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MANAGEMENT CHANGES IN MRO BUSINESS THROUGH PRODUCT LIFECYCLE

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Abstract
Nowadays organizations and entire industries have faced the challenges of globalization and rapid technological development. These changes have brought new kind of competition and it has shaped and mixed organizations traditional business logic. This research is based on multiple case studies where the focus is on management changes through product lifecycle management. Emphasis is on MRO (Maintenance, repair, overhaul) providers and how they implement dynamic capabilities through product life cycle management. MRO is abbreviation for Maintenance, repair and overhaul and it is a commonly used in Aerospace industry. The study identifies several products in various stages of the life-cycle and thus identify the essential changes related to management. The stages that study identifies are Learning phase, Productisation phase and PBL phase. These phases can be used for clarifying dynamic capabilities in MRO markets.

Keywords
dynamic capabilities, service business, MRO – business, business model, aerospace.

Introduction

Many industries and market places have faced changes through globalization and rapid technology development. Also different kind of collaboration between firms give another dynamic point of view of markets. Incumbent organizations have faced difficulties carrying on with traditional business model. These challenges can be seen through all industries [1].

We can say that this is a global phenomenon. These changes have brought new kind of competition and it has shaped and mixed organizations traditional business logic. In order to be successful organizations must be able to change and adapt to changes facing. This requires organizations to have dynamic capabilities [2, 3].

Aerospace industry can be divided in two separate section; Military and civil segments. Both segments have different drivers for dynamics but what is common is the change. This study focuses on military side. In military side dynamics are based on reducing budget [4]. At the same time organizations must do with spending less. This gives the opportunities to MRO (Maintenance, repair, overhaul) providers.

The biggest expenditure for aircraft lifecycle is the fuel costs. The second place goes to MRO and that is the one which costs can be influenced by actions. On the other hand when aircraft operators are forced to cut costs, then the focus is on MRO costs [5]. Furthermore when existing systems age consequently costs and cycle times increase also [4].

This research is based on multiple case studies where the focus is on management changes through product lifecycle management. Emphasis is on MRO providers and how they implement dynamic capabilities through product life cycle management. Dynamic capabilities theory is marginally studied in MRO business. Selected case organizations are either solely operating in MRO field or have business in other markets also.

A dynamic capability is not unknown theory nowadays in the field of research. There are also case studies from different industries but the aerospace

industry itself is unexplored area in the field of dynamic capability. From quick overview Aerospace industry is not seen very dynamic itself but on the other hand the dynamics lies in the changes of management, not the changes of the products, and that's the reason that makes aerospace industry a fruitful area of research study.

Research questions

The aim of this study is to clarify management changes focused in MRO markets. The study also reflects results via theory of dynamic capabilities and by that trying to find connection with dynamic capabilities.

Research questions:

- What are the success factors in service business in dynamic environment
- How success factors connect with product lifecycle thinking
- Changes to management through product lifecycle

Literature review

Dynamic capabilities

Competition and changes in business environment create challenges to organizations to maintain and build competitive advantage. For being successful organizations must have dynamic capabilities [3].

Organizations with strong dynamic capabilities are able to sense and reach to changes in environment; in other words, they are able to adapt to changes. Great organizations can also change their current ecosystem by innovation, collaboration and entrepreneurial activities [6].

The roots of the theory of dynamic capabilities theory is structured from Resource based view (RBW) of a firm [7]. In short RBW shows that if organizations have resources that are valuable, rare, inimitable and non-substitutable, they can achieve sustainable competitive advantage [8].

Scholars have seen that RBW can't explain how organizations achieve and maintain competitive advantage in rapid markets where rapid technological change and aggressive competition is commonplace. Theory of dynamic capabilities takes theory of RBW and extends it to dynamic markets [7].

When describing what dynamic capabilities are we can approach the question from the point of what dynamic capabilities are not. Usually organizations make their living out of so called zero level capabilities or ordinary capabilities. Usually these are processes that are visible to the customer. Winter defines that dynamic capabilities modify or create these zero level capabilities. Dynamic capabilities are not adhok responses to changes, they are based on systematic approach, process in other words [9].

Unlike zero level capabilities dynamic capabilities are idiosyncratic [7]. It means that they are unique to each organization. Dynamic capabilities are also path dependent [10]. Path dependent reflects the organization's history and the decisions made. Organization's current status is made from the path it has gone and the decisions it has made.

There are many different definitions about dynamic capabilities but the most famous and cited is Teece's definition [3]

"the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments ".

Teece divides Dynamic Capabilities in three separate sections; Sensing, Seizing and Reconfiguring [6]. In short, sensing includes perception of threats and opportunities. It also includes the organization's processes how it's able to scan changes in the ecosystem. Examples of sensing are R&D research, collecting customer feedback (tacit and explicit) and also scanning competitors [11].

Seizing describes how organizations act or use the opportunity which they have found from sensing. It can be said that this is the phase where innovation is connected to services or products [12]. Examples of seizing are investment decisions, decision making and also changes in current business model if the response requires it.

Reconfiguring describes how organizations maintain their competitive advantage. This includes for example knowledge transfer between recourses inside the organization, cospecialization on products and services. Reconfiguring includes also discussion about organization's management system. Studies [13] have shown that decentralization is one key issue to maintain competitive advantage.

MRO business and lifecycle management

In aerospace industry there are several players whose responsibility is to take care of the flying airplane. The main stakeholders in the use phase of an aircraft are: operator of the aircraft, aircraft manufacturer, part manufacturers (also known as OEMs) and partners repairing and overhauling aircraft (known as MRO providers) [14].

MRO providers are one segment of the whole. MRO (maintenance, repair, overhaul) is a key activity in the lifecycle of an aircraft [15]. MRO providers

goal in short is providing service to customer at minimum cost, maximum quality and best lead-time [16].

MRO business includes a varied range of services to customers. These can be divided into five section. Line maintenance, Base maintenance, Engine maintenance, Spares and rotables support and aircraft modification. Aircraft end operator should be able to recognize which activities are the core business and on the other hand which activities can be outsourced to MRO companies [17].

In early days airliners in civil aerospace used to produce all of these activities but now days if not all at least major of them have been outsourced. This is because of the growing competition in the market.

Maintenance can be also divided in two sections; scheduled maintenance and unscheduled maintenance. Scheduled maintenance is preventive form of maintenance and it's done by pre-set intervals to ensure that the aircraft is air worthy. Unscheduled maintenance is used when the event of a breakdown occurs [18].

During the lifecycle of a military aircraft, planes system is regularly upgraded according to latest technology. This is the result of the technological development. MRO companies must change and gain their knowledge base because fresh technology requires different capabilities [19]. This kind of activity requires sensing and seizing capabilities.

Research methods

This research investigates three different organizations All of these are operating in MRO market but are on different stages of business. The phases can be found from Table 1. The method that was used is case study method. Case study method applied is empirical research method that collects versatile data in many different ways [20].

Table 1
Case organizations.

Company	Product and service offerings	Main phase of the business	Role of interviewee	Company size
A	MRO services, engineering	Learning	Member of the Board of management	900
B	MRO services, products	Productisation	Member of the Board of management	300
C	MRO services	Productisation and PBL	Member of the Board of management	1100

Three case organizations examined in study and their overview can be found in Table 1. All of the organizations operate mainly in MRO business and they differ from their main phase of the business. However, this doesn't mean that they don't perform some of these phases in other segments of their business.

The interviews are built on semi structured questions and the same questions were asked from all of the case organizations. Questionnaire conducted to case organizations is based on research questions introduced earlier in the study. The interviews were held between end of the year 2015 and at the beginning of 2016 inside case organizations offices.

Results

In this study product lifecycle starts from the design table and ends when the product is no longer operating. The product lifecycle is divided into three separate sections; Learning phase, productisation phase and PBL phase. It can be seen that the focus is not the product itself but how MRO activities are executed and developed during product lifecycle. Product lifecycle can be divided in many ways; the approach in the study is derived from selected case organizations. In different lifecycle phases organizations should apply different business models to fit prevalent environment. Thus organizations must change their business models when they change their position from one phase to another if they want to do it in a successful way. In other words, organization must have dynamic capabilities to step from one business phase to another.

Learning phase is based on Case A interview, productisation phase is based on Case B and C interviews. Thirdly PBL phase comes from the Case C interview.

There are organizations in MRO market that are making revenue solely by exploiting learning phase business model. They are continuously utilizing dynamic learning model throughout product lifecycle never standardizing product or process. This is crucial if the organization is going to meet aggressive competition or the industry itself change gradually or radically.

MRO providers are regarding themselves as service providers and thus the success factors can be found from service industry. Customer role on MRO business is much bigger than in traditional new products supply industry. In service business, information exchange between supplier and customer is seen as a critical success factor. Figure 1 shows different maturity stages of collaboration between supplier and cus-

tomer. Nature of information represent comprehensiveness of shared information between parties. Location of information tells where information is stored for example spoken (tacit) or documented (explicit). Basic idea behind the picture is that relationship between provider and customer has many different stages.

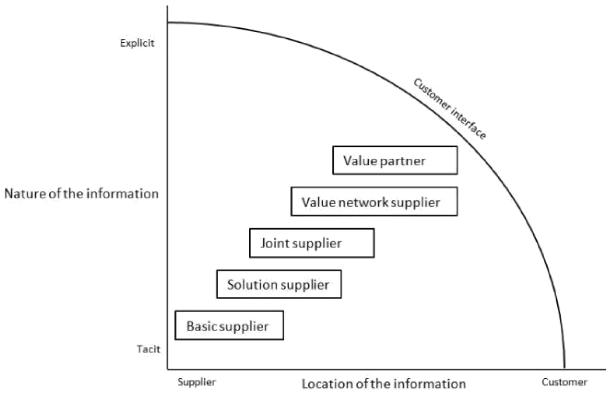

Fig. 1. Service business stages [21].

Research question: What are the success factors in service business in dynamic environment?

Customer is the key in service business and every case organization expresses that understanding customer value is one of the biggest factors for achieving success. In MRO service business partnership pops up every time when conversation focuses on success. Partnership can be seen as the same as trust. If customer does not trust supplier then partnership cannot be found.

Usually service contracts are based on long-term commitments and this reflects trust between customer and MRO provider. Long-term contracting can be seen as a stabilizer in dynamic environment.

From dynamic capability point of view Sensing happens almost all the time when organization has deep partnership with customer. Customers take part of the production process and in strategic partnership the customer might take part even in strategy process.

Next topic is how to build customer relationship in order to achieve partnership. None of the case organizations were able to answer clearly on that question. But all of them have however, divided their service offerings in separated sections; Learning phase, productisation, PBL phase. Normally service organizations are doing service business "as business as usual". When service providers have to sell more or find new customers they come up against a problem; How to get new customers? Case organizations have reached to this problem by dividing the service offerings as mentioned earlier. Traditionally service business is much more closely related to customer service than product business.

Research question: How success factors connect with product life-cycle thinking and changes to management through product life-cycle?

Success factors and their position on product life-cycle are shown in Table 2. Management element and success factor section shows the key issues found from the interviews. The table also shows how the content of these issues changes when going from one phase to another.

The sources of information come from the interviews. Success factors and their content on different phases are based on case organizations and their position on different phases.

Table 2
Management elements and success factors and their role in different phases in product life-cycle.

Management element and success factor	Learning phase	Productisation phase	PBL Phase
Risk management	Mitigate	Control	Buy these from customer
Customer encounter	One-time	Continuous	Long-term contracts
Business model	Selling what customer orders	Selling solutions to customer problems	Selling availability, capability and reliability
Trust between provider and customer	Narrow	Wide	Key element
Knowledge transfer from customer	Tacit	Explicit	Open knowledge transfer between supplier and customer
Suppliers role from customer poin of view	Service provider	Partner	Strategic partner
Protection against competition	Poor	Moderate, building VRIN elements	VRIN elements can be found

Learning phase

At learning phase the focus is on the organization itself, rather than the customer value. This doesn't mean that organization is ignoring the customer or its value, it means that most of the focus is concentrated on internal learning. This can be seen a way to mitigate risks. Customer value is part of the learning stage but the next stages bring that on totally different position.

During learning phase MRO organizations are recognizing parts of the whole system, which are related to the services provided to customers. These parts can be divided in two; materials and resources. MRO companies must have both of these to complete the service to customer. Through resources organization learns what kind of knowledge and competences production of the service requires. At the same time organization is gaining knowledge about materials management. This includes management of the supplier base and also building material management inside the organization. From the management point of view resource allocation is important task in this phase.

At learning phase the information from customer is tacit. Organization must develop their sensing skills to understand tacit information. Usually supplier has not reached a firm position in customers' processes. Thus understanding and learning from customer's process is still on shaky ground. The relationship between customer and supplier concentrates on one-time deliveries of the services. The business model on learning phase cannot be seen as service business and certainly not as partnership based on business interactions.

Usually invoices are based on actual costing on learning phase business model. The customer is not offered a fixed-price services. The actual cost includes used hours and materials for maintenance. Supplier aims to reduce risks by using actual based invoicing.

Productisation phase

Organizations begin to move towards productisation phase when they want to offer better service solutions to current customers or they want to gain competitive advantage compared to competitors. The basic idea of productisation is to create concrete service packages, which are easier to sell to customer. Productized services have fixed prize and duration. Fixed prize and duration can be offered because of the evaluation and performance measurement conducted in the learning phase. While learning phase is about sensing tacit knowledge and needs from the customer, consequently productisation phase is about answering to those needs.

At productisation phase the supplier has understanding about customers' processes and also how the productisation services are connected to those. Gaining that understanding requires trust and deeper cooperation between supplier and customer. Suppliers are trying to build long-term relationship with customers by productizing services. Supplier's goal is to get theirs services recognized part of customer's core processes. This is a way to strengthen relationship and also the point when we can talk about partnership. Long-term partnership is also a good position and an opportunity to try out new concepts and business models in co-operation with the customer.

Stepping in productisation stage requires changes to current business model. This is a must if organization wants to gain competitive advantage against competitors and also to achieve closer in partnership relationships with current customers. One good example of this is the pricing model and its potential to drive development. Fixed price services provide the opportunity to develop the business and thereby improve profit.

PBL phase

Building up the PBL capability starts with the identification of customer needs. Examples may include performance, qualification assignment, availability and reliability. These elements are the base for PBL contract. PBL contract is not "one size fit all". Actually PBL contracting is closer to case-by-case earning. It can be said that PBL focuses on delivering performance not parts or single maintenance to customers [22].

Performance Based Logistics can be seen as the most advantageous business model in MRO – business. Organizations must change their business model to step in to PBL concept. Successful PBL concept is built around partnership. However we have to remember that PBL is not just a service contract and its implementation in practice, it is much more. Customer and supplier must have deep co-operation and transparent information exchange and sharing together. The ability to deep co-operate and exchange information transparently is the key to building success together between customer and supplier.

The biggest change from this phase compered to others can be found from customer point of view. The customer does not pay for repairing, maintenance or failures; customer pays for usability and availability.

PBL model binds the customer and the supplier on long term and sometimes the length of the agreement might be until the end of the product life cycle. In part, this is due to the fact that the customer is no longer able to outsource operations because the

supplier has strong role in part of the customer's core processes. At this point, the partnership will have a new format and this can be called a strategic partnership.

PBL can be made in many different levels. Picture two is showing three examples of that. PBL can contain system level at the widest. At this point were talking about the whole aircraft as a unit. Subsystem level comprises of a group of smaller systems, such as a motor, that finally compile a complete system, an aircraft. Smaller PBL contracts can be built on component level. This includes single components, component families or spare parts for different maintenance programs. Case organizations in this study are building their PBL capabilities at component level and sub-system level. It can be said that system level PBL requires a lot of extensive and time-consuming learning and development before actual PBL contract can be established.

Fig. 2. Different levels of PBL contract [23, 24].

Conclusion and discussion

When organizations in MRO business are changing their business concept from one stage to another, they have to make all kind of changes to transform, for example in activities, processes, organization structures and way of thinking. Not all of the changes mandatory but the study shows that, if organization wants to succeed and gain competitive advantage, some changes are inevitable and must be brought forward and implemented. Developing from one phase to another requires change in the business model to perform successfully in every phase in MRO business.

Biggest changes in customer interface are related to depth of the relationship and building trust. Through these features it is possible to create competitive advantage and protect the business from competition. It can be seen that the sensing ability is much easier when organization is on higher level of MRO business phases. Good organizations are able to learn from existing partnerships and reflect that into new customers.

Another large area for driving change can be found from organization culture and also its values. From those we can discover many factors related to business behavior for example risk-taking ability, openness of the business, creating opportunities and their management. Culture and values are big change drivers related to creating partnership. This is one area in MRO business, which needs much more research.

The theory of Dynamic capabilities with their real life applications are not well known in MRO – business. However, the activities related to Dynamic capabilities can be found in all case organizations but this is also a theme that needs more research and recognision. The study is focused in military segment and same kind of study made in civil segment might give a better view of the whole aerospace MRO – segment. In general, the elements of the theory of dynamic capabilities can help organizations to gain competitive advantage in aerospace industry.

In the management and business point of view the results can give more understanding about changes in business model and theirs role on competitive advantage. Like mentioned earlier, business model changes are related closely to competitive advantage.

Same sort of study in different markets can give better understanding about changes in management level and also show if the same kind of phases can be used on other market segments.

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