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Products, activities and competence
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Products, activities and competence - an integrated view in association with customization

Within the academic debate attempts have been made at combining the resource based view and the activities based view¹. Among the calls for such attempts we find Haanes and Fjeldstad² who point out that there is a need for integrating the activity based view and the resource based view. Their discussion is focused on intangible resources and in particular competences. The link between competences and activities is also investigated by Løwendahl and Haanes³. Other examples that more implicitly bridge the activity and resource based views, with a particular focus on intangible resources, can be found in the work on value constellations and value configurations. Especially Normann & Ramirez⁴, Stabell & Fjeldstad⁵, and Ramirez⁶ display similarities in the way that they describe issues on value creation logics. What is interesting is that the Normann & Ramirez paper largely originates from a competence perspective while Stabell & Fjeldstad start their discussion from the activity based perspective. We can also turn towards organizational learning in order to find a link between activities and competences. In the description of learning and competences by Nordhaug⁷, we find that major parts of learning take place in association with daily work tasks, either directly or by triggering studies associated with work tasks.

Another debated issue is the relationship between competences and its representation in products, systems and other types of output. This theme has for instance been discussed by authors such as Grant & Baden-Fuller⁸ and Teece et al⁹. Grant & Baden-Fuller include dynamism and learning in their discussions, but the direct link of how knowledge gets represented in products is not analyzed in detail. Teece et al position capabilities and competences towards products as the focus of strategic importance. They claim that competences can be “molded” into products but do not elaborate more closely on the subject since the primary focus on the article is on dynamic capabilities. Thus, there seems to be a need for examining the relationship between competence, output and the daily work tasks of the organization and its individuals.

The empirical setting of this study has been delimited to organizations supplying highly customized deliveries on industrial markets. The reason for this focus is the particular characteristics of such organizations. The organizations studied are not working entirely with non material deliveries, as advertising agencies or professional service firms do, but nevertheless supply highly customized deliveries. An organization acting on an industrial market, although it might supply highly customized deliveries based on a high degree of highly skilled work, is closely related to its products and the processes linked to

¹ C.f. Mathews, 2006

² Haanes & Fjeldstad, 2000

³ Løwendahl & Haanes, 1997

⁴ Normann & Ramirez, 1993

⁵ Stabell & Fjeldstad, 1998

⁶ Ramirez, 1999

⁷ Nordhaug, 1993

⁸ Grant & Baden-Fuller, 2004

⁹ Teece et al, 1997

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developing and producing them. The organizations' deliveries depend both on activities directed towards customers in customer projects, and products or solutions for repeated reuse that are the outcomes of internally oriented activities. Therefore, the organizations in this study are likely to utilize their competences differently based on how they direct their activities. And furthermore, the way that competences are represented in products and solutions is likely to vary due to the focus of the organizations activities. Therefore the focus of this paper is on the interdependence between these three entities.

Thus,

How is competence related to activities and products, as well as other organizational outputs, in organizations supplying highly customized deliveries on industrial markets?

Highly customized deliveries in industrial organizations

Customization is not a new phenomenon and has always been significant in industrial markets¹⁰. In their literature review, Spring & Dalrymple map different distinctions between levels of customization. Of particular interest here are the higher levels of customization, what Shapiro would refer to as "custom-designed", Sharma "standard, modified to customer specifications" & "customized product", and Lampel & Mintzberg "tailored customization" & "pure customization"¹¹. Customization as a topic in academic writings has, from a manufacturing strategy perspective, been discussed rather limitedly¹². It has to some extent been implied in association with service and innovativeness¹³ and the links between for instance customer co-innovative activities and customization has been established quite recently¹⁴. Recent research associated with customization has been spurred by the emergent ideas of mass customization¹⁵ and modularity for flexibility¹⁶. Although the issues of modularity are interesting, mass customization and the larger volumes associated with it is not a key focus here. The emphasis is instead put on the higher levels of customization where adaptations for each project and customer are far reaching.

Organizations working with higher levels of customization have, according to Nemetz & Fry¹⁷, invested in order to have a flexible production process. In turn, a high level of customization in production opens

¹⁰ Spring & Dalrymple, 2000

¹¹ Spring & Dalrymple, 2000; review including Shapiro, 1977; Sharma, 1987; Lampel & Mintzberg, 1996.

¹² Spring & Dalrymple, 2000

¹³ Spring & Dalrymple, 2000

¹⁴ Athaide et al, 2003

¹⁵ Spring & Dalrymple, 2000

¹⁶ E.g. Kotler, 1989, Sanchez & Mahoney, 1996

¹⁷ Nemetz & Fry, 1988

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for innovation and new product development¹⁸. Customization furthermore involves a close connection between design and manufacture¹⁹. Customization is also a key characteristic of professional services²⁰. Professional service firms can in turn be seen as one of the key examples of organizations with a high degree of highly skilled workers. It can also be worthwhile noting that competence characteristics that can be associated with professional service firms are seen as prominent when moving towards integrated deliveries of products and services in as varying industries as the computer and electronics sector and capital intensive manufacturing²¹. What is especially brought to attention are competences that are related to interaction with the customers in order to diagnose needs, solve problems and adapt deliveries.

Since client interaction is the key driver in firms completely devoted to business services, this interaction is likely to be increasingly important for the direction of the firm if an organization incorporates more and more customization and consequently intense, complex customer interaction. This is probable to affect what direction competence development takes in the organization and is likely to have effects on the organization and the conceptions of the business within and outside of the organization. Furthermore, the customization of products is connected to the intertwining of design and manufacturing. This interconnection indicates an organizational setting where activities that utilize problem solving competence, such as highly skilled workers, seem to be directly related to product characteristics. In this study, an attempt at integrating competence with products and activities is embraced partly due to the close links between design and production.

Problem solving is also the central function in the “value shop” configuration that is associated with for instance professional service firms²² that commonly have a high degree of highly skilled workers. The value shop relies on intensive technology²³ to solve customer problems. The problems can be defined as differences between an existing and a desired state. The success of employment of the intensive technology rests on the “... custom combination of selected capabilities as required by the individual case or project”²⁴ The selection, order and application of resources vary due to the problems. The matching of problems and problem solving are the basis for the allocation of resources in the value shop. The flow of activities in a value shop configuration is cyclical and iterative and the diagnosis of a problem moves back and forth between hypothesis and data collection. “... feedback both from trying to generate a solution and from implementing a chosen solution might require redefinition of the problem or search for alternative solutions.”²⁵

¹⁸ Sanchez & McKinley, 1998

¹⁹ Spring & Dalrymple, 2000

²⁰ Löwendahl, 1997

²¹ The modified model in Windahl et al, 2004 based on Shepherd & Ahmed, 2000

²² Stabell & Fjeldstad, 1998

²³ Thompson, 1967

²⁴ Thompson, 1967, p18

²⁵ Stabell & Fjeldstad, 1998, p 422

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On the other hand, industrial organizations, of the kind focused on in this study, supply deliveries with tangible content and are likely to benefit from reuse and repeatability in its output. Therefore we also have to consider the logic of what Thompson²⁶ would refer to as long-linked technology. In the descriptions by Stabell & Fjeldstad the value shop can be contrasted by the value chain, which utilizes long-linked technology. For the value chain, the transformation is central: “Value chains sell products that are the outcome of a transformation. The customers pay for the quality of the product.”, whereas, “Value shops sell competencies and approaches to help solve unique problems. The customers pay for solutions to – or effort spent on – their problems.”²⁷ Thus, the highly skilled workers in industrial organizations supplying highly customized deliveries are likely to act within either or both of these logics. But working in a value shop oriented way does not mean that every new project must be developed from scratch. Løwendahl²⁸, in the case of professional service firms, shows how some repeatability can be reached through formalized innovation structures into “ready solutions”.

The cases

Two of the in-depth cases in this study are organizations that are units within the Trelleborg Group, a global industrial corporation, headquartered in Sweden. Close access is made possible through a research collaboration between the Trelleborg Group and the School of Economics and Management at Lund University, Sweden. Unit RD works towards a specific niche and primarily within a specific industry whereas unit VG works towards a set of niches within several industries, but the most complex deliveries are focused on one specific industry. Both organizations rely on concepts on various levels of specificity that are utilized in order to primarily deliver small series of highly customized solutions. Each new delivery requires problem solving efforts and the flexibility of the concepts or the subparts utilized. When it comes to manufacturing it is worth noting that the automation degree is seen as relatively low but that the flexibility is seen as rather high. In VG the distinction between various levels of development i.e. applications development and ‘underlying solution’ development is rather clear formally. But the underlying development staff is heavily involved in application development through direct project support.

An additional case outside of the Trelleborg Corporation supplements the two. The third organization studied, here referred to as “Automation”, delivers highly customized automation systems to a wide variety of industries. The deliveries consist of hardware as well as software parts, but the primary amount

²⁶ Thompson, 1967

²⁷ Fjeldstad & Haanaes, 2001, p 5

²⁸ Løwendahl, 1997

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of customization is done through adaptation of the software part of the systems. This makes it different from the other two cases where the physical character of the deliveries is dominant. All of the case organizations have a rather high degree of highly skilled workers, primarily represented by engineers.

Products and output

The cases indicate that firms working with high levels of customization face assignments that require interaction with the buyers and that they also include a high degree of highly skilled workers and problem solving. But this does not necessarily mean that they have no ability to apply repeatability through standardization and re-use. Löwendahl²⁹ has, in the case of professional service firms, shown how some repeatability can be reached through “ready solutions”. The cases in this study, in a rather similar fashion, show that repeatability is pursued simultaneously with the pursuit of high levels of customization of deliveries to customers.

The output that is produced by the organizations has either an external application, as products, or an internal function as platforms for future deliveries. The ‘platforms’ in the cases have a limited standardization of interfaces³⁰ and are therefore denoted ‘underlying solutions’³¹ rather than platforms in this study. Underlying solutions can be in the form of different types of materials, systems, and parts etc that are developed over longer time perspectives. The high levels of customization in the final deliveries seem to limit the use of modular approaches in underlying solutions since strongly imposed modular boundaries might hinder flexibility in customization³². The search for repeatability nevertheless sets a number of boundaries within which a certain level of flexibility is allowed both for the short-term tasks and for longer-term development. This does not mean that the boundaries are always very rigid – that depends on the type of boundaries and of the type of business, and probably the rate of development required in the industry. The underlying solutions vary according to formality, their closeness to delivery, tangibility and with the level of potential reuse.

We can view the cases as having either linear or hierarchical output structures. The hierarchical structure (figure 1) could be described as consisting of an underlying solution together with final deliveries that utilizes the solution. The underlying solution has a set of functionalities that correspond largely with the final deliveries. But functionality can be adapted, added or subtracted depending on the requirements at hand in the projects. The linear structure (figure 2) on the other hand utilizes prior deliveries in an ad-hoc

²⁹ Löwendahl, 1997

³⁰ Therefore they may well serve as a base for multiple products but the level of standardization that enables common interfaces and subsystems is rather low. Compare with the description of platform characteristics in Meyer & DeTore, 2000 with references to Meyer & Lehnerd, 1997.

³¹ This is a label inspired by Löwendahl, 1997

³² Therefore the principles of mass-customization have a limited applicability here.

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fashion in order to construct new ones. The prior deliveries are not likely to be reusable for as many new projects compared to an underlying solution since the level of detail of implementation is much higher. Thus it is more rigid and less adaptable

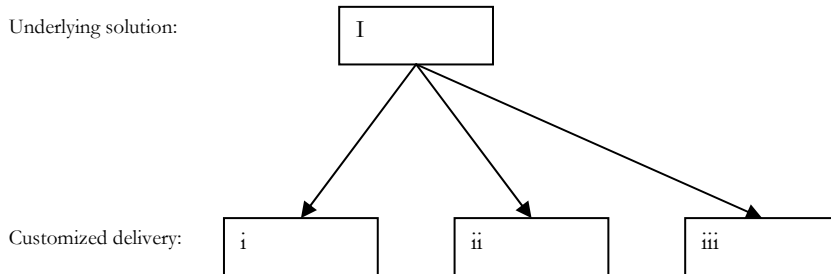


Figure 1: Hierarchical relationship between underlying solution and customized deliveries

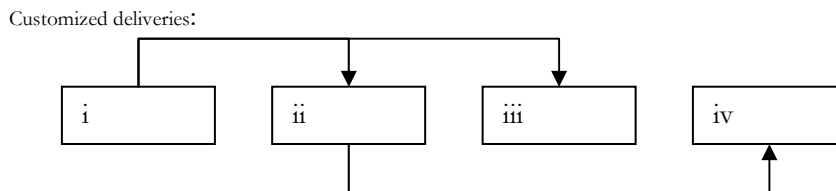


Figure 2: Linear relationship between customized deliveries

Creating and developing underlying solutions that are formalized and have a high reuse level, requires specific development projects which are not primarily related to one or a few customer projects. Thus whether something is an underlying solution or not is rooted in how activities are allocated in the organization. If the organization commits to identifying a set of requirements to be covered repeatedly and develops entities that enable reuse within that set of requirements, the outcome is an underlying solution. Therefore, we direct our attention towards the activities of the organizations.

Problem solving activities

Activities in the organizations are influenced by the project directed ways of working in the organizations. Projects are oriented towards either short-term customization projects or longer-term development initiatives. The customization projects are aimed at solving customer problems. The longer-term projects on the other hand are aimed at providing repeatability and reuse. For clarification we may illustrate the relationship between these logics in the following way: Long-term development is either the outcome of projects fully devoted to long-term development goals or an aggregate of customization projects. Automation is the most distinct example of an organization with clearly defined long-term development separated from customization efforts.

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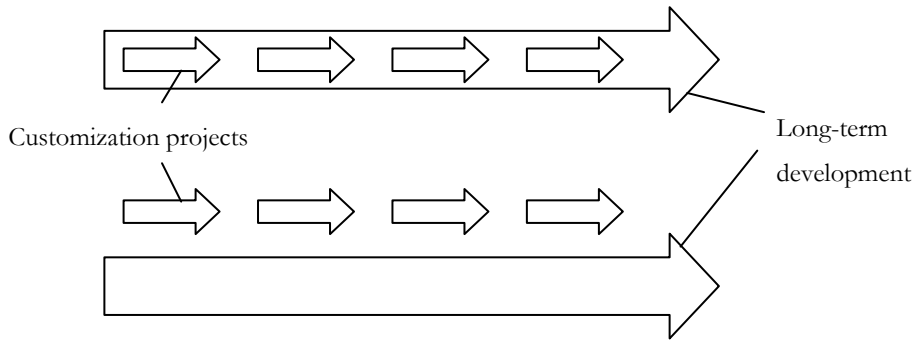


Figure 3: Long-term development as an aggregate of short-term projects vs formalized long-term development in its own right.

Staff types and competence concentrations

Staff, and especially engineers working with development and design tasks, can be divided roughly in two groups:

- Technical intermediaries who have insight and experience of application of deliveries and the customer's technological realities. They are also experienced in handling social and business situations with customers.
- Technical specialists who first and foremost are focused on their delimited technical development tasks.

These two types of staff work either in an integrated fashion or more divided. The organization as an effect displays either cross-utilization of these competences, a concentration of competences into separate entities, or a combination of both of these extremes. RD is an example of a highly integrated way of utilizing competences. Automation is strongly divided, resulting in structures where long-term development units supply underlying solutions to a network of internal as well as external customizing units. TV has two entities that are not as clear cut and competences are often cross-utilized in projects. Thus, the reuse, activity and competence configurations seem to correspond to each other.

Interconnections and time perspectives

In the above sections we have dealt with output structures, activities and competences respectively. It has been indicated that the three are interdependent and furthermore that the division and non-division of short and long-term activities is reflected in all of them. In output it is represented in the hierarchical level of deliveries and underlying solutions. In some of the cases the underlying solutions are more clearly defined and serve as the basis for the final deliveries. In others the division is less clear and new deliveries are based on prior ones. Similarly, activities on an organizational level have either short-term customizing characteristics or specific long-term oriented development characteristics. In some of the cases the long-

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term development is not specifically planned and could almost be described as non-conscious. It is an outcome of the long line of customization projects that continue where previous projects have left off. The previous sections indicate varying characteristics depending on how strongly a long-term perspective is present in the organizations. If we recapitulate the key characteristics of the previous sections in relation to short-term and long-term perspectives importance we find the following comparison (table 1).

Table 1: Importance of long-term perspective and its representations in output structures, activities and competence concentrations

	Presence of long-term perspective	
	Low	High
Output structures	Linear affinity	Hierarchical affinity
Activities	Long-term development aggregate of short-term activities	Formalized long-term development in its own right
Competence concentrations	Integrated	Divided

In order to further elaborate on the interconnection between output, activities and competence we return to the workforce and the role of individuals. Competence development is dependent on the learning that takes place in association with the work that staff performs. Especially this is the case for highly skilled workers, such as engineers, who continuously learn from their own and others experiences as well as perform individual training in connection with their work. For the category of highly skilled workers, research on organizations where high levels of customization is present, such as business service firms or professional service firms, indicates that problem solving is a key aspect in association with customer interaction. It also sets the stage for how resources are applied. But simultaneously we see that for instance for engineers, problem solving is dependent on interaction with internal actors such as colleagues and co-workers³³. Furthermore, while the work task of problem solving influences competence development, competence also relates to the products, systems and underlying solutions that the organization produces and works with. Competence in organizations working with highly customized deliveries therefore is a concept that seems related both to work tasks which often involve customer interaction, and the work with the artefacts that are produced. Activities can be used as a way of bridging the concepts of competence and products or solutions. Competences and output can thus be proposed to be viewed as interlinked. Activities serve as the intermediating part between the two (see figure 4).

- New output of work is developed and produced in the form of deliveries, solutions, or other internally or externally oriented artefacts.

³³ Henriksen, 2001

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- On the other hand such artefacts can be utilized in order to produce other items in later stages. Here the previous output serves as representations of competence that is reused either directly or indirectly.
- When development and production is executed they draw on the competences of the employees, teams or the organization (or from external parties such as the customer organization).
- When work is performed, competence develops as learning takes place.

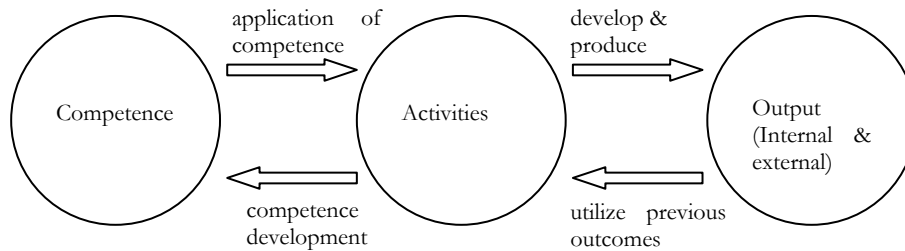


Figure 4: Links between competence, activities and output (internally and externally oriented).

Strategic implications with regards to innovation

In the introduction to the empirical setting of this study the links between innovation and customization were discussed briefly. If we reconsider the two extreme forms presented above with regards to output, activities and competences we find a few interesting implications related to innovation. In both of the instances firms face the two options of either focusing on their customization abilities or focusing on the reuse abilities.

- In the first type of organization the reuse aspect is less formalized and consciously planned. On the other hand, the customization activities can reach far into the organization and utilize competences across the organization. But simultaneously there may be a limitation to the more radical innovative work that these organizations can undertake as they are strongly customer project allocated. The customer projects come first and there is seldom time nor financial resources for longer-term radical innovations.
- In the second type of organization, or supply network, the formalized reuse activities are divided from the customization activities (within the same organization or into separate units within a network). This enables more consciously planned long-term development projects that can involve more focused utilization of technical specialist competences. From an innovative perspective this makes way for technological innovation and a possibility to strengthen the ability to incorporate new technologies into the underlying solutions that are developed. On the other hand there is a risk that this way of working limits more radically innovative development as the possibilities to utilize competences cross-functionally diminishes.

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