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Developing and Sustaining Capabilities – A Look into the Black Box

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Abstract

Management studies suggest that developing and sustaining dynamic and operational capabilities is important in achieving competitive advantage. The process of developing capabilities is an underdeveloped research area and new insight is needed to understand how capabilities can be developed as well as sustained. This paper will show that the implementation of practices leads to dynamic and operational capabilities, therefore shedding light into the black-box of developing capabilities. Our research, based on a cross-case analysis, supports propositions relating to the importance of implementing practices in the development of capabilities and the resulting influence on competitive advantage.

Keywords: Practices, RBV, Case Studies, Dynamic Capabilities

1. Introduction

Research in operations management for this study was conducted within the context of the resource based view (RBV). Our primary objective is to use the RBV to show how manufacturing companies develop and sustain competitive advantage. This approach focuses on the resources and capabilities needed to achieve competitive advantage.

Capabilities in functional areas, such as manufacturing, can contribute to performance and may also be a source of competitive advantage (Schroeder, Bates, and Juntilla, 2002). We analyze the underlying mechanism of achieving and sustaining competitive advantage by examining how capabilities are developed and sustained. Although researchers agree that the capability base is crucial for achieving competitive advantage (Barney, 1991; Coates et al., 2002) the process of developing and sustaining is not as clear (Coates et al., 2002; Priem and Butler, 2001; Zhai, Shi, and Gregory, 2007). Based on a cross-case analysis, we show how companies develop and sustain capabilities. Because the analysis we provide is compiled through the RBV, we begin with an overview of literature in RBV and focus on its application in operations management. This overview is followed by a methods section and a description of four case studies which are the basis for our propositions.

2. Literature review

1. The resource based view

Within the field of operations management, the resource based view (RBV) explains differences based on company specific factors rather than market power. The RBV of the firm has its beginning in the work of Penrose (1955) and recently has become more widely used (Barney, 1991; Wernerfelt, 1984). Resources include knowledge that can be traded (e.g. patents), financial and physical assets (e.g. property plant and equipment), human capital, etc. (Amit and Schoemaker, 1993; Grant, 1991). Competitive advantage is gained if resources are valuable, rare, inimitable, and non-substitutable (Barney, 1991).

The RBV distinguishes between resources that can be acquired in factor markets and those developed internally (Makadok, 2001; Schroeder et al., 2002). Internally developed

resources and capabilities are, by definition, not available to competitors and therefore have the potential to be a source of competitive advantage (Schroeder et al., 2002). Many researchers applying the RBV have focused on the internal or intangible assets of a firm which may be more significant for profit generation than available purchasable resources (Conner, 1991). The internally developed resources are seen as inputs to the production process and the generation of competitive advantage is based on the bundling of these resources through the use of capabilities (Grant, 1991). We define capabilities as specific resources which are developed over time through complex interactions among the firm's resources. Capabilities, therefore, refer to a firm's capacity to deploy resources to effect a desired end (Amit et al., 1993). Furthermore, capabilities are firm specific because they are embedded in organizational processes and their primary purpose is to enhance the productivity of other resources (Makadok, 2001). Unlike resources, capabilities are based on the exchange of information through the firm's human capital (Amit et al., 1993).

From a firm's perspective, value is created if value is provided to the customer. If the firm produces greater value than its competitors, competitive advantage is achieved (Sirmon, Hitt, and Ireland, 2007). Possessing valuable, rare, inimitable, and non-substitutable resources is a necessary but insufficient condition for value creation. It is not the existence of the resources per se, but how these internally developed resources are used which produces customer value (Sirmon et al., 2007). We focus our analysis on the development of capabilities and its influence on value creation.

RBV has been criticized for its failure to address the dynamics of a firm's development (Teece, Pisano, and Shuen, 1997). To overcome this weakness, researchers have introduced the concept of dynamic capabilities which focuses on organizational change.

Although the notion of dynamic capabilities is widely applied, a commonly accepted definition is still missing (Zahra, Sapienza, and Davidsson, 2006). Most definitions distinguish between operational capabilities (“how you earn your living”) and dynamic capabilities (“how you change your operational routines”) (Cepeda and Dusya, 2007; Helfat and Peteraf, 2003; Winter, 2003). There exists some agreement that competitive advantage stems from new configurations of resources and operational capabilities and not from the existence of dynamic capabilities per se.

2. The resource based view and operations management

Manufacturing activities are a major source of capabilities, therefore it is not surprising that the RBV is widely applied in operations management (see the literature review of Dangayach and Deshmukh, 2001). As Coates and McDermott (2002, p. 437) state: "It is important to remember that many of the resources and capabilities upon which competitive advantage are formed have their basis in the operations area."

Studies in the operations management area have often investigated the relationship of manufacturing capabilities and business performance (Hayes, Wheelwright, and Clark, 1988; Vickery and Droge, 1993; Vickery, Dröge, and Markland, 1997). However, the manufacturing capabilities studied are often aggregate measures such as quality, flexibility, dependability and cost. Applying the RBV instead emphasizes the specific capabilities a company needs to achieve these aggregate measures (Coates et al., 2002; Kim and Arnold, 1996). Furthermore, the same factors (quality, dependability, etc.) are used by different names such as competitor success requirements (Fine and Hax, 1985), competitive criteria (Platts and Gregory, 1990), competitive priorities (Hayes and Wheelwright, 1984), competitive variables (Marucheck, Pannesi, and Anderson, 1990),

competitive manufacturing capabilities (Ward, Bickford, and Leong, 1996), or order winners (Hill, 2000). Corbett and Van Wassenhove (1993) exemplify correctly that the same factors are used as external criteria (measures of external competitiveness) and as internal capabilities. This analysis focuses on the achievement of customer need, based on internally developed capabilities.

We refer to these measures of external competitiveness (e.g. quality) as order winners (Hill, 2000). Order winners mirror customer need and can be achieved through internally developed capabilities. In both the RBV and dynamic capabilities research stream, developing and sustaining capabilities is underdeveloped (Coates et al., 2002; Sirmon et al., 2007; Teece et al., 1997). Specifically, clear answers concerning the origins and evolution of capabilities are largely missing (Coates et al., 2002; Priem et al., 2001; Zhai et al., 2007). Our research goal is to further understand how companies develop capabilities in order to achieve and sustain competitive advantage.

Research in operations management helps identify unique capabilities and illustrate how these capabilities evolve inside the firm (Coates et al., 2002). It is the use of resources and capabilities that leads to competitive advantage, rather than their mere existence (Sirmon et al., 2007). Managers facing change often use the methods of practices such as TPM, TQM or supplier management to achieve the desired goal (Kim et al., 1996). Therefore, we focus our analysis on the implementation of practices and its potential to develop and sustain capabilities (Voss, 2005). Although the development of capabilities can be influenced by a variety of internal actions, we limit our study to the analysis of the implementation of practices such as TPM, TQM and supplier management. This focused

approach will shed light into the black-box of the development and sustainment of capabilities.

3. Methodology

1. Research setting

The analysis of the bundling and leveraging of resources is exploratory in nature because little is known about these processes. Although the exploration of the constructs and variables can be elaborated in different ways (Yin, 1994), the chosen multiple case study approach is especially appropriate when little is known and the purpose of the research is to gain new insights (Eisenhardt, 1989). Its emphasis on developing constructs, measures, and testable theoretical propositions makes the multiple case studies approach a suitable method for theory development (Eisenhardt and Graebner, 2007).

The study focuses on four manufacturing companies from Switzerland (see Table 1). The companies have a strong market position and, based on self-judgment, consider themselves as more successful than their respective competitors (see Table 2).

-Table 1-

2. Data collection

Data were collected for each company from four main sources: questionnaire, interviews, corporate documents and site visits. Responses to the questionnaire, submitted by the CEO or the production manager, provided a first impression of each company and were a valuable source of information in preparing for the interviews. Each company was interviewed twice by two researchers from the field of operations management. Each interview was semi-structured and recorded. The first interview (each interview was scheduled to last 3 to 4 hours) was complemented with a site visit. To substantiate the

information submitted in the questionnaire, top management provided additional documentation such as strategic plans and project descriptions. These internal documents constituted a valuable secondary source of data and provided a way to cross-check the information from the recorded interviews and to control for retrospective bias. The protocols were distributed to the top management to assure a mutual understanding of desired outcomes.

3. Data analysis

The data analysis started with traditional methods of inductive fieldwork (e.g. Miles et al., 1994). One of the researchers wrote detailed case studies based on the recorded transcripts and archival data. The second researcher cross-checked the case studies with the available data and suggestions for revisions were discussed. The finalized case studies were then provided to interviewees for review with the goal of minimizing any bias potentially associated with retrospective interviews.

The case studies are the basis for developing theory. To achieve this goal we relied on the method of causal loop diagrams (CLD), common in system dynamics (Sterman, 2000) and recently applied in organization theory (Repenning and Sterman, 2002). The CLD method allows visualizing the interactions of capabilities and the influence on order winners. Based on the data derived, one researcher mapped the interactions of the factors. The diagrams were discussed with three researchers in the area of operations management. The three researchers were asked to cross-check the diagrams with the case studies and then to test the logic of the CLDs. Finally, the diagrams were reviewed by the interviewed top manager and if necessarily appropriate revisions were made.

4. Case Studies

Our research examines four cases with the goal of demonstrating how the selected manufacturing companies develop and sustain capabilities in order to achieve and sustain competitive advantage. The cases are presented in four sections. We begin with manufacturing strategy focusing on customer needs. The customer needs are represented by order winners, a common approach in operations management literature (Christiansen, Berry, Bruun, and Ward, 2003; Frohlich and Westbrook, 2001; Kathuria, 2000). The second section examines the practices implemented, and sheds light on specific elements, establishing the starting point for the derivation of the developed capabilities. The third section explores the capabilities and analyzes the interaction of the capabilities and their influence on the order winners. These findings lead to section four and the analysis of the capabilities, specifically whether they are operational or dynamic in nature, and their influence on competitive advantage.

1. Manufacturing strategy

The four manufacturing companies studied compete on multiple order winners simultaneously. The competitive factors analyzed (see Table 2) cover a broad range of possible factors and are widely used in various studies (e.g. Christiansen et al., 2003; Frohlich et al., 2001). The managers were asked to indicate which specific order winners they aim for and if they are more successful than their relevant competitors in these identified areas (see Table 2). If a firm provides greater utility for customers than its competitors, it enjoys competitive advantage (Sirmon et al., 2007).

-Table 2-

Table 2 shows that the four companies consider themselves more successful than their competitors in at least five out of ten factors. The fulfillment of these order winners is influenced by underlying capabilities (Coates et al., 2002; Kim et al., 1996). Therefore, we focus our analysis within the four companies on the development and sustainment of capabilities in order to understand how value is generated.

2. Practices

Practices are defined as ongoing procedures with a clear goal. They provide structure to how activities must be conducted within a company to achieve a defined goal (Flynn, Sakakibara, and Schroeder, 1995). Examples of practices are TPM or supplier management which provide companies with structure as new tasks are integrated (Laugen, Acur, Boer, and Frick, 2005). Because the goal of this study is to reach an in-depth understanding of how capabilities are developed and sustained in order to gain competitive advantage, our research required a comprehensive look at internal operations and practices. The statement of a three letter acronym such as TPM or TQM does not lead to the needed insight because every company has a slightly different understanding or definition of the practices. Therefore, we asked what type of practices the companies implemented and, specifically, what changes were achieved during the implementation. Table 3 shows the main practices implemented by the four analyzed companies. The following description of the practices implemented is based on the statements provided by the companies.

Two of the companies, Pipe System and Printer Board Ltd., stated that they have implemented lean production. In combination with the goal of waste reduction, the two companies are also managing the implementation of pull-system, training and continuous

improvement. Shah and Ward (2007) define lean production through three underlying constructs: supplier, customer, and internal related. The respective operational definitions of the internal part of lean include pull, flow, JIT or fast changeover. If we compare the two companies' activities to the Shah and Ward (2007) definition of lean production, we see that they are using the operational methods underlying the lean production philosophy. Therefore, for this research setting we do not consider lean production as a singular practice. Instead we analyze the underlying operational methods such as pull-system, training and supplier management.

-Table 3-

All companies conduct pull-system, training and supplier management practices. Just-in-time (JIT) initiatives are often seen as best practice (Laugen et al., 2005), nevertheless many Western companies often do not implement all elements of JIT (Mc Lachlin, 1997). The four analyzed companies have particularly focused on the flow element, utilizing the pull-system. In contrast to the push-system, in a pull-system a preceding machine produces parts only after it receives a request from the succeeding machine (Bonney, Zhang, Head, Tien, and Barson, 1999; Venkatesh, Zhou, Kaighobadi, and Caudill, 1996). All four companies studied restructured their processes to be pull-systems. The practice of training refers to the coordinated actions undertaken to improve the employee's skills and knowledge (Mc Lachlin, 1997). All four companies utilize a matrix tracking the existing and needed capabilities of the employees as well as the training needed to fill identified gaps. Training is ongoing (in contrast to an ad hoc style) and cover activities as diverse as machine operator trainings or introductions into methods (value stream mapping, six sigma, etc). The third practice implemented by all four companies is

supplier management. The supplier's performance influences the manufacturer's performance and is therefore a critical resource (Szwejcowski, Lemke, and Goffin, 2005). The companies studied have all implemented a supplier evaluation system and are monitoring the competitive landscape (e.g. benchmarking) (Modi and Mabert, 2007).

Another widely applied practice is continuous improvement and all four companies have instituted systems to gather improvement suggestions from their employees. The applied continuous improvement philosophy is based on the assumption that every process contains waste which has to be reduced or eliminated in order to achieve customer value (Imai and Heymans, 1999). Continuous improvement as implemented by the four companies covers not only the philosophy of the practice, but the active process of gathering employee suggestions. Therefore, we use the term continuous improvement with focus on the systematized process of idea gathering. This practice is present in three of the four companies. The exception is Tool Ltd., whose management stated that they once installed a system to enhance continuous improvement activities but the results were of minimal help. However, Tool Ltd. has since implemented the practice of "integration between product development and manufacturing" and the respective team of product developer and manufacturer are not only responsible for the development of products that are easier to produce, but are in charge of improving processes, as well. The team members do encourage continuous improvement, but as we look at the systematized process of idea gathering, Tool Ltd. does not have a company-wide continuous improvement practice in place.

The practice "Total Productive Maintenance" (TPM) is present only at the business unit Pipe System. The practice TPM is designed to maximize equipment effectiveness by

establishing a comprehensive productive maintenance system (Tsuchiya, 1992). The companies Pipe System and Tool Ltd. have higher levels of automation in comparison to the other two companies. Whereas Pipe System counts TPM as one of the important practices installed, Tool Ltd. does not follow a practice such as TPM.

Another widely applied practice is project management. The practice enfolds the systematic process of the new product introduction. Tool Ltd., Pipe System and Printer Board Ltd. have each implemented the practice of "integration between product development and manufacturing" to reduce manufacturing costs and speed the product to market (Womack et al., 1992).

The only company that listed the coordination with customers as one of the important practices was Printer Board Ltd. The company produces customer specific printer boards and stated that the coordination with customers is crucial because it helps to translate the customer needs into products. This practice addresses how and how effectively the company determines current and emerging customer requirements and expectations (Samson 1999). It addresses the relationship with customers in a coordinated way as it provides guidelines on how to structure the interaction. In contrast to the other companies, customer interaction at Printer Board Ltd. is highly structured through defined contact points, checklists and milestones.

3. Capabilities

Capabilities are defined as specific resources which are developed over time through complex interactions among a firm's resources. Capabilities refer to a firm's capacity to deploy resources to effect a desired end (Amit et al., 1993). Practices, on the other hand, are defined as ongoing procedures with a clear goal. They guide the complex interactions

within a company to achieve a defined goal. Therefore, the implementation of practices leads to the development of capabilities. The following section highlights the capabilities developed by the four companies studied. We asked the top management to describe in-depth the practices implemented and to highlight the change achieved. Through the comparison of operations before and after implementation, we identified eleven capabilities within the four companies. Table 4 highlights the capabilities identified as well as the practices which served as the foundation for the development of the capabilities.

Three capabilities were specified in each of the four case studies: "process oriented thinking", "adherence to task specifications", and "market knowledge". "Process oriented thinking" demonstrates the importance of processes, as stated in this example by the chief production officer of Cable Ltd: *"During the implementation of the pull-system we trained our employees in process-thinking. They not only learned which process steps did fall under their responsibility but they also learned the relationships of the individual tasks."* In close relationship to the capability of process oriented thinking, the analysis of the four companies revealed another capability: "adherence to task specifications". In addition to the statement above, the chief production officer of Cable Ltd told us: *"As the employees understood how a process variation influences the subsequent process steps they have been motivated to stick to the given specifications. Whereas in the traditional production environment where mistakes have been only detected at the end of the process, the implementation of the pull-system has led to the situation that mistakes were identified in the subsequent process steps and reported to the respective worker."* The direct feedback strengthened the capability "adherence to task specifications". This

example also shows that the two capabilities are closely linked. The understanding of processes helped the employees determine why it is important to adhere to the given specifications.

The third capability identified in all four companies analyzed is “market knowledge”. The companies are very familiar with the leading players of the competitive landscape. The performance level of the suppliers often has a significant impact on the companies’ own performance (Van der Vaart and Van Douk, 2008). For instance, Tool Ltd stated that they do not have adequate resources to conduct research and therefore rely heavily on the skills of the suppliers. The CEO of Tool Ltd explained that the management has put a lot of effort into supplier management which involves the key methods of benchmarking and market analysis. Based on these two methods the employees gained in-depth knowledge of the competitive landscape which strengthened their market knowledge. The group Pipe System strengthened supplier management and therefore the capability of “market knowledge” through the implementation of a lead buyer concept. The concept utilizes the strength of each business unit, and the responsibility for supplier management is given to the business unit with the greatest expertise in the respective market. The unit does not aim to be expert in every market, but rather works to strengthen its existing knowledge in one specific market. The capability described by Pipe System represents specific market knowledge critical to employees of a particular business unit.

Another identified capability is “close collaboration with suppliers”. This capability addresses the company’s relationship to the supplier with the goal of reaching an efficient and effective supply. As stated above, the performance of the suppliers influences the companies’ potential for value creation. The influence of the suppliers becomes apparent

when considering that Cable Ltd buys 50% of needed machine parts from external sources. And, Printer Board Ltd reports that 50% of its value creation stems from suppliers. Another example of the importance of this capability is Printer Board Ltd's guarantee of lifetime repair service for the product. The supplied parts must be available even after the respective machine might be replaced by a newer version. Printer Board Ltd's guarantee for the life of the product highlights the importance of a close collaboration with the suppliers. Whereas the capability "market knowledge" addresses the capability of the company to choose the right supplier, the capability "close collaboration with suppliers" describes the management of the relationship. The top management interviewed highlighted the importance of having both capabilities. A successful relationship with a supplier is positively influenced by the right choice which in turn is influenced by the market knowledge. However, the capability "close relationship with suppliers" was identified in only three of the case studies. The difference lies in the production network. Pipe System has 16 specialized production plants. Each of the plants is focused on a special technology and production process. This production network allows Pipe System to rely heavily on its own products and, therefore, it is less dependent on suppliers than the other companies studied. In comparison to the other companies, Pipe System's reliance on external suppliers is lower which explains why the capability "close relationship with suppliers" is not replicated.

The data also revealed the capability of "employee flexibility, which allows a company to quickly adopt new procedures and efficiently assign employees to different tasks. Cable Ltd installed a routine which they call "floating". Based on the production volume, the company temporarily employs external workers. Due to high capacity utilization, fifty

percent of the employees at Cable Ltd are external. This system requires a high process transparency, and the internal employees must be able to perform the more difficult tasks in order to assign routine tasks to temporary employees. Cable Ltd has systematically trained their employees to reach this level of skill and flexibility. Although three of the analyzed companies clearly demonstrated the capability, it could not be observed at Pipe System. Looking at the shop floor, the difference between the companies becomes apparent. Pipe System is fully equipped with machining centers (e.g., CNC machines) and automated parts loading as well as automated guided vehicles (AGVs). The high automation level reduces the need for employee flexibility. The goal of volume flexibility is mainly influenced by the change over time and the machine flexibility. The data from the business unit Pipe System highlighted another capability: "short change over time". The chief production officer stated that: *"To be able to be flexible and cost sensitive at the same time we have an ongoing goal to improve the change over time. Our shop floor employees had intensive training and most of them have nowadays a broad experience."* Because Pipe System distinguishes itself by its high level of automation, we argue that the automation level is a contingency factor which influences the necessity of the capability "employee flexibility" or "short change over time".

- Table 4-

Another capability existing in each of the four companies analyzed is "knowledge transfer". Although the capability appears in slightly different forms, it is clear that the collaboration and, therefore, the exchange of knowledge between departments is important. The analysis of Business Unit Pipe System and Printer Board Ltd revealed a capability which we named "production and process know how". "Knowledge transfer"

addresses the collaboration between development and production, and the goal of utilizing the “production and process know how” of employees as early as possible in the development process. The CEO of Printer Board Ltd stated that: *"This capability helped us tremendously. As the employees of the two departments started to exchange their knowledge, we faced lesser problems during production which helped us to positively influence the production costs as well as to improve the process stability."* The interaction between development and production at Tool Ltd has led to the capability we identify as "knowledge transfer". The company has appointed four technical coaches who are responsible for process improvements in production. Because the four coaches are still working in the development department, traditional barriers between the two departments have been reduced. The coaches are not only transferring their knowledge to the shop-floor activities but reflect the production requirements in their own development activities. Cable Ltd. implemented an independent project management group which is responsible for the implementation of products and projects. The core team consists of five employees with a combined high level of experience who are responsible for the knowledge transfer between the departments. The core team is supplemented with additional employees as needed. Because the goal of "production and process know how" is to articulate and exchange knowledge, we refer to the shared philosophies of both capabilities as “knowledge transfer”.

The capability “management of internal outsourcing activities” addresses the inter-plant exchange. Two of the studied companies, Tool Ltd and Printer Board Ltd, are closely linked to other plants. Tool Ltd decided four years ago to build a new plant in Hungary in order to produce mature products with lower costs. It reduced the total production costs

by thirty percent. The internal outsourcing activity provided Tool Ltd with enough free capacity to introduce new products and to flexibly react to changing customer orders. This newly developed "management of internal outsourcing activities" capability allowed the company to reduce the production costs and to stay flexible and innovative simultaneously. The capability also exists in Printer Board Ltd. If the company faces high volume changes, it has the potential to pass on orders to the internal production network. Both companies have plants in their networks with similar technologies and production techniques which allow them to pass on orders. The systems at Cable Ltd and Pipe System are different. Each of Cable Ltd's plants produces different machines and the interaction among the plants is low. Pipe System has organized its production network based on technologies and production techniques with the goal of avoiding redundancies. Internal outsourcing possibilities are not available at Pipe System.

The capability "comprehension of the customer" stems from Printer Board Ltd. and can not be replicated within the three other case studies. The capability highlights the importance of translating the customer needs into specific product requirements. The CEO of Printer Board stated that: *"As every single product is built to order, this capability is crucial. The better our employees translate the customer needs into product specification the more successful is our company."* Although the "comprehension of the customer" is important in every business, clearly the more customer specific the orders, the higher the importance of this capability.

4. The nature of the capabilities and their influence

Researchers applying the RBV distinguish between dynamic and operational capabilities (Cepeda et al., 2007; Teece et al., 1997; Winter, 2003). Whereas the operational

capabilities describe how a company earns its living, the dynamic capabilities are related to change (Cepeda et al., 2007; Winter, 2003). Dynamic capabilities influence or change operational capabilities in order to achieve new goals (Winter, 2003). To understand how companies are able to achieve and sustain competitive advantage we have to understand the mechanism and influence of the capabilities developed.

To define the nature of the capabilities, we apply the following definitions. An operational capability can be measured at any given point in time and is related to stability. A dynamic capability is indicated by changes in manufacturing outcomes over time or by the development of new operational capabilities (Swink and Hergarty, 1998). In order to understand the nature of the capabilities, we analyze the description given by the top management and discuss the stated influence on order winners. Based on the definition, two distinctive criteria are applied. First, a capability is dynamic if it is influencing the development or improvement of operational capabilities (Cepeda et al., 2007; Swink and Hergarty, 1998; Zollo and Winter, 2002). Second, in contrast to an operational capability, a dynamic capability is related to change (Cepeda et al., 2007; Winter, 2003). In order to identify the change or stability related nature of the capability we studied the stated influence on order winners. A dynamic capability influences change related order winners whereas an operational capability influences stability related order winners. In order to reach a high influence on the order winners “product design and quality”, “conformance quality”, “dependable delivery”, “fast delivery”, and “after-sales service”, the underlying capabilities need to have a stability related nature. E.g. to reach “conformance quality” on a high and continuous level, stable processes are required. In order to achieve this goal, the underlying capability has to be stable in nature. On the

other hand, the order winners' "innovative products" and "frequency of new product introduction" are closely related to change. Therefore, capabilities which influence change related order winners are more likely to be defined as dynamic capabilities (Cepeda et al., 2007; Winter, 2003).

Based on the two decision criteria, the identified capabilities were separated into dynamic and operational capabilities. The following section describes the procedure. Table 5 highlights the result.

-Table 5-

The top-management of each of the four companies was asked to rate the influence of the capabilities on the order winners. Because the capabilities are highly interactive, we used the method of causal loop diagrams (CLD) popularized in Systems Dynamics, to visualize the interdependencies (Sterman, 2000). Figure 1 shows the causal loop diagram of the capability "adherence to task specification" as encountered by Cable Ltd. Based on the CLD's derived, we are able to see the interactions of the capabilities and to characterize the impact on the order winners. Table 6 summarizes the findings.

-Figure 1-

Table 6 implies two findings. First, it supports the assumption of the RBV that capabilities can lead to economic rent creation (Makadok, 2001). Secondly, it shows the diverse influence specific capabilities have on the achievement of the order winners. Every capability influences the achievement of multiple priorities, although some connections are indirect. Because the capabilities influence each other, it raises the question of hierarchy. The following section describes the identified capabilities with respect to their influence on order winners.

-Table 6-

The capability “adherence to task-specification” influences the stability of processes. The CEO of Printer Board stated that: *"If everyone sticks to the task specification given, the processes should run smoothly. We constantly try to reduce variances as these lead to problems which have to be solved by unplanned actions which in turn have a negative influence on process stability."* Based on the capability “adherence to task-specification”, variances are minimized and the stability of the processes optimized. The statement shows that this capability can be best described through the term steady-state or operational capability. Table 6 further exemplifies that the capability "adherence to task specification" influences order winners which need stable processes: conformance quality, quality and design, dependable delivery, and fast delivery.

The capability "process oriented thinking” has a different nature as it is often the starting point for change. The leader of the project management group of Cable Ltd stated: *"Process oriented thinking is the basis for process improvements. The capability can lead to change and at the same time influences the capability "adherence to task specifications" as it helped the employees to understand why they should stick to the specifications."* Dynamic capabilities can lead to changes in processes and products and are dedicated to the modification of operational capabilities (Cepeda and Vera, 2007; Helfat and Peteraf, 2003; Zahra et al., 2006). Therefore we conclude that the capability "process oriented thinking" is a dynamic capability which influences the operational capability "adherence to task specifications". This combination of capabilities is also identified in the lean production literature. Employees of a lean producer must fulfill

assigned tasks based on clear specifications. At the same time, the employees are encouraged to continuously improve processes (Liker, 2004).

The capability "close relationship to suppliers" has a broad influence on the achievement of order winners (see Table 6). This influence is supported by various studies (e.g. Van der Vaart et al., 2008). The chief production officer of Printer Board Ltd put it this way: *"A close relationship with our suppliers helps us tremendously to fulfill the diverse customer needs. Problems with the dependability of our suppliers influence our activities tremendously. Our main goal is to have stable processes which we can only achieve if the performance level of the suppliers is as specified and stable."* Based on the description, the capability allows Printer Board Ltd to stabilize its processes and to gain as much value of the existing products as possible. Therefore, its nature is operational. However, looking at Table 6 gives another impression because the capability is related to the change related factors "innovative products" and "frequency of new product introduction". The case study data indicates that the change itself happens on the supplier side. The CEO of Tool Ltd stated that: *"We rely heavily on our supplier's potential to innovate as we are too small to cover all areas where innovation could possibly happen. This means that the supplier's innovative behavior allows us finally to introduce new products but the actual change happens at the supplier side and we profit as our order winners "innovative products" and "frequency of new product introduction" are positively influenced as well."* Because the change happens at the supplier side and the main impact of the capability within the company is influencing how it earns its living, we identify the capability "close relationship to suppliers" as operational despite its influence on change related factors.

The "market knowledge" capability describes a company's familiarity with market activities and the competitive landscape. The chief production officer of the Business Unit Pipe System stated that: *"The employees have a great knowledge about the competitive landscape. They know which supplier has the highest skills of the material and procedure we use. Furthermore, they monitor the market to insure that we are upfront if new procedures are developed by one of the suppliers."* This statement shows that the capability leads to change and it is defined as a dynamic capability. In addition, it influences the operational capability "close relationship to suppliers".

"Employee flexibility" is the ability to easily adapt to new situations which enables a company to efficiently change processes or products. Environmental uncertainties drive the need for flexible employees. The chief production officer of the Cable Ltd described it as follows: *"We train our employees that they can move from one task to the other. We can bring up to 50 percent external employees into the production but this is only possible because the internal employees are able to fulfill the more difficult tasks. It is important that all employees fulfill their new tasks in accordance to the specifications."* This statement shows that the capability of "employee flexibility" is reactive in nature and does not proactively encourage change. The fulfillment of operational tasks as efficiently as possible describes an operational capability.

The capability "knowledge transfer" describes the collaboration between product development and production with the goal of improving or investing new products and processes. Because this capability is crucial for developing and implementing new products, it is closely related to change. We summarize that the "knowledge transfer" capability is dynamic in nature.

"Management of outsourcing activities" is a capability which allows companies to outsource tasks into their own production networks. The CEO of Tool Ltd stated that: *"The second plant in Hungary allowed us to outsource some of the older products. Based on this we gained free capacity and have been able to introduce new products. The capability developed through this new collaboration allowed us to still produce on the same performance level as before with the exception that the production costs are lower."* Although the opportunity to outsource production capacity to the second plant helped Tool Ltd gain free capacity and introduce new products, the capability itself is operational as because it supports the fulfillment of the daily activities.

The capability "comprehension of the customer" translates customer needs into product specification which in turn influences the change related order winners "frequency of new product introduction" and "innovative products". Therefore we conclude that the capability is dynamic in nature.

Pipe System has a high automation level which has led to the capability "short change over time". The chief production officer stated that: *"To be able to fulfill the needed volume flexibility despite our high automation level we had to strengthen our capability "short change over time"*. The capability allows reacting flexibly to changing volumes, and positively influences the through put time which in turn has a positive influence on cost. The capability influences how well a company earns its living and is operational in nature.

The case study data reveals that all four companies possess a combination of dynamic and operational capabilities, and the analysis demonstrates that the capabilities influence each other. Capabilities needed to compete successfully on multiple order winners are

those capabilities which secure the value generation of ongoing operational activities. Equally important are the dynamic capabilities which allow a company to not only sustain and improve already existing capabilities, but to influence the development of new capabilities.

5. Discussion

The purpose of this study is to examine the development and sustainment of capabilities crucial for gaining and sustaining competitive advantage. Using a multiple case study approach, we analyzed the operations management strategies and the capabilities developed while implementing manufacturing practices. Using the identified capabilities as a starting point, we analyzed the nature of the capabilities by studying their relationship and their influence on order winners. The following discussion addresses the relationships identified and the resulting propositions.

Based on the above analysis, we propose that specific practices such as pull-system and supplier management are implemented to achieve a specific change. While implementing practices, existing systems are questioned, improved or sometimes dismantled. New guidelines help employees adapt to newly structured tasks. This adaptation to new circumstances influences the development of new capabilities or the strengthening of existing capabilities. Furthermore, the achieved change may lead to the demise of previous capabilities as new capabilities replace existing ones (Winter, 2003). Analyzing the relationship of practices and capabilities demonstrates that the implementation of practices influences two different kinds of capabilities: dynamic and operational.

The existence of dynamic and operational capabilities is widely discussed in research literature (Swift and Hwang, 2008; Winter, 2003; Zollo et al., 2002). Whereas most

studies are conceptual in nature, some researchers are beginning to analyze the existence of these capabilities empirically (Zahra and Nielsen, 2002; Zahra et al., 2006; Zhai et al., 2007). Still, clarification is needed regarding how capabilities are developed (Coates et al., 2002; Priem et al., 2001; Zhai et al., 2007). Our case studies reveal that the implementation of practices triggers the development of specific capabilities in a predictable fashion. The case studies not only show that capabilities are developed while implementing practices but, furthermore that implementation leads to dynamic and operational capabilities.

The multiple case study comparison demonstrates that the implementation of practices does lead to dynamic and operational capabilities. The analysis reveals three different groups of practices. The first group influences the development of operational capabilities. The second group influences dynamic capabilities and the third influences dynamic as well as operational capabilities (see Figure 2).

-Figure 2-

The first group consists of TPM-related practices, which enables the development of operational capabilities. We label this group “conforming”. The group which influences the development of dynamic capabilities enfolds practices such as project management, continuous improvement, integration of development and manufacturing, and coordination with customers. This group yields at the transformation of a company, we name it therefore the transforming group. The last group of practices fosters the development of dynamic and operational capabilities. The “conforming and transforming” group consists of the practices pull-system, training and supplier

management. Summarizing, the observations of the four companies, coupled with insights from recent dynamic capabilities literature, leads to the following propositions:

P1: The implementation of practices of the “conforming group” leads to operational capabilities.

P2: The implementation of practices of the “conforming and transforming group” leads to dynamic and operational capabilities.

P3: The implementation of practices of the “transforming group” leads to dynamic capabilities.

The analysis of the relationships of the capabilities shows that the capabilities are highly connected. As clearly visible by the example of the dynamic capability "process oriented thinking" on the capability "adherence to task specification", dynamic capabilities influence the development of operational capabilities. Although the development of either one capability is possible in an isolated way, the case studies show that the capabilities "process oriented thinking" and "adherence to task specification" are linked hierarchically. In alignment with existing literature (Wang and Ahmed, 2007; Winter, 2003; Zollo et al., 2002) we therefore summarize that the relationship between dynamic and operational capabilities is hierarchic:

P4: Dynamic capabilities influence the development of operational capabilities.

Studies in the operations management area applying RBV often use the terms order winners and capabilities interchangeably (Hayes et al., 1988; Vickery et al., 1993; Vickery et al., 1997). However, researchers have argued that applying the RBV should lead to an analysis of the capabilities underlying order winners (Kim et al., 1996). We

have incorporated this concept and demonstrate how capabilities influence order winners.

Based on the data analyzed we summarize:

P5: Dynamic capabilities and operational capabilities influence the achievement of order winners.

Companies implementing practices influence the development of dynamic and operational capabilities. The underlying logic of the RBV suggests that variance in competitive outcomes between competitors stems from differences in resources and capabilities (Barney, 1991). Therefore, we analyzed the developed capabilities and their influence on competitive advantage. Table 6 highlights the influence capabilities have on the achievement of order winners, while Table 2 exemplifies that each of the studied companies ranks themselves as better than their relevant competitors in at least five order winners. Competitive advantage is achieved when a company produces greater value for the customer than its competitors (Sirmon et al., 2007). This result leads us to the final proposition:

P6: The fulfillment of order winners has a significant influence on the achievement of competitive advantage.

The model in Figure 3 summarizes the 6 propositions.

-Figure 3-

6. Conclusion

Because a study based solely on the analysis of order winners does not capture how competitive advantage is developed and sustained, we analyzed the capabilities underlying order winners for insight into competitive advantage. The in-depth analysis of

four Swiss manufacturing companies revealed that the fulfillment of order winners and, therefore, the generation of value is influenced by capabilities. The process of developing capabilities is an underdeveloped research area and needs clarification (Coates et al., 2002; Priem et al., 2001; Zhai et al., 2007). To understand how capabilities are developed we analyzed the implementation of practices (Voss, 2005).

The resulting interaction of the propositions is captured in Figure 3. The model explains how competitive advantage is achieved and sustained, and it reveals that the implementation of practices leads to dynamic and operational capabilities. Based on the case study analysis, we are able to show how capabilities are developed, and we address the question posed by Ketokivi and Schroeder (2004, p. 172): "Why do practices matter?". Practices enable the development of capabilities which are important for the fulfillment of order winners which leads to competitive advantage. We argue that practices matter due to their potential to develop dynamic and operational capabilities.

Furthermore, we shed light into how dynamic capabilities can be developed. We show that dynamic capabilities can be developed intentionally if a company chooses to implement one or more practices from the "transforming group" or the "conforming and transforming group".

Successful competition based on a single factor such as quality seems to be unlikely given today's global environment and competitive landscape. Various studies have shown that manufacturing companies are competing on multiple order winners simultaneously (Christiansen et al., 2003; Kathuria, 2000; Roth and Miller, 1992). What kinds of capabilities are needed to fulfill diverse customer needs simultaneously? The analysis reveals that they are both dynamic and operational in nature, confirming the literature

regarding dynamic capabilities (Cepeda et al., 2007; Winter, 2003). Each of the four companies analyzed utilizes a bundle of dynamic and operational capabilities, thus the data suggest that a combination of the two capabilities is necessary to be competitive on multiple order winners simultaneously. Although the derived model (see Figure 3) shows that the achievement of competitive advantage is possible if a company possesses only operational or dynamic capabilities. We argue that, in moderately dynamic and high-velocity markets (Eisenhardt et al., 2000), long-term competitive advantage is achieved if both capabilities are present. The dynamic capabilities open up new market opportunities, for example, through the introduction of new products, and the operational capabilities enable long-term success and sustainability.

The study also reveals significant findings for top managers. We surmise that the achievement of competitive advantage is based on a bundle of dynamic and operational capabilities. Therefore, it is important to know what kinds of capabilities exist within the company and what kinds of capabilities have to be developed. We have shown that the implementation of practices leads to operational or dynamic capabilities or to both. Moderately dynamic and high-velocity markets need a combination of dynamic and operational capabilities, suggesting that the choice of practices should be aligned to the desired capabilities. Companies lacking dynamic capabilities should consider implementing practices such as pull-system, training and supplier management or project management, continuous improvement, integration between development and manufacturing and coordination with customers. Companies in need of operational capabilities can implement TPM or practices from the second group (see Figure 2).

The following limitations should be highlighted. The 6 propositions regarding the development and sustaining of capabilities to achieve competitive advantage are based on an in-depth analysis of four manufacturing strategies. The results are therefore specific to the practices implemented by the four companies. Therefore, the studied practices are illustrative rather than exhaustive. Although the study provides valuable insights into the development and sustainment of competitive advantage, the analysis should be tested on a broader data set.

To further understand how capabilities are developed and sustained, we narrowed our focus to the implementation of practices and its potential to develop capabilities. This approach allowed us to analyze the development of capabilities in a structured way. Although we believe that this approach is appropriate for understanding the processes of capability development, it is nevertheless a sub-framing of the real world.

Finally, our study provides a look into the black box of sustaining and developing capabilities by shedding light on the importance of specific practices and their influence on capabilities and, in turn, competitive advantage.

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Tables

Case	Name	Number of employees	EBIT (Mio CHF)	Head-quarters	Plants	Industry
1	Cable Ltd	978	38	CH	CH, CHN, F, P, US	Manufacture of machinery
2	Pipe Systems Ltd*	5000	480	CH	AU, CH, CHN, CS, D, I, SLO, US	Manufacture of plastic equipment
3	Printer Board Ltd	2200	-	CH	CH, EU, CHN	Manufacture of electrical machinery and apparatus
4	Tool Ltd	450	Sales: 100	CH	CH, H, US	Manufacture of fabricated metal products

* The analysis is focused on one business unit. Therefore later on called Business Unit Pipe Systems.

Table 1: Description of the four analyzed companies

	Cable Ltd		Business Unit Pipe System		Printer Board Ltd		Tool Ltd	
	A	B	A	B	A	B	A	B
Order winners								
Low price	No	No	No	No	Yes	No	No	No
Conformance quality	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Product design and quality	Yes	Yes	Yes	Yes	Yes	No	Yes	No
Fast delivery	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dependable delivery	Yes	No	Yes	Yes	Yes	No	Yes	No
Wide product range	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Order size flexibility	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
After-Sales Service	No	No	No	No	Yes	Yes	Yes	Yes
Innovative product	Yes	Yes	Yes	Yes	No	No	Yes	Yes
Frequency of new product introduction	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Legend:
A = Company aims at
B = Better than competitor

Table 2: Order winners of the four Swiss manufacturing companies

Practices	Company			
	Cable Ltd	BU Pipe System	Printer Board Ltd	Tool Ltd
Pull-System	X	X	X	X
Continuous Improvement (Kaizen)	X	X	X	
Project Management	X		X	
Supplier Management	X	X	X	X
Integration between Product Development and Manufacturing		X	X	X
Training	X	X	X	X
TPM		X		
Coordination with customers			X	

Table 3: Practices

Company	Capability	Description	Practices
Cable Inc.	X process oriented thinking	employees understand their tasks as well as the overall process	pull-system, continuous improvement, training
Pipe System	X		pull-system, continuous improvement, training
Printer Board Ltd.	X		pull-system, continuous improvement, training
Tool Ltd.	X		pull-system, training
Cable Inc.	X adherence to specification	Employees understand that a variance leads to unstable processes and negative influence on performance	pull-system, training, TPM
Pipe System	X		pull-system, training, TPM
Printer Board Ltd.	X		training
Tool Ltd.	X		pull-system, training
Cable Inc.	X employee flexibility	employees are able to fulfill different jobs	pull-system, training
Pipe System			training
Printer Board Ltd.	X		training
Tool Ltd.	X		training
Cable Inc.	X market knowledge	knowledge about the competitive landscape	supplier management
Pipe System	X		supplier management
Printer Board Ltd.	X		supplier management
Tool Ltd.	X		supplier management
Cable Inc.	X close collaboration with suppliers	transparent supplier management	supplier management
Pipe System			supplier management
Printer Board Ltd.	X		supplier management
Tool Ltd.	X		supplier management
Cable Inc.	X production and process know-how	knowledge about the production techniques	integration of development and production
Pipe System	X		project management, training, integration of development and production
Printer Board Ltd.	X		
Tool Ltd.			
Cable Inc.	X management of the outsourcing tasks	transparent management of the outsourcing activities	
Pipe System			pull-system
Printer Board Ltd.	X		pull-system
Tool Ltd.	X		project management
Cable Inc.	X knowledge transfer	close collaboration between product development and production	
Pipe System			integration of development and production
Printer Board Ltd.			
Tool Ltd.	X		integration of development and production
Cable Inc.	X apprehension of the customers	ability to comprehend and translate the customer needs into the product specifications	
Pipe System			project management, close collaboration with customers
Printer Board Ltd.	X		
Tool Ltd.			
Cable Inc.	X short change over time	employees have the capability to change the machines to the new activities in a short time	
Pipe System	X		training
Printer Board Ltd.			
Tool Ltd.			

Table 4: Capabilities and relation to practices

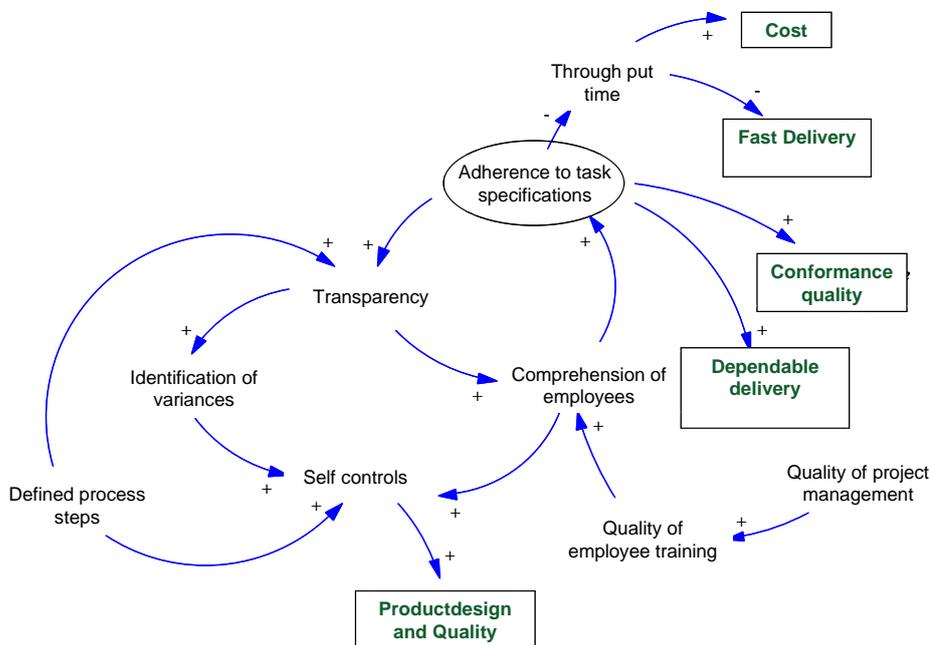


Figure 1: Example of Causal Loop Diagram "adherence to task specification" of Cable Ltd.

Capabilities	Nature of the capabilities
Adherence to task-specifications	operational
Process oriented thinking	dynamic
Market knowledge	dynamic
Employee flexibility	operational
Close collaboration with suppliers	operational
Knowledge transfer	dynamic
Management of the outsourcing tasks	operational
Comprehension of the customer	dynamic
Short change over time	operational

Table 5: Nature of the capabilities

Capabilities	Order Winners																																											
	Low price				Product design and quality				Conformance quality				Dependable delivery				Fast delivery				After-Sales Service				Wide product range				Frequency of new product introduction				Innovative product				Order size flexibility							
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4				
Adherence to task-specifications	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																	X			X
Process oriented thinking	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Market knowledge	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Employee flexibility	X	0	X	X	X	0	X	X	X	0	X	X	X	0	X	X	X	0	X	X	X	0	X	X	X	0	X	X	X	0	X	X	X	0	X	X	X	0	X	X	X	0	X	X
Close collaboration with suppliers	X	0	X	X	X	0	X	X	X	0	X	X	X	0	X	X	X	0	X	X	X	0	X	X	X	0	X	X	X	0	X	X	X	0	X	X	X	0	X	X	X	0	X	X
Knowledge transfer	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Management of the outsourcing activities	0	0	X	0	0	0	X	0	0	0	X	0	0	0	X	0	0	0	X	0	0	0	X	0	0	0	X	0	0	0	X	0	0	0	X	0	0	0	X	0				
Comprehension of the customer	0	0	0	0	X	0	0	0	X	0	0	0	X	0	0	0	X	0	0	0	X	0	0	0	X	0	0	0	X	0	0	0	X	0	0	0	X	0	0	0	X	0	0	0
Short change over time	0	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Legend: 1 Cable Ltd X Identified influence
2 BU Pipe System 0 Capability not existing
3 Printer Board Ltd
4 Tool Ltd

Table 6: Relationship Capabilities and Order winners

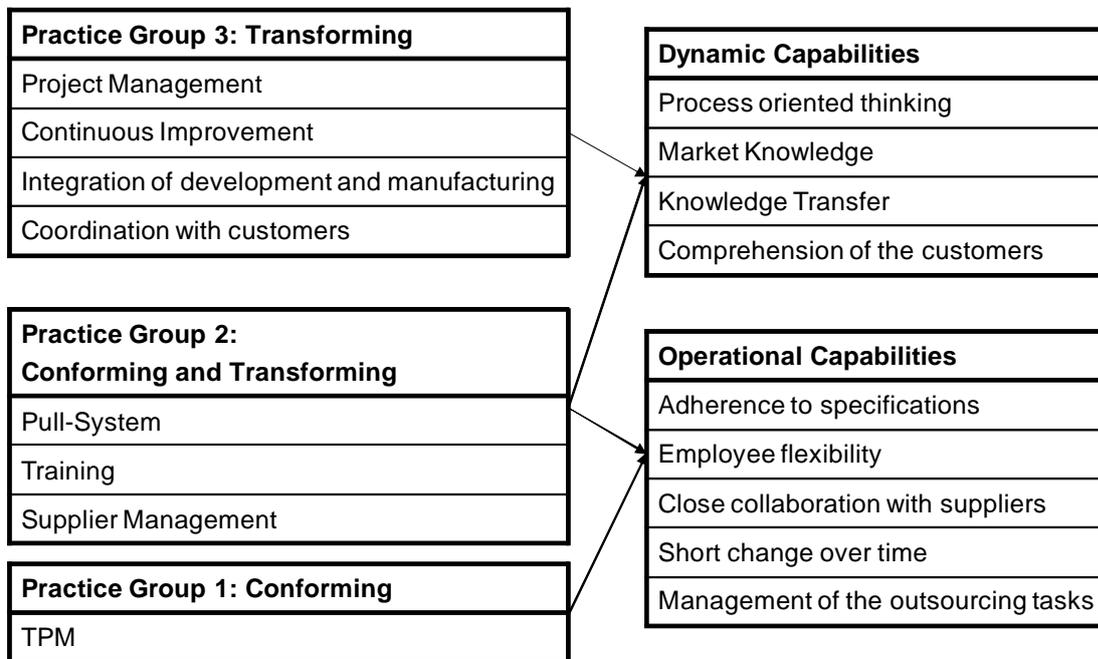


Figure 2: Relationship of practices and capabilities

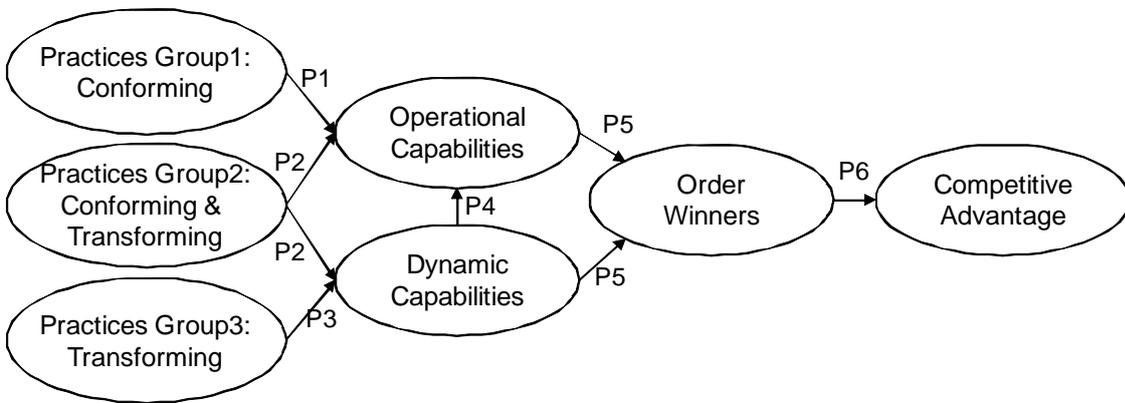


Figure 3: Model: "The sustainment and development of competitive advantage"