION

The Role of Team Mental Models Divergence for Performance During Situational Changes (completed, target: Organizational Behavior and Human Decision Processes)
Topic: Understanding how team mental model similarity affects team adaptation to changing situations for teams of knowledge workers

The Role of Team Mental Model Convergence for Performance in Project Teams (completed, target: European Work and Organizational Psychology Journal)
Topic: Understanding how different types of mental models develop in project teams and how their development affects team performance

Enhancing Adaptive Performance Transfer: Task Variation, Team Mental Models Flexibility, Learning, and Strategy development (completed, target: Organizational Behavior and Human Decision Processes)
Topic: Understanding how the form of team mental model emergence during varied task practice affects long-term team adaptability

The Environment-Cognition Fit Perspective In Determining Team Adaptive Performance (completed, target: Journal of Management)
Topic: Detailing the role of team mental models configurations for managing different problem spaces and achieving adaptive transfer

RESEARCH PRESENTATIONS

Toader, A. F. (2015, June). *The role of team mental models dissimilarity for team performance during changing situations*. Presentation at the London Business School European PhD Workshop, June 11th-13th, London Business School, London, United Kingdom. [invited talk]

Toader, A. F. (2015, May). *Tracing the influences: Shared cognitive mechanisms as determinants of project planning efficiency and novelty in interdisciplinary teams*. Poster presented at the 17th congress of the European Association of Work and Organizational Psychology, May 20th-23rd 2015, Oslo, Norway.

Toader, A.F & Kelterborn, P. (2014, August). *Team composition, team process, and creative performance*. Presentation at University of Southern Denmark, Centre for Integral Innovation Management, Odense M, Denmark. [invited talk]

Toader, A.F. (September, 2011). *Job satisfaction in the context of person-organization fit: Does value congruence improve work satisfaction?* Poster presented at the Psiworld International Conference, 2011, Bucharest, Romania.

SCIENTIFIC EVENTS ATTENDANCE

July-August 2015	The 9th Summer School of the IMPRS Uncertainty Friedrich Schiller University, Jena, Germany
June 2015	The 17th Jena Workshop on Intergroup Processes, ―Social Justice: Inequality and Recognition, Oppurg, Germany
June 2015	London Business School European PhD Workshop, London Business School, London, United Kingdom
May 2015	The 17th Congress of the European Association of Work and Organizational Psychology, Oslo, Norway
September-October 2014	The 8th IMPRS Uncertainty Topics Workshop / Cologne Doctoral Workshop on Cognition, Coordination, Cooperation,

	and Competition, University of Cologne, Cologne, Germany
July-August 2014	The 8th Summer School of IMPRS Uncertainty Max Planck Institute of Economics, Jena, Germany
September 2013	The 7th IMPRS Uncertainty Topics Workshop ―Economics meets Psychology, Wrocław, Poland
July-August 2013	The 7th Summer School of the IMPRS Uncertainty Max Planck Institute of Economics, Jena, Germany
July 2013	The 15th Jena Workshop on Intergroup Processes ―The puzzle of ―me and I: Individual and Collective Perspectives on Self and Identity, Oppurg, Germany
April 2012	APIO, Industrial and Organizational Psychology Conference, The Psychology of Occupational Health—A Challenge for Organizations, West University, Timisoara, Romania
October 2011	Psiworld International Conference: Psychology and the Realities of the Contemporary World, 2nd Edition, Faculty of Psychology, Bucharest, Romania

RESEARCH EXPERIENCE

October 2012- February 2013	Research assistant - The Psychology and Philosophy Institute-Constantin Radulescu-Motru The Romanian Academy, Psychology Department Literature review for Academy project on adolescent antisocial behavior
November 2011- October 2012	Scientific Performance Scholarship granted by the University of Bucharest – Project: Person-organization fit as a predictor of employee turnover University of Bucharest, Bucharest, Romania

APPLIED EXPERIENCE

Psychological assessment, interpretation, and reporting IRSCA Gifted Education, School No. 155, Pascani Street No. 6, District 5, Bucharest, Romania:

November 2011- February 2012	Children assessment with the ―Wechsler Intelligence Scale for Children, 4th Edition during the final selection phase for admission to the School of Excellence program at IRSCA Gifted Education of children aged 9–14 years

September-November 2011	Children assessment with the ―Raven's Standard Progressive Matrices Plus during the pre-screening phase for admission to the School of Excellence program at IRSCA Gifted Education
January-March 2011	Personality analysis (Nonverbal Personality Questionnaire) of gifted children participating in the IRSCA education program

SELECTED GRADUATE COURSEWORK

Basics in the economics of innovation (UI Cantner, FSU, Microeconomics department, 2014)
Structural equation modeling ii – beyond the basics (Friedrich Funke, FSU Graduate Academy, 2013)
Conditional process analysis with mediation and moderation (Friedrich Funke, FSU Graduate Academy, 2013)
Confirmatory factor analysis (Master course, Faculty of Psychology, University of Bucharest, 2012)
The multilevel approach in researching organizational behavior (Laurentiu Maricutoiu, Workshop ―APIO, 2012)
The use of human capital efficiency indices in organizational diagnosis (Lavinia Tanculescu, Workshop―APIO, 2012)
Self-taught (readings) – Hierarchical linear modeling, longitudinal data analysis

TECHNICAL SKILLS

Statistical programs: SPSS, AMOS, R (intermediate), UCINET, Pathfinder, Automap/ORA
Microsoft Office
SurveyMonkey
Project planning, organizing, and management skills

PROFESSIONAL AFFILIATIONS

Society for Industrial and Organizational Psychology
European Association of Work and Organizational Psychology
Academy of Management
International Association of Applied Psychology (2014)
Society for Human Resource Management (2014)

AWARDS/HONORS

International Max Planck Research School on Adapting Behavior in a Fundamentally Uncertain World, PhD grant, 2013-2016
University of Bucharest, Faculty of Psychology, Bucharest, Romania, research project grant, 2011-2012
Travel grants 2014-2016 (IMPRS)