Chapter 12
Engineering Change Management and Transition Towards Mass Customization

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12.1 Introduction

A common trend of today's markets is the increased demand for customized products and services meeting the individual customer's needs. At the same time, it is common for all industries that globalization has led to increased competition and shortened product life cycles. A recent study by Roland Berger documents that the average product life cycle has been reduced by 24 % over the last 15 years [17]. Consequently, today's manufacturers are in pressure for finding more efficient approaches for bringing customized products to the market.

12.1.1 Mass Customization (MC)

Perfectly suited to the challenge described in above, MC arose as a concept and an operations strategy in the late 1980s, in a response from the US car manufacturers to the new competition from low-cost, high-quality Japanese car manufacturers [3]. MC enabled a new approach to competition, combining the ability to deliver products meeting the individual customer's needs, with an efficiency similar to mass production [15]. By introducing higher variety as a competitive parameter in the market, the US car manufacturers were able to gain a competitive advantage over the Japanese manufactures. Since then, research on MC has focused on clarifying the defining characteristics of the companies that successfully adopt the MC strategy. This has led to the introduction of three fundamental dimensions in enabling

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the MC ability. The three dimensions are by Salvador et al. [18] framed as the three fundamental MC capabilities: solution space development, robust process design and choice navigation.

Companies who decide for an MC strategy can have very different starting points. Traditionally, MC has been described as companies mass-producing standard goods, introducing higher variety, thus customizing each product. However, as MC gained popularity, companies who originally produced high variety, such as engineer-to-order companies, began to recognize the potential of the MC approach. Over the last decade, a number of studies have also been reported on ECO companies adopting an MC approach, to increase profitability [2, 6, 7].

Regardless of the starting point of the transition process towards MC and the approach at MC, the process of designing starts rarely from scratch, but rather by modification of existing design [4, 5, 12]. Eckert et al. [4] also describe two extremes for customizing by modifying existing design: changing existing base to meet individual customer's needs or developing a modular product range which can be configured to the individual customer's need [4]. Another classification of customizing by modifying existing design is proposed by Muntslag [14], who has developed a classification scheme for how much of the design that can be done order-independently in a customization effort [14].

Since designing or product development in a customization scheme inevitably involves modifications to existing design, it is evident that engineering changes and their management (ECM) are an inevitable part of mass customization. This implies furthermore that for companies transitioning towards MC, it is assumed that the effective and efficient management of engineering changes becomes even more important.

12.1.2 Engineering Change Management

As a consequence of the increased demand for customization and that product life cycles are growing shorter, the design of new products based on adaptions from existing products, or by the combination of existing design elements, is today becoming a dominating approach to new product development [8, 23]. On this background ECM, which addresses management of the technical changes, i.e. engineering changes, in products and related value chain processes, is also becoming increasingly important, especially when dealing with complex engineered products. ECM has not only received increased attention due to the shift in approach and focus of product development but also due to the increasing product and value chain complexity [4]. Combined with this, globalization has led to increased complexity in supply chains and to increased variation in market and documentation requirements [17]. All of this increases the need for managing engineering changes in order to ensure efficiency and profitability.

Different definitions for engineering changes can be found in literature. Based on an overview on some of the most prevailing definitions, Hamraz et al. [5] propose the following definition: 'ECs are changes and/or modifications to released structure (fits, forms and dimensions, surfaces, materials etc.), behaviour (stability, strength, corrosion etc.), function (speed, performance, efficiency, etc.), or the relations between functions and behaviour (design principles), or behaviour and structure (physical laws) of a technical artefact'. This definition delimits engineering changes to concern changes to already released structure. Based on experience from practice, this paper takes point of departure in a broader understanding of engineering changes, also concerning the release of new structures. The introduction of a new product family in a product program, or the introduction of new design elements to an existing product family, is also considered as engineering changes. The definition used in this context is therefore:

> ECs are changes and/or modifications to released structure (fits, forms and dimensions, surfaces, materials etc.), or product programs (release of new structure), behaviour (stability, strength, corrosion etc.), function (speed, performance, efficiency, etc.), or the relations between functions and behaviour (design principles), or behaviour and structure (physical laws) of a technical system.

ECM refers to the organization, control and execution of ECs and can, as topic and research field, be regarded as one of the five sub-elements of the broader field configuration management [8]. The goals of ECM are to avoid or reduce the number of engineering change requests (ECRs) before they occur, to select their implementation effectively when they occur, to implement required ECs efficiently and to learn from implemented ECs. Research on ECM has for years focused on specific and isolated practices in relation to change handling, e.g. change impact assessment [13], reasons for initiating EC [10] and effects of change propagation [11]. Only lately research on ECM has focused on giving a more comprehensive overview of the practices and capabilities needed for successful management of engineering changes. Based on an extensive literature review, Jarratt et al. [8] have established an overview on the key practices of ECM. Another extensive and recent literature review has been conducted by Hamraz et al. [5], who focuses on bringing a holistic categorization framework for literature on ECM. In a study by the Aberdeen Group of 135 enterprises from different industries, a number of capabilities, characterizing best in class companies in relation to change handling, are identified [1]. Based on a case study and a review of literature on ECM, a capability framework for ECM has been developed by the authors of this paper [21]. The framework introduces a number of ECM-related capability areas and has in a recent study been further developed into an ECM maturity grid, which provides a comprehensive overview of the capability areas within ECM [20].

12.1.3 Objectives of the Paper

From the overall introduction to ECM and MC, it is clear that the two research domains are related, both from a practical level and in sharing the aim of ensuring an efficient introduction of variants. Despite of the close relation of these fields, none of the contributions within ECM addresses how ECM can support a more efficient customization. The objectives of this paper are on this background to add clarity to the relation between ECM and MC and building on previous research [19–21] to develop new knowledge on what capabilities within ECM a company should mature to support the transition towards MC.

The transition towards MC can generally be described by two extremes, either as a transition from mass production in which the manufacturer pursues a greater adaptability to customer demand by increasing the solution space or as a transition from complete customization, where the manufacturer pursues efficiency by delimiting the solution space. This paper is based on a case study in a global engineering-oriented manufacturer which is managing customization to some degree, but at a cost which is not fully competitive. The case company is based on this striving to achieve an increased and more efficient product customization. The case company is therefore not to be categorized in either of the two extremes, but rather as a mix.

12.1.4 Research Questions

Based on the objective introduced in above, this paper takes point of departure in the following research questions:

1. Which practices of ECM are especially challenged by an increased adaption to customer-specific requirements?
2. What are the relations between the fundamental capabilities of MC and the capability areas of ECM?
3. What capability areas within ECM are central to support the transition towards MC?

Research question 1 is answered in Sect. 12.3 based on findings from a case study. Building of the findings from this and by a literature review and a focus group interview, research questions 2 and 3 are answered in Sect. 12.4.

12.2 Research Methodology

In this section, the research methodology is introduced together with choices in regard to the methods applied. Due to the scarcity of literature addressing the relation between ECM and MC, a combination of case study, literature review and focus group interview was considered necessary to answer the research questions.

12.2.1 Literature Review

In order to clarify the relation between ECM and MC, a thorough review of literature on ECM and MC was conducted. Through title and topic searches on Thomson Reuter's 'Web of Science' and Elsevier Scopus, and by using combinations of the search strings ‘mass customization’ and ‘engineering change management’ and ‘configuration management’, 96 contributions were identified. By title and abstract review against the following criteria, the list of relevant contributions was narrowed down to only three relevant contributions. The criteria used in this were literature that satisfied the following criteria: (a) literature defining or describing MC and ECM capabilities and (b) literature addressing the relation between MC and ECM.

Through detailed review of the relevant papers, the relations between the capabilities of MC and ECM were clarified by the following approach. First the mechanisms of ECM reported in literature as important for MC were identified. From these, ECM-related capability areas were then identified using the ECM capability framework of Storbjerg et al. [20]. Finally the relations between the ECM capabilities reported in literature and the fundamental MC capabilities were identified by deducing for each capability, with logical reasoning, the higher goal or purpose that the ECM capability serves. The findings from the literature review are introduced in Sect. 12.4.

12.2.2 Case Study

In order to identify which capability areas of ECM are especially challenged by the transition towards MC, a longitudinal case study was conducted in a global manufacturer pursuing the MC benefits. Through observations and participation in new product development projects, key challenges and enablers of ECM in achieving the MC benefits were identified. The case study and the case company are further introduced in Sect. 12.3.

12.2.3 Focus Group Interview

It is generally accepted that organizational researchers can improve the accuracy of their judgements by collecting different kinds of data bearing on the same phenomenon. This method is also referred to as triangulation [9]. In order to allow for greater reliability and validity of the results of the paper, it was decided to supplement the literature review and case study with a focus group interview with five configurations responsible from the case company. Focus group interview was selected as it is generally acknowledged that this interview method allow for more efficient data generation, due to the interaction in the group [16]. The participants of the focus group interview were selected based on their experience from practice with configuration and change handling. The questions for the focus group interview are introduced together with the findings from this in Sect. 12.4.

12.3 Case Study: Barriers of ECM for the Transition Towards Mass Customization

This section introduces the capability areas of ECM, which, based on the longitudinal case study, were identified as especially challenged by the transition towards MC. First a brief introduction is given to the case study and the case company, followed by a section on the key findings from the observations and interviews.

12.3.1 Introduction to Case Study and Case Company

The case study was conducted over the period from 2011 to 2015 in a large industrial manufacturer of power plants. The case company is a global organization of 20,000+ employees having activities in more than 70 countries. The internal value chain involves everything from sales, engineering, sourcing, manufacturing, transportation and construction to service and decommissioning. The products of the case company, i.e. the power plants, are complex engineered products having a lifetime of up to 25 years. The development of new products is based on a platform-based approach. Being faced with varying customer requirements and a demand for customization of the product offering, the case company has for years been pursuing the MC benefits. The approach to MC has primarily been relying on building the solution space development capabilities, by a focused effort on modularization, and building the choice navigation capabilities, by a number of initiatives on building the capabilities concerning product and sales configuration. The case company is, in addition to the products, offering service and repair solutions and therefore also required to manage changes throughout the entire product lifetime.

All of this is having a significant impact on the complexity of change handling, e.g. in evaluation of change impact and interchangeability. Operating in a maturing market, the case company is facing an increased competition and is based on this in an emergent need for improving its competitiveness. As a consequence, the design strategy has over the last years increasingly focused on further developing and improving the existing product platforms, in order to introduce more cost-efficient product variants. As a result, the handling of engineering changes, which in the case company is formalized in the ECM process illustrated in Fig. 12.1, has gained increased importance and management attention.

12.3.2 Findings from Case Study

By participating in several new product development projects and ECM improvement initiatives, and from interviews with configuration experts, a number of challenges in ECM have been identified as barriers for the transition towards MC. Using

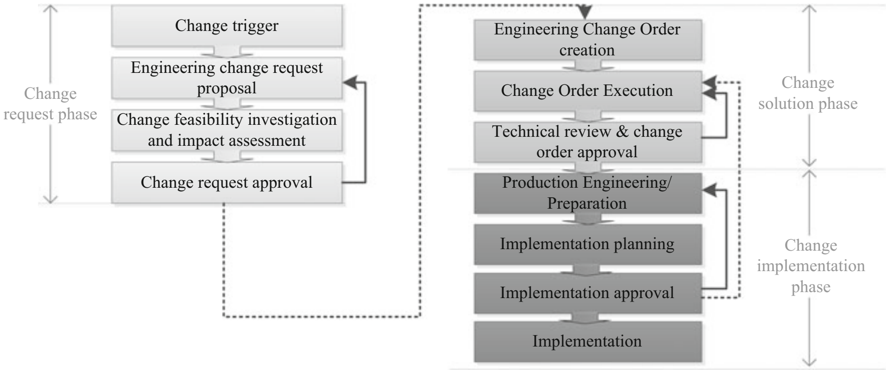

Fig. 12.1 Process for handling engineering changes in case company, i.e. ECM process

the capability framework of Storbjerg, Brunoe and Nielsen [20], the challenges have been characterized. From this, the following four capability areas of ECM have been clarified as important for the transition towards MC:

ECM roles and responsibilities

One of the challenges identified through the case study is how to organize around change execution. This topic has also been noted by other scholars; e.g. Hamraz et al. [5] highlight this as one of the core themes of ECM. From the observations and the interviews, it is clear that the transition towards MC and an increased adaption to customer-specific needs call for changes to the organization around change execution, especially if the MC strategy followed builds on a modular and platform-based approach, as in the case company. In this the product development activities are organized according to a matrix-based organization, in three product platforms and 11 generic technical systems, which carry all functionality of the products. The organization around change execution is based on the product platform driving the need for the change and typically as part of a product development project to create a new platform variant. For each platform project, staffing of the project organization is done by having resources from relevant systems in the line organization of the R&D function allocated to the project. Depending on the scope, one or several changes are initiated for each system, and a case handler, typically the responsible design engineer, is assigned. The case handler is responsible for the change execution until design finalization, where an implementation responsible from the receiving business unit, which often is a manufacturing unit, takes over. This organization has in the case company proven to work well for years. However as the case company during the last years have intensified the adoption of a modular and platform-based approach to product development, the coordination of change execution has become an increasing challenge.Based on the increased reuse of components and modules across products and product families, changes are now not only impacting one configuration but more often several configurations. Planning and coordination are consequently increasingly required across the platforms. On top of this, it is in the case company more the rule than the exception that multiple development projects for each platform are running at the same time with separate timelines. It has based on this become an increasing challenge to handle change execution and change implementation without conflicting priorities and needs. The coordination is up to the responsible case handler which often does not have the full overview of the change and its relations to other ongoing projects and changes. The organization around change execution is on this background identified as an important capability for the success of the transition towards MC.

Change structuring and planning

Closely related to above challenges, structuring and planning change execution are significantly challenged by the transition towards MC. Especially planning and controlling the effectivity of changes have become a challenge. Changes have different priorities and timelines, e.g. due to differences in supply lead time and supply setup across the divisions of the company. As the sequence of the change implementation matters, the structuring of change creation to support an efficient and coordinated change implementation, which is also respecting the diverse timeline requirements, has become an increasing challenge.

Change approval process

Another practice of ECM in the case company, which is becoming increasingly challenged by the transition towards MC, is the change approval process. As a consequence of the increased reuse of components and modules across platforms, changes are increasingly impacting multiple platform variants or configurations. This is a challenge for the change approval process in the case company, which is based on change approval boards organized per product platform. Changes having impact across product platforms are most often only reviewed at one of the platform change boards, with the consequence that key stakeholders are not involved in the change approval process. Consequently it is in several cases experienced that conflicting or non-authorized changes are implemented.

System integration and use of product data management (PDM) systems and product life cycle management (PLM) systems

Customization calls for not only customizing the product but also the related information, e.g. documentation, specifications, etc. The case company uses an own-developed change management system which has been integrated to some degree with the PDM system and the enterprise resource planning (ERP) system. Based on the increased number of product variants in the case company, the handling of changes in documentation and specifications as, e.g., bill of materials and master data have been a significantly growing challenge. Especially the lack of system integration in between, e.g., the CAD, ECM, PDM and ERP system has generated not only a massive administrative task due to the inefficient workflow but also a significant data quality issue. The use of integrated PDM and PLM systems has on this background been identified as a key capability to handle an increasing product variety.

12.4 Enablers of ECM for the Transition Towards MC

In this section, the relation between ECM and MC is described based on a combination of literature review, case study and a focus group interview. By this research question 2 is answered. First, the findings from a review of relevant literature are reported using the method outlined in Sect. 12.2.3. Following this, the findings from a case study and a focus group interview are described. In closure of this section, the results are summarized, and the capability areas of ECM which are central to support the transition towards MC are listed, by which research question 3 is answered.

12.4.1 Literature Review: Mass Customization and ECM

It is, from the introduction, clear that MC and ECM are closely related concepts and research domains. This relation is both on an operational level, e.g. depending on the same activities, and at a strategical level, e.g. sharing the aim of ensuring an efficient introduction of variants. In spite of the close relation of between these fields, the relation between ECM and MC has not been studied. Following a literature search according to the method introduced in Sect. 12.2, the below three contributions were identified and reviewed.

The relation between MC and ECM is noted by Hamraz et al. [5] in a comprehensive review of literature on ECM. In this it is highlighted that ECM has gained increasing popularity benefiting from the rise of attention towards MC among other concepts [5]. No further notions or references are however given the exact relation of ECM and MC.

Eckert et al. [4] have studied relation between MC, change and inspiration with focus on the process of changing design to meet new needs. Based on observations and interviews with engineers in three companies engaged in customization and handling of engineering changes, Eckert et al. [4] propose a classification of change processes in three different types of changes. The classification is used to describe the relation between old and new products. Building on the classification, Eckert et al. [4] describe MC as a change process with the argument that MC can be described as design for change, where change is explicitly aspired to and answered by flexibility. Following this view, the common challenges of MC and ECM are discussed. One of the common challenges highlighted is change propagation, i.e. that changes propagate to other parts of the system. In relation to this Eckert et al. [4] highlight the importance of predicting the scope of change, i.e. knowing the impact of change as early as possible in the process. Another challenge highlighted as common of MC and ECM is planning the change process, e.g. in running parallel challenges with interfaces to each other. The study of Eckert et al. [4] concludes that common methods for predicting impact of changes, assisting in planning of changes and handling parallel changes could be developed with benefit for both ECM and MC. The study does however not bring any further detailed clarification of which capabilities of MC these support or how the methods should be developed.

In a recent study, Veldman and Alblas [22] also argue for that the relation between ECM and MC has only grown more important with what they characterize as the MC wave. MC is in this study viewed as a balancing act of reuse and distinctiveness, from which it is clear that Veldman and Alblas [22] primarily focus on the solution development capabilities of MC. Based on a multiple-case study in two capital-goods manufacturers, the study contributes with knowledge on how to structure and manage the ECM process in order to support the balancing of reuse and distinctiveness [22]. The paper contributes based on this with knowledge on the relation between especially the solution development capability of MC and the capability areas of ECM. The following mechanisms are identified: (a) managing generic design information; (b) isolating large engineering changes, which concern the planning and structuring of changes; (c) managing process variety; and (d) designing and executing change process, which concern the ability to develop a process for controlling changes. In addition to the four mechanisms, the following practices in relation to ECM are identified as important for the management of design variety: minimizing complexity, change approval, change planning, managing generic design types, avoiding engineering changes by standardization and categorizing engineering changes. Veldman and Alblas [22] conclude that the importance of the practices and capabilities differs according to product delivery strategy and, based on this, that different configurations should exist for the ECM setup and each of the four mechanisms [22].

From the above literature review, a number of mechanisms within ECM have been identified as enablers for the transition towards MC. In total five enablers have as illustrated in Fig. 12.2 been identified.

12.4.2 Findings from Focus Group Interview

Seeking the same goal as with the literature review, i.e. to identify capabilities of ECM that are central to support the transitions towards MC, a focus group interview was conducted with configuration responsible from the case company. The interview was conducted by the following approach:

1. Firstly, based on the ECM capability framework by Storbjerg and Brunoe [20], the interviewees were asked to identify which capabilities in relation to ECM they experienced especially challenged by an increasing variety and hence important for the ability to offer new variants efficiently.
2. Secondly, the interviewees were asked to complete and validate the list of case company-specific MC-related capabilities and initiatives in Table 12.1.
3. Finally the interviewees were asked to evaluate the degree of influence of the ECM-related capability areas on each of the case company-specific MC-related capabilities using a scale from 1 to 4. These were done taking point of departure in the capabilities identified as important for MC based on case study, literature and interview (Table 12.1).

Capability area	Sub-capability area	Important for MC: Identified from focus group interview	Important for MC: Identified from literature review	Important for MC: Identified from case study	Related mass customization capabilities: Product management process	Modularization process	Standardization	Engineering process	Scoping process	Sales Configuration tools	Sales process	Product configuration setup	New product introduction processes	Flexible manufacturing	Total score
(A) ECM process	(1) Change identification, prediction & proposal	X	X		3	3		3	2				2	1	14
	(2) Change approval	X	X	X		1	3	1	4				1		10
	(3) Change impact analysis	X	X			4		3	3	3		4	3	3	23
	(4) Change prioritization	X			1			3	4			2	2		12
	(5) Change definition and categorization														
	(6) Change cost management	X			3						3				6
	(7) Change solution development, selection and	X						3				2	2	2	9
	(8) Change implementation	X											3	3	6
	(9) Documentation of change														
	(10) Coordination & integration with internal stakeholders	X			2	1	1	4		1	1	1		3	14
	(11) External integration; customers, vendors etc.	X			3	2	1	1	5	3	2	3	1	1	22
	(12) Process for emergency change handling														
	(13) Planning of change handling and implementation	X	X	X	2	3		3	1	2	2	1	4	4	22
	(14) Process of controlling engineering changes		X												
	(15) Scaling and tailoring of ECM process														
(B) Change monitoring	(16) Change status reporting	X						3			1		4		8
	(17) ECM performance management	X						3					4		7
(C) IT tools	(18) ECM system														
	(19) Use of PDM&PLM systems	X		X	3	1	2	2	1	4	1	4	3		21
(D) Management & communication	(20) Communication	X			1	1	1	1	1	1	1	1	1	1	10
	(21) Front-loading of ECM														
	(22) ECM strategy														
	(23) Resource management	X						2	2			1	2		7
(E) People, skill & competencies	(24) ECM roles & responsibilities			X				3	1				4		8
	(25) ECM competence management & training	X			1	2	2	2	2	1	1	1	2	1	15
	(26) Continuous improvement & learning														
1 = 1 slightly influential, 2 = 2 Somewhat influential, 3 = 3 Very influential, 4 = 4 extremely influential					Solution Space Development					Choice Navigation		Robust Process Design			

Fig. 12.2 Mapping of ECM capabilities with the fundamental MC capabilities

The result of the focus group interview is presented in Fig. 12.2. Based on the input from the configuration responsible, 17 ECM capability areas were identified as important for the ability to offer new variants efficiently and thus important for the transition towards MC. From the interviewees' evaluations of the degree of influence, which are summarized in the rightmost column in Fig. 12.2, the following four capability areas are especially attributed as influential:

1. **Change impact analysis**: The capability of early detecting change and predicting the impact of the change before change approval is as indicated in Fig. 12.2 especially impacting the solution space development capabilities. Uncontrolled change propagation is indisputably impacting the ability to efficiently develop a customer-required solution space. Eckert et al. [4] also highlight the importance of predicting the scope of change.

Table 12.1 List of initiatives and capabilities specific for the case company

MC capabilities	Case company-specific MC capabilities and initiatives
Solution space development	• *Modularization*: process and initiative aiming to build an optimal modular product architecture • *Standardization*: process, governance setup and initiative to build a standard product catalogue • *Engineering process*: framework and process to ensure a well-defined and structured engineering design process • *Scoping process*: process, IT and governance setup initiated to control the scoping of new variants
Choice navigation	• *Sales configurator*: IT setup to support the product customization and building of specification and documentation in sales • *Sales process*: process to support customer solution selection
Robust process design	• *Product configuration setup*: IT setup to build the complete set of product specifications based on customer selection • *New product introduction processes*: process to prepare specifications for manufacturing • *Flexible manufacturing*: process, IT setup and initiative aiming to build the needed supply chain flexibility

2. **External integration**, **customers**, **vendors**, **etc**.: ECM is integrating many functions and activities across the value chain; it does based on this not come as a surprise that the ability to integrate to customer, vendors, etc., is important. Dealing with changes to customized products, the configuration responsible reports in the group interview that integration of vendors and customers in the change handling is increasing in importance. Much quality management literature have for decades also highlighted the importance of clearly understanding the voice of the customers. Similarly research on product development has also for years advocated an integrated approach.
3. **Planning of change handling and implementation**: Thorough planning of change handling and implementation is not only evaluated important of the ability to develop a new variant but also for ensuring a robust process. In the group interview, it was reported that challenges in the case company in change implementation originating in poor planning had only increased, as the product variety increased.
4. **Use of PDM and PLM systems**. Another ECM capability that, based on the interviewees' experiences, was significantly impacting the ability to customize efficiently is the use of IT tools to support the change handling. Based on insufficient system integration, it was reported that multiple manual data entry and lack of transparency caused the workload of change execution to explode, with an increasing product variety.

Based on the findings above, it is evident which capability areas of ECM that can be considered as enablers for the transition towards MC and therefore especially important to focus on if pursuing the MC benefits. The results are presented in Fig. 12.2 which also indicate the relation between the fundamental capabilities of MC and the capability areas of ECM.

12.5 Conclusion

With an intensified competition and an increasing demand for customization, manufacturing companies are today more than ever challenged to develop the capabilities, which can ensure an effective and efficient customized product introduction, i.e. the MC capability.

Although engineering changes, which are central for the customization process, has been studied for years, it has until now not been studied how ECM can support MC. On this background, the purpose of this paper is to support practitioners in the academia and industry, with clarity on the relation between ECM and MC.

Based on a combination of review of literature on ECM and MC, a longitudinal case study and a focus group interview in a global manufacturer pursuing the MC benefits, 17 capability areas of ECM have been identified as important for the transition towards MC. From this it is evident that MC and ECM are related concepts and that the transition towards MC also depends on ECM-related capability areas.

The degree of influence of the ECM capability areas to the MC capabilities has been evaluated by a group of domain experts involved in product configuration and change handling. From this it is evident that the following four ECM capability areas are evaluated to have significant importance, for the ability to introduce customized solution effectively and efficiently: change impact analysis, use of PDM and PLM systems, planning of change handling and implementation and external integration with customers, vendors, etc. These ECM capability areas are therefore especially important to focus on, in order to support the transition towards MC.

This paper contributes on this background with knowledge of the relation between the fundamental capabilities of MC and the capability areas of ECM. Furthermore the paper contributes to existing knowledge in ECM and MC with knowledge on which capability areas of ECM are central to support the transition towards MC.

Based on these results, a number of opportunities exist for further research. One opportunity for further research is to extend the group interviews to other companies involved in ECM and pursuing the benefits of MC, in order to strengthen the findings of the research. Another opportunity for further research is to further study and validate the relations between ECM and MC, e.g. by obtaining data from multiple-case studies in companies pursuing MC benefits, in order to investigate the correlation of company performance with presence of ECM capabilities.

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