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**Handling the Information Management
Process in Industrial Service Organisations
Aligning Goals and Measures to the Needs of
Service Operations**

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Abstract:

For industrial service organizations information management (IM) has become a critical success factor. An increasing product complexity, global distributed customers and inter-organizational service networks require the ability to efficiently manage product and service process related information. However, the need to focus on all organizational, technical and human aspects makes an implementation of IM complex and difficult.

This paper discusses the goals of IM in industrial service organisations and shows how IM has to be designed to support these goals. Based on this, different measures are developed and their interdependencies are analyzed. By clustering these measures into five categories, a sequence is created which starts with the culture of the organisation and continues with the design of processes, the allocation of resources, the provision of capabilities and finally the offering of extrinsic compensation. Organizations can use this sequence for supporting the implementation of the identified measures.

1. Introduction

Offering product related services is increasingly important for equipment manufacturing companies. Because of a high competition and low margins in the traditional hardware business even technologically leading companies have to secure new sources of revenue. By offering product related services companies can differentiate from competitors and justify higher prices. However, for being successful in offering and selling product related services, equipment manufacturing companies have to establish an effective IM. Three major changes raise the importance of information exchange in service organizations. Firstly: There is a shift from technology orientation to service orientation. In the past, most products have been sold by offering sophisticated technology while customers today want to buy comprehensive solutions for their manufacturing process. Therefore companies have to offer additional services like maintenance contracts or availability agreements which cover the entire lifecycle of the machines. Offering these new services increases the information needs of the service organization. Secondly, new markets are emerging in Eastern Europe and Asia. To serve these new customers it is important to build up a global service organization. Such an organization needs to be supported with all necessary information. Thirdly: Products become more complex and information intensive since the amount of electronic components, programmable logic controllers and software has increased. In addition, the machines can be customized or modularly assembled. For customers and technicians who are used to work with mechanical components, this poses a significant challenge. They need to be supported with information about these products.

Assuring an efficient and an effective exchange of information is a significant challenge. Many companies have no defined goals and no strategy for improving their IM activities. Often, they only act in the case of emerging problems and they focus on working on the symptoms but miss to identify the causes of the problems. One major reason is the complexity of IM which has to consider human, organisational and technical aspects and the interactions between them.

2. Objectives of this Paper and Used Methodology

This paper shows the importance of IM for developing and offering industrial services in global service organisations. It identifies relevant goals and measures for improving information management and it discusses possible interactions between them. Both, goals and measures are derived from the requirements of the service operations and are structured according to the different steps of the IM processes. For supporting the design of the different measures, a map is developed that shows the interdependencies between them. In addition, this allows setting a sequence for the implementation of the measures.

A process oriented approach that relates to the different steps of the Information Management Process is used for this paper. It mainly bases on workshops and interviews with selected employees of four medium sized equipment manufacturing companies offering their services via a global service organization. In a series of structured interviews the objectives and potential measures for information management are elaborated. In addition, possible interrelationships are discussed in the interviews and in a workshop with managers of all three companies.

3. Relevance and Objectives of IM in Industrial Service Organizations

Why is information management so crucial for successful service operations? To answer this question it is necessary to look at the objectives of service organisations and to disentangle their goals. An example for a pyramid of objectives highlighting the interactions between the different goals is illustrated in Figure 2.

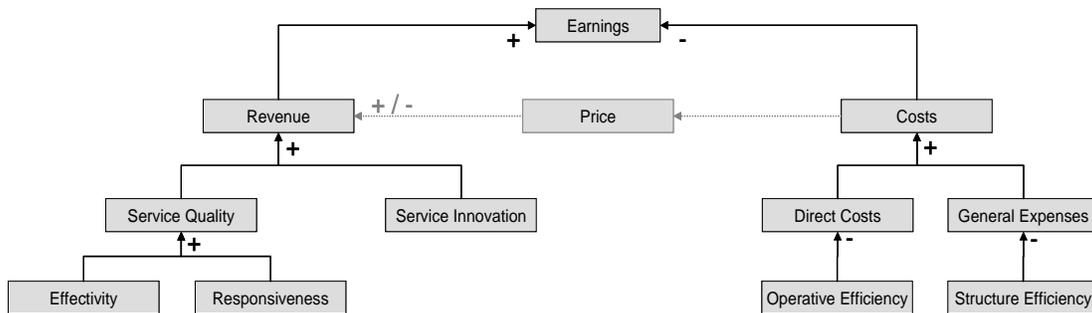


Fig 2: Value Driver for Successful Service Operations

In most equipment manufacturing companies, service operations have to generate earnings with higher margins than achieved in the traditional hardware business. High earnings result from high revenues and low costs. Companies can achieve high revenues by selling outstanding service products at competitive prices. However, for requesting premium prices the service offerings need to have a high quality standard and they have to be innovative. For a customer, a high service quality has to assure a high availability and reliability of his equipment and has to minimize his efforts and costs. Therefore, a service provider has to “offer” such a high equipment availability¹ and equipment reliability² by realising high service effectiveness whilst guaranteeing low response times. Typical goals and examples for KPI’s are illustrated in Figure 3.

¹ Equipment availability describes the percentage of time that a machine is capable of working (Blackstone and Cox III 2005)

² Equipment reliability describes the probability that the equipment will perform its specified function under prescribed conditions without failure for a specific period of time (Blackstone and Cox III 2005)

Goals	Examples for Service Performance Indicators	Examples for Needed Information
Increase the performance of the service operations	<ul style="list-style-type: none"> • Equipment recovery rate by hotline activities [%] • Equipment recovery rate by trouble shooting activities [%] • Accuracy of spare part deliveries [%] • Number of necessary troubleshooting activities [#] • Number of necessary customer contacts [#] 	<ul style="list-style-type: none"> • Equipment and service history of the customer • Technical information about the specific equipment (technical manuals, instructions, protocols, parameters etc.)
Increase the sustainability of the service operations	<ul style="list-style-type: none"> • Recurrence of identical failures [#] • Recurrence of failures resulting from the same cause [#] • Mean time between failures [time] 	<ul style="list-style-type: none"> • Problem related information about symptoms and causes • Frequent failures in specific conditions (environment, use) • Information about recommended technical upgrades
Enhance the perception of the service operations	<ul style="list-style-type: none"> • Coverage rate of customer languages [%] • Adherence to agreed delivery dates [%] • Professionalism of the service employees [rating] • Ease of contact [rating] 	<ul style="list-style-type: none"> • Information about the customer • Information about available resources and planned service assignments, open orders • Records of previous communications with the customer

Fig 3: Goals for Increasing the Service Effectiveness

The service responsiveness describes the capabilities of a company to quickly react on a customer order or a customer need. A higher Service responsiveness will increase the perceived service quality. Figure 4 illustrates three major goals for improving the responsiveness.

Goals	Examples for Service Performance Indicators	Examples for crucial information
Increase the availability of service resources	<ul style="list-style-type: none"> • Availability of Spare Parts [%] • Availability of the Hotline [%] • Availability of Service Technicians [%] 	<ul style="list-style-type: none"> • Information about the availability of resources (at headquarters and at subsidiaries / partners to allow for a possible exchange of resources) • Data about the utilisation of resources to identify bottlenecks
Decrease the response time for a customer request	<ul style="list-style-type: none"> • Response Time for Spare Part Delivery [time] • Response Time for Hotline requests [time] • Response time for troubleshooting requests [time] 	<ul style="list-style-type: none"> • Information about the customer, his equipment and his needs and orders • Information about the communication process with the customer
Reduce the downtime of the equipment	<ul style="list-style-type: none"> • Mean time to repair [time] • Mean time between failure recognition and repair [time] • Mean time between service provider contact and repair [time] 	<ul style="list-style-type: none"> • Information about the performance status of the equipment • Information about the service processes

Fig 4: Goals for Increasing the Service Responsiveness

Besides offering a competitive service quality companies have to be innovative in their service offerings. They have to anticipate future needs of their customers and they have to be flexible in fulfilling the current customer requirements. This allows for differentiating from other service providers and therefore justifies premium prices. Figure 5 illustrates three major goals for improving the service responsiveness.

Goals	Examples for Service Performance Indicators	Examples for crucial information
Improve innovation rate	<ul style="list-style-type: none"> • New service offerings in a selected period [#] • Relative revenue of service offerings started in the selected period [%] • Number of potential new service offerings identified in the selected period [#] 	<ul style="list-style-type: none"> • Information about current and future customer needs • Operating conditions at the customer • Information about the own service processes (performance, flexibility)
Improve innovation scope	<ul style="list-style-type: none"> • Percentage of specific customer adapted service offerings (inc. modular compositions) [%] 	<ul style="list-style-type: none"> • Information about capabilities and current status of service activities
Improve innovation speed	<ul style="list-style-type: none"> • Mean time to develop new services[time] • Mean time to marked new service offerings [time] 	<ul style="list-style-type: none"> • Information about the service development process

Fig 5: Goals for Meeting Innovation Expectations

The second input factor for achieving high earnings is a reduction of costs. By doing this, two types of costs can be distinguished: direct costs and general expenses. Direct costs can be decreased by increasing the efficiency of the service operations. General expenses can be decreased by a carefully selection of the needed infrastructure. Figure 6 illustrates some major goals for improving cost effectiveness.

Goals	Examples for Service Performance Indicators	Examples for crucial information
Decrease direct costs	<ul style="list-style-type: none"> • Number of working and travelling hours needed for performing a service order [time] • Number of employees involved in performing a service order [#] • Number of different organisations involved in performing a service order [#] • Travelling costs needed for performing a service order [costs] • Penalty payments resulting from a service order [costs] 	[same as service effectiveness and service responsiveness]
Decrease general expenses	<ul style="list-style-type: none"> • Investments costs of infrastructure [costs] • Depreciation of infrastructure [costs] • Maintenance and support of the infrastructure [costs] 	<ul style="list-style-type: none"> • Information about the usage of infrastructure • Information about the value added of infrastructure • Information about user satisfaction

Fig 6: Goals for Meeting Innovation Expectations

The illustrated examples show the relevance of IM for achieving the objectives of the service organisation. By looking at the different information needed for planning and performing the services but also for developing and producing the equipment five types of information can be identified:

- A: Information for calculating and designing new services. There are two different sources for this type of information. Firstly, this comprises information about the needs of the customer and shows how he is using the equipment for his processes. This information will help to identify potential new service offerings. Secondly, it also includes information about the current status of the equipment performance at different customer environments and about the performance of the current service

processes. This will help to identify whether a potential service offering can be conducted effectively and efficiently and it will identify needs for improvement. In addition, it helps to price the services in regard to the specific customer characteristics.

- B: Information for selling the services to the customer. This includes information about the service activities of the company, possible performance guarantees and the prices. Especially for modular service offerings, it also includes information about how to combine these services. For the pricing and for performance guarantees, the specific requirements and characteristics of the customer have to be considered and compared with company guidelines.
- C: Information for resource planning and allocation. This includes information about company resources (tools, spare parts, technicians), about the customer and his service order and this also includes administrative information about the service assignment.
- D: Information for performing product related services. It includes technical information about the product and its different modules (e.g. schemas), about possible equipment failures, symptoms and solutions or information about the assembly process. Further information necessary are safety instructions, test protocols or information about technical changes. However, the most crucial information for performing the services is the service and equipment history of the customer.
- E: Information for designing new equipment. This information is relevant for R&D and construction to improve existing and develop new equipment. It includes technical information about the equipment performance and failures but it also includes information about how the customers are using the equipment and how the needs of the customers will develop in the future.
- F: Information for improving manufacturing. This information is relevant for the manufacturing department. Often, the final assembly is first been done by service technicians at the side of the customer. Therefore, the manufacturing department needs protocols about these activities to improve the assembly of the single modules.

Different Barriers can prevent the exchange of all these types of information (Minkus et al. 2006). To avoid these barriers, it is necessary to identify clear goals and measures for all parts of the information management Process. In addition, operating ratios can help to discover existing barriers and can be used to show need for improvement.

4. Objectives and Ratios of the Information Management Process

The information has to be provided JIT, at the right time, in the right quality, in a suitable format and to the right person. This shows that different dimensions of objectives for IM have to be considered. Similar to the pyramid of objectives for the whole service organisation (see Figure 2), the objectives for IM can be structured in the dimensions of quality, time and efficiency. However, for the information itself it is difficult to distinct between the dimensions of quality and time. Information delivered at the wrong time has a low quality from the perspective of the user (Eppler 2006). In addition, the quality of the information content is directly connected to the time it needs to update the information. Therefore, for this work following distinction between the areas of IM objectives is chosen: *information coverage*, *process time* and *costs*. The term “information coverage” describes all issues related to the static quality of the information. This comprises the accuracy, comprehensibility, applicability and integrity of the information. In addition, it also shows

the quantitative extend to which the existing information needs are covered by the existing information. The process time describes the speed in which certain aspects of the IM process are accomplished. This has an impact on weather the information is up to date. The last term describes the costs resulting from fixed and general expenses. They derive from the necessary efforts to be taken at different steps of the IM process.

The different objectives have to be seen in context with the different steps of the IM process. The four major steps are the *identification*, the *collection*, the *search* and the *use* of information (see Davenport 1993). The identification of information describes the process of identifying all information needed within the service organisation. The collection of information describes the process of codifying the needed information. Both, identification and collection of information can therefore be regarded as “information production processes”. The third aspect describes the search for information. This comprises all activities of a potential user to identify and to access existing information within the service organisation. The last step describes the use of the collected information. Both, the collection and the use can therefore be regarded as “information consumption processes”. The different identified objectives will now be analysed in connection to the four steps of the information management process.

A. Objectives and Ratios of the Process “Identification of Information”

The major objective is to maximize the rate of information coverage (for information identification). This rate describes the degree to which an existing need for information is recognized within the service organisation. It is therefore the basic of all activities for the “production” of information. A high coverage rate can be achieved by creating a culture which illustrates the needs and increases the interests of the employees to exchange information. In addition, it is necessary to create transparency about the different processes within the organisation. That allows identifying or communication specific needs for information.

$$\text{Information coverage rate} = \frac{\# \text{ Information relevant for performing services}}{\# \text{ Information recognized as relevant for performing services}} \quad [\text{max}; \%]$$

The second objective is to minimize the process time needed for the information identification activities. The process time describes the period from the first identification of a specific information demand to the time this demand is known by all persons involved in the “production” of this information. It shows the delay which occurs during the identification process and has a direct influence on the coverage rate and on the timeliness of information.

$$\text{Process time for information identification} = t_1 (\text{detection of information demand}) - t_2 (\text{knowledge about information demand}) \quad [\text{min}; \text{time}]$$

The third objective describes the costs of the information identification process. Since it is very difficult to measure the efforts for identifying a specific need for information, only fixed costs will be taken into consideration. These costs accrue through investments in infrastructure and in the people producing the information. Typical examples for infrastructure are ICT or videoconferencing tools for illustrating and exchanging information needs. Examples for investments into people are lectures to increase organisational knowledge or measures for increasing the informal communication like meetings, job rotation, or other joint vents.

$$\text{Costs for information identification} = \Sigma (\text{infrastructure, training, exchange activities}) \quad [\text{min}; \$]$$

B: Objectives and Ratios of the Process “Collection of the Information”

In this process the major objective is to codify the information and to store it or transfer it to the user. This objective is displayed by the information coverage rate (for information collection). It shows how much of the information recognized as relevant is collected in a way that it can be used in the “information consumption process”

$$\text{Information coverage rate} = \frac{\# \text{ Information recognized as relevant for performing services}}{\# \text{ Information collected and usable}} \quad [\text{max}; \%]$$

However, there are two breakpoints which need to be considered during the collection process. The first illustrates the quantity of all collected information. The second refers to the quality of the information collection process. It shows what percentage of all collected information has a suitable quality and therefore can be used during the consumption process. Both rates are influenced by the willingness and the capabilities of the employees responsible for collecting this information. The willingness again can be increased by creating a suitable culture and by establishing formal and informal relationships between the employees of the different organisational entities. The capabilities of the employees can be increased by providing an adequate ICT infrastructure and by assuring sufficient professional but also methodical knowledge. Latter is especially important for using the ICT and for structuring and formatting the information. Some of the capabilities can also be provided by third parties, e.g. an editorial department for structuring the information.

$$\text{Quantitative coverage rate} = \frac{\# \text{ Information recognized as relevant for performing services}}{\# \text{ Information collected}} \quad [\text{max}; \%]$$

$$\text{Qualitative coverage rate} = \frac{\# \text{ Information collected}}{\# \text{ Information collected and usable}} \quad [\text{max}; \%]$$

The second objective of this process is to minimize the process time needed for the collection of the information. This includes not only the physical collection of the information but also the formatting, structuring and a possible quality check. A low process time is crucial for offering a high information coverage rate and for assuring a fast updating of the information.

$$\text{Process time for information collection} = t_1 (\text{knowledge about information demand}) - t_2 (\text{Information collected and usable}) \quad [\text{min}; \text{time}]$$

In the process of “collecting information” variable costs and fixed costs have to be considered. To calculate the variable costs, the number of employees involved in the collection of information has to be multiplied with time required by them and their personal charge rate. Another way of calculating the process costs is using the opportunity costs of the employees. This is feasible since they have to suspend their core activities while collecting the information. The fixed costs mainly accrue from investments in ICT or in training activities.

$$\text{Costs for information collection} = \Sigma \text{ variable costs (manpower needed for collecting information * charge rate) AND fixed costs (infrastructure, training)} \quad [\text{min}; \$]$$

C: Objectives and Ratios of the Process “Search of Information”

The search of information is usually performed by the potential user of this information. It therefore belongs to the “information consumption processes”. The main objective of this “search” process is to provide all the needed information to the user – with a content and in a format which allows using the information. Therefore the information coverage rate (for information search) displays the amount of requested information that is delivered in a useful manner to the potential user.

$$\text{Information coverage rate} = \frac{\# \text{ Information needed by a potential user}}{\# \text{ Information delivered to the potential user}} \quad [max; \%]$$

For identifying weaknesses in this process it is necessary to set two separate breakpoints. The first breakpoint shows how much of the needed information is requested by the user. A low “request coverage rate” shows a lack of willingness, capabilities or opportunities to search for the needed information. A lack of willingness can result from low prospects of success or from large efforts necessary for requesting the information. In addition, the user might fear to ask for information, especially if different departments and hierarchies are involved or if a request for information is regarded as a professional weakness. By establishing an open culture for cooperation and by supporting the processes with a suitable infrastructure these barriers can be reduced. A lack of capabilities can exist if the potential users do not know where to search for the information or if he lacks the social competences for interacting with others.

$$\text{Request coverage rate} = \frac{\# \text{ Information needed by a potential user}}{\# \text{ Information requested by a potential user}} \quad [max; \%]$$

The second breakpoint is the delivery coverage rate. It shows how much of the requested information is actually delivered to the potential user. As mentioned above, a low delivery coverage rate might have a negative impact on the request coverage rate. To identify the reasons for a low delivery coverage rate, it has to be adjusted to take only information into consideration which has already been collected. This adjusted rate can be increased by implementing and using an appropriate infrastructure, e.g. ICT solutions, videoconferencing tools, or the famous water dispenser. In addition, for using this infrastructure the potential users need to possess sufficient methodical skills. Also, for requesting information without technological support, knowledge about the organisation and about potential senders of the information is crucial.

$$\text{Delivery coverage rate} = \frac{\# \text{ Information requested by a potential user}}{\# \text{ Information delivered to a potential user}} \quad [max; \%]$$

$$\text{Delivery coverage rate (adjusted)} = \frac{\# \text{ Available Information requested by a potential user}}{\# \text{ Information delivered to a potential user}} \quad [max; \%]$$

The process time for searching the information describes the length of the period between the request or the start of the search and the delivery of the information. Minimizing this time is very crucial because it seriously increases the probability that the delivered information will be used. Similar to the delivery coverage rate, a low process time can be achieved by the provision of a suitable infrastructure and by assuring necessary methodical and organisational skills.

$$\text{Process time for information search} = t_1 \text{ (starting a search or request for required information)} - t_2 \text{ (Information delivered to the potential user)} \quad [min; time]$$

In addition, it is also necessary to increase the adherence to delivery dates. This is especially important when the information the demand is known in advance. In these cases, not the process time but the adherence to the delivery date is crucial for the usability of the information.

$$\text{Delivery coverage rate (adjusted)} = \frac{\# \text{ Available Information requested by a potential user}}{\# \text{ Information delivered to a potential user}} \quad [\text{max}; \%]$$

The costs for the information search comprise variable costs for the time and efforts needed to search for specific information and fixed costs for the infrastructure, the provided training or contact events.

$$\text{Costs for information collection} = \Sigma \text{ variable costs (manpower needed for collecting information * charge rate) AND fixed costs (infrastructure, training)} \quad [\text{min}; \$]$$

D: Objectives and Ratios of the Process “Use of Information”

The use of information is the final step of the IM process. It shows whether the delivered information will be used for planning or providing industrial services. The coverage rate (for the use of information) displays the ratio of the used information in relation to all delivered information. Therefore, the value of the coverage rate directly depends on the quality of the delivered information. For being used, the information has to be applicable for a specific task. This includes a fit of the content, the format and the comprehensibility of the information and it requires that the information is provided at the right point in time to support a specific task. A good performance of all three previous steps will therefore lead to a high coverage rate. However, it must be considered that the user might have searched for the wrong information. This decreases the coverage rate but can be reduced – but not excluded – by increasing professional skills for identifying the right information and using it in an effective way.

$$\text{Information coverage rate} = \frac{\# \text{ Information delivered to the potential user}}{\# \text{ Information used by the potential user}} \quad [\text{max}; \%]$$

An analysis of the process time and the expenses for the use of information can be neglected. Only if the user has to do some modifications on the information, these ratios should be taken into consideration.

5. Alignment of Measures for the Information Management Process

Some possible measures for achieving the objectives of the IM process have already been illustrated in the previous chapter. However, a major question is how to structure and align these measures. This chapter explains the different classes of measures and present a possible sequence for aligning them.

From their characteristics, the different measures can be categorized in five different types: *cultural related measures*, *process related measures*, *resource relates measures* and *capability related measures*. In addition, measures for an *extrinsic compensation* can also influence the IM process.

Cultural measures are the most elementary instruments which have to be considered. They help to create an environment which is supporting the exchange of information. The

basic of all cultural measures is to develop a *strategy* for the implementation of IM and to balance it with the overall company objectives (Decoene and Bruggeman 2006). From this strategy, the value of exchanging information can be derived. This value and therefore the need to exchange information have to be *communicated* by the whole management (Shani and Docherty 2003; see Figure 7[1]). To know “why” to exchange information increases the willingness of the employees to participate in the IM activities. For utilizing this awareness *professional relationships* as a basis of any cooperation have to be build (Artail 2006; see Figure 7[2]). In such relationships, the different partners and their objectives have to be integrated in the design of all IM activities and an atmosphere for cooperation building on trust and loyalty has to be established (Artail 2006). In addition, for assuring a sustainable commitment it is necessary to agree on *rules* for the information exchange activities (see Figure 7[3]). This requires encouraging the participants to learn from each other and to reduce their fears of making mistakes (Decoene and Bruggeman 2006). Besides, hierarchical barriers have to be reduced and the management has to lead by example.

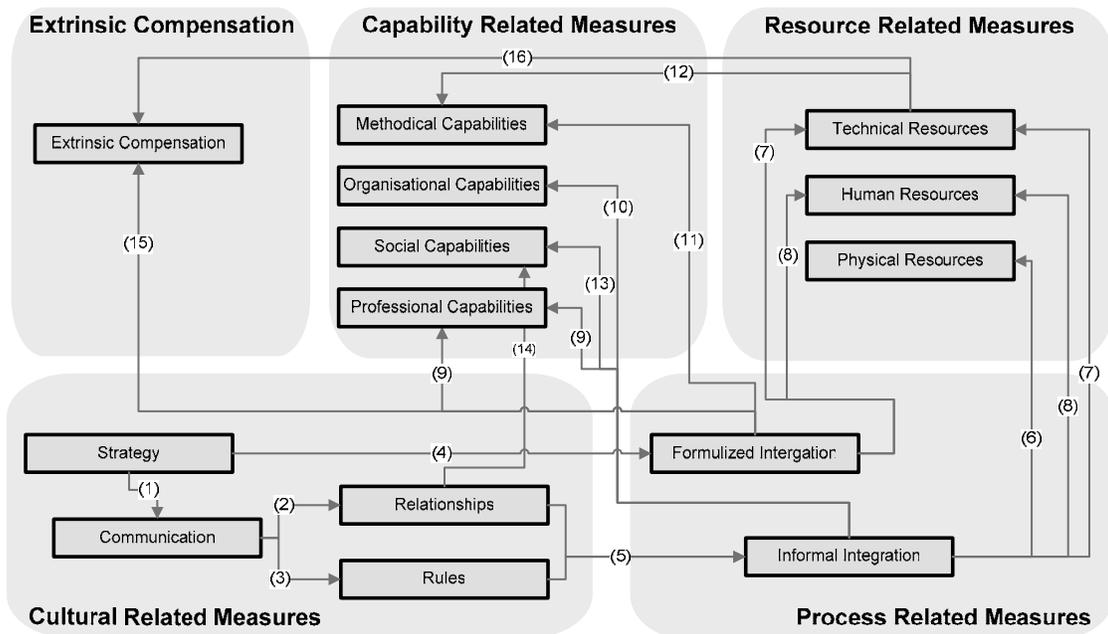


Fig 7: Dependencies between different Measures for Information Management

The second large complex describes the process related measures. They show how to integrate the different IM activities into the workflow of the organisation. This includes all core activities of information management, notably the processes for identifying, collecting, searching and delivering information. The integration can take place in two different ways. In the *formalized integration*, the IM activities are defined and included into the processes schemas of the organisation. This includes defining specific tasks and responsibilities which have to be integrated into the daily activities. These tasks should be designed that their fulfilment can be measured and controlled. For increasing the acceptance of these new tasks it is necessary to ensure that everybody understands the needs to exchange information (see Figure 7[4]). In the *informal integration*, opportunities and occasions to exchange information are created outside of standardized processes. This can complement the “formal way” and is especially efficient for exchanging complex and user specific information. A basis for building up informal relationships is the willingness to cooperate which can be

achieved by creating a suitable culture (see Figure 7[5]). For establishing informal ways to exchange information organisations have to provide occasions for the participants to get to know each other and to build up their personal network. This reduces the insecurity during all kinds of interactions. Examples for such occasions can be job rotation initiatives, temporary visits or organized meetings attended by partners of the whole organisation (McEvily et al. 2003; Song et al. 2003).

The third complex shows resources necessary for the execution of the different IM tasks. The first type describes *physical resources* which are especially important for an informal information exchange. Examples are offices, meeting rooms, a cafeteria or the well known water coolers (Davenport and Prusak 1998; see Figure 7[6]). The second type describes *technical resources*. They can support both, formal and informal information exchange by providing resources like ICT, telephone or videoconferencing tools. For most service organisation there is a huge potential in using ICT for the support of the formal exchange of information (Minkus and Nobs 2006, see Figure 7[7]). For an efficient support, the ICT has to provide the needed functionalities and has to assure a high reliability and a high perceived ease of use. Finally, *human resources* have to provide sufficient manpower for supporting both, formal and informal information exchange activities (see Figure 7[8]).

For being effective, the people involved in the exchange of information need to have all capabilities necessary for executing the IM tasks (Argote et al. 2003). There are four different types of capabilities which are important for IM activities: professional, organizational, techno-methodical and social skills. In addition, external competencies offering support within certain IM activities should be provided. *Professional competence* enables employees to perform their core tasks within the service operations. They are needed for all activities (see Figure 7[9]). *Organizational competence* provides participants with the capabilities to identify external information needs and information sources (Borgatti and Cross 2003) and it is therefore especially important for informal information exchange (see Figure 7[10]). To improve the exchange of information by using technical tools, it is necessary to ensure *methodical competencies*. On the one hand, participants must be able to structure and articulate information. This is especially important for formal information exchange activities (see Figure 7[11]). On the other hand, they have to be able to use the technical infrastructure (see Figure 7[12]). *Social competencies* which should provide soft skills necessary for IE are the most difficult to train. Three types of social competences have to be acquired by the employees: self confidence, competence for team work and the willingness to learn and change (Kwok and Gao 2006). They are needed whenever personal interactions with other participants are necessary, e.g. for informal information exchange (see Figure 7[13]) and for creating a suitable company culture (see Figure 7[14]).

In order to increase the extrinsic motivation service organizations can provide *extrinsic compensation* to the participants. To avoid the danger of reducing the intrinsic motivation (Deci 1975) the form of compensation has to be adapted to the conditions of the organization – most notably the strategy, the culture, the processes and the people. Compensation needs some underlying object which has to be fulfilled. This can either be a general business objective or an individual task. The quantitative and qualitative fulfilment of both, objective or task must be measurable. Therefore, an extrinsic compensation might only be useful for formalized activities (see Figure 7[15]) or for the specific use of ICT resources (see Figure 7[16]).

A review of all five types shows that there is a perceivable sequence in which the different measures interact with each other. It starts with creating a suitable company culture. The characteristics of the culture affect the range of possible forms for integrating IM activities in the workflows of the organization. That again influences the resources needed for executing the IM activities. And all, culture, process related measures and used

resources have an impact on the competences needed by the participants. Finally, for selected measurable goals and activities an extrinsic compensation is possible. Therefore, a sequence can clearly be detected even if it is not strictly linear. The knowledge about this “chain” can help to design of the different measures and can show a sequence for implementing them.

6. Conclusion and Further Research

The presented paper has shown that the management of information is a critical success factor for designing and offering industrial services in global service organisations. It has identified the critical objectives for providing services and has shown that achieving these objectives requires specific information. For being usable, this information has to be provided Just-In-Time: in the right quality and time and in an efficient way. The paper has defined the meaning of costs, quality and efficiency and it has applied these objectives to every step of the Information Management processes. The allocation of indicators to all these processes allows for an identification of current strengths and weaknesses and can help to identify need for action. It also illustrates how suitable measures have to be designed to take effect and it can help to control an implementation.

From the different objectives suitable measures for improving the information management process have been identified and have been clustered in five categories: cultural related measures, process related measures, resource relates measures, capability related measures and extrinsic compensation. These measures have been detailed and their interactions have been analysed. It was shown that by arranging the different measures a sequence can be identified which can support the design and the implementation of these measures. This can improve the illustrated objectives of information management and as a result, the efficiency of performing the service offerings can be increased. In addition, more complex products can be serviced and new knowledge intensive service offerings can be designed. Offering improved services to the customer will increase customer loyalty and is a pre-requisite for selling new equipments.

The presented sequence is a concept which mainly bases on the results of a scientific cooperation with four equipment manufacturing companies. Therefore, in a next step a further validation of this concept is necessary. This will be achieved by a literature study and by discussions with researches and experts form other companies. Finally, the concept has to be tested in a case study within a industrial service organisation.

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