Standardizing delivery processes to support service transformation: a case of a multinational manufacturing firm

Abstract

While enlarging their value proposition adding services to their product portfolio, an increasing number of manufacturing companies is suffering a lack of methods to engineer and manage the service offer effectively and efficiently. In particular, multinational companies are struggling with the complexity of organizing the service delivery process of a composite portfolio throughout their branches spread in different geographical locations and characterized by different maturity levels. This paper specifically focuses on this dilemma proposing an approach for service delivery process standardization as a mean to make the service activities uniform and similar in different units. The intent is not to create organizations all working in the same way but instead to re-use best practices and share business optimization. To achieve the research objective, a structured approach that guides the identification of a standard process and a service based reference model internal to the company are proposed. They would pursue the identification of a common taxonomy inside the company and the contextualization of the standard process into the company structure. Through a step-by-step procedure to apply the technique, an industrial application was carried out showing the practical and managerial implication coming from the adoption of the standardization approach inside the company. The outcome of the case constitutes a first step toward the development of a standard reference model for service delivery process to be adopted in multiple industries and contexts.

Keywords: service delivery process; service process modularization; service operations; reference model; process standardization

1. Introduction

In order to differentiate their positioning in the markets and retain long-term customer's loyalty, manufacturing companies are seeking to increase the perceived value of their offerings through the provision of services along the lifecycle of products [1]. Throughout this service transformation phenomenon, the tangible value of products is replaced by an intensification of the intangible service contents [2] [3].

This evolution, entailing the improvement of customization and the reduction of material consumption, requires deep changes to the structure, the processes, the operations and the mindset of a company. Moreover, traditional engineering processes turn out to be inadequate to govern the intangibility and the process-based nature of services [4] whilst suitable methods to support the service engineering stages are not available yet.

Referring to a global context, multinational companies are heavily struggling in organizing the service delivery processes of a complex portfolio throughout their branches spread in different geographical locations and characterized by different maturity levels. They need to manage multiple interconnected process variants characterized by: i) an exponential increase in the number of services they are offering in terms of number and scope, ii) a variegated adoption of technologies and tools to support the service delivery, iii) a higher uncertainty in market demands and iv) different customer segments and needs. As in the case of product design, they have to "increase their efficiency by providing new competitive solutions faster; and at the same time cut costs by improving quality and productivity" [5]. In order to respond to such uprising critical requirements [6], Service Engineering (SE) has emerged as a technical-methodological approach that inherits and adapts, when possible, the traditional engineering expertise to develop innovative services [7] [8] [9]. In spite of the success of SE in academia, the suggested methodologies in literature are still poorly applicable in industry. According to the major reviews [3] [10] [11] [12], the main scope of the most known methodologies [13] [14] [15] [16] [17] is mainly limited to the translation of customer requirements into service concepts. Guidelines and methods recommending how to structure the service delivery process in pursuing the satisfaction of different customer segments while minimizing operational costs, are lagging. So far, despite their societal and economic significance, services remain largely under-researched in the operations management field [18].

Starting from the literature gaps and the practical criticalities mentioned in the previous paragraph, this paper focuses on the need of reducing the complexity and variety of service delivery processes variants through a standardization effort in order to increase customer satisfaction while reducing process management costs.

In particular, it proposes i) a structured approach that guides the identification of an internal standard process for the delivery of each single service offered by a company (or that will be offered) and ii) a reference model to set concepts inside the company and to contextualize the standard process into the company structure and offering. A step-by step procedure to implement the outlined research and standardize service delivery processes in a real environment is also proposed. Then, the procedure validity and practical feasibility are demonstrated through its implementation in ABB, a multinational company with a worldwide service offering.

The paper is structured as follow. Section 2 presents the research methodology. Section 3 describes the search for literature in the area of service process standardization, whereas section 4 theoretically describes the technique to be adopted for company internal standardization. Section 5 summarizes the validation case in ABB, where the standardization technique has been applied. Section 6 lists the main insights of this work from the academic and the industrial perspectives, while section 7 closes the work and proposes further research prospects.

2. Research Methodology

Having in mind the difficulties that big multinational companies have to face, as hinted in the introduction, this paper tries to answer the following research questions (RQ):

RQ1. How to develop a technique to support the "internal" standardization of service delivery processes?

RQ2. How to describe and contextualize the identified standard service delivery process in a way that makes it seamlessly replicable in different units of the company?

In order to answer these two research questions, a 3-steps research approach tracing "design study methodology" [19] was pursued. First, starting from the relevant problem of multinational companies described in the previous section and following the design study guidelines proposed by Hevner [20], an exploratory literature review was carried out to further highlight the problem relevance. Indeed, exploratory research is a good approach to be adopted when researchers are facing with "new fields of study where little work has been done, few definitive hypotheses exist and little is known about the nature of the phenomenon". [21]. This applies particularly to the research streams related to service process standardization.

Second, a theoretical artifact was designed (first Hevner's guideline). In line with the first phase proposed by [20], the theoretical artifact proposed in this paper is an approach to support the standardization of the service delivery process together with a framework to formalize the nomenclature. The approach is mainly addressed to large companies and aims at improving their process management.

Third, as suggested by Hevner's guideline number three, the evaluation of the artifact [20] was performed in an industrial case to gain relevant insights and to collect in-depth feedbacks. The case was also adopted as a mean to verify the practical contribution of the proposed approach (the artifact). A great amount of data has been gathered during the long term analysis. Since it was the first application, within the case, a highly adapted approach [22] has been followed in order to collect and gather all the relevant information. The company characteristics, structure and standardization needs has led to the selection of the specific case, which is better explained in section 5.

All the previous steps were carried out following the application of rigorous methods, as explained in the following sections.

3. Explorative literature analysis

The first step of the research methodology dealt with the explorative literature analysis on the main area of the paper, namely the service delivery process standardization. Thus, literature on "service engineering", "service design" and "service operations" has been screened to highlight existing researches around standardisation techniques for the service delivery process. The analysis has been conducted using Scopus, Web of Science and EBSCO databases as a structured search using "service" as the main keyword coupled with "process standardization" or "business process standardization" or "standardisation procedure". Since after the first search no results were obtained, the collection of papers has been extended pruning the "service" term. Accordingly, the results obtained were mainly in the area of "business process standardization". A first search has led to 256 peer-reviewed papers. Then, the following language and topic screening (2nd step) and abstract reading (3rd step) further reduced the research works. It is worth considering that the majority of the papers have been excluded during the 3rd step since their finding are not applicable to the service delivery process context. Indeed, most of the identified research pertains to technical issues in IT and computer science area (e.g. software infrastructure [23], service oriented architecture or cyber physical systems). Among the papers analysed, many standards for processes were found and some discussions on the topic of standardization can be reported.

According to the analysis, a common understanding about business process standardization can be defined: [24] describes business process standardization as "bringing the selected business process in line with the archetype process", where the archetype process is a business process that serves as master. Similarly, [25] define business process standardization as the activity of unifying different variants of a family of business processes and [26] highlight the different possibilities to manage a large collection of business processes among which the unification of them is in the direction of standardization. Besides, other topics subjected to scrutiny are worth mentioning: i) analysis of the advantage related to standardization [27]; ii) identification of suitable processes to be standardized [28]; iii) identification of success factors for process standardization [29] [26].

The importance of a common and clear nomenclature emerged as a relevant factor to reach consistent results from process standardization. [30] identify "conceptual modelling" as an established approach to support and guide standardization efforts and consider "reference models" and "modelling languages" as two ways to support the integrated design. [23] highlight the importance of "reference models" to make the system complexity manageable.

In the same direction, [26], focusing on data system management, highlight the importance of language support while merging more processes. Finally, [31] highlight the need for a domain-specific glossary and verb-object phrase structures for element labels as a mean to avoid confusion and pitfalls.

In addition to nomenclature, also the way processes are represented is highlighted in literature. [32] points out the following three main criteria for the definition of a standard representation of a business process: (i) an intuitive notation; (ii) a meta-model and vocabulary; (iii) a breakdown of the meta-model and notation for each level of analysis. In the light of this, many business process modelling standards are available for the business process management. [33] propose a survey of all the available methods and classify them according to the stage of business process modelling lifecycle. In the categories of approaches for process design, the most common are BPMN, and UML [33].

For what concern the standardization procedure some suggestion can be also acknowledged. [34] considers it in a broad perspective and proposes a managers' guide to deal with the topic of process change and improvements. [24] is more concerned with the process standardization and define a four-step-approach for the standardization of a process, suggesting to i) document all the process variants, ii) define an archetype process and then iii) enhance it to a standard process, exploited at the end to iv) homogenize the variants. Another similar approach based on 7 steps has been developed by [35], called the "standard work wheel".

In conclusion, this explorative analysis highlights that literature on business process standardization is quite developed and many works are related to the investigation of benefits coming from standardization and the factors influencing this transition. However, few works propose guidelines for setting of standard process procedures to guide company internal standardization. The main gap found is that none of the existing researches explicitly refers to service delivery processes and none proposes a usable step-by-step procedure to support companies in identifying and setting a standard in the service environment. Services are characterized by specific features (e.g. perishability, intangibility and simultaneity [36], [13]) that make them different from traditional processes. The service delivery process indeed is not the mere delivery of traditional product, it implies the relentless participation of the customer in the provider's processes and their continuous interaction makes difficult any prediction of the process. Hence, the final service process depends on many factors (e.g. customer needs, company's resources, features of the external business environment) that are complex to forecast and that make it different from a traditional process. The available standards, summarized by [33] were also screened but none of the proposed has been developed in the service domain or can be applied to the specific service features.

Thus, in order to fill this gap about the standardization of the service delivery process, this paper aims at proposing a structured approach supporting companies to standardize their service delivery process.

Even if a comprehensive and shared technique for process standardization in the service domain is missing, the abovementioned literature highlights the following two main concepts in process standardization:

- representation of the standard process itself through the definition of a *process archetype* (i.e. the content of the standardization);
- identification of a standard taxonomy and process nomenclature to be associated with the standard process to make the standard easily replicable in different contexts; this drives to the definition of a *reference model*.

This finding provides a useful trajectory to properly answer to the abovementioned research questions. In particular, literature argues that two parallel actions are required to enhance process standardization and to represent standard processes: i) the definition of a standardization approach based on the identification of a process archetype (RQ1) and (ii) the standard process representation enhanced by the formalization of a reference model (RQ2).

In this perspective, additional literature research was devoted to the analysis of process archetype definition and reference models, trying to understand if they can support the standardization in the domain of services.

3.1. State of the art on process archetypes

According to [24], the identification of a process archetype is based on four main dimensions: (i) document process, (ii) modularize process, (iii) isolate specificities and (iv) ensure process excellence. For what concerns process documentation, service processes representation usually adopts common and widespread methods, such as blueprinting [37]. Conversely, research in the area of service process modularization is quite limited even if it is considered as a proper method to enhance process standardization [35]. Regarding the third and the fourth steps, there is no specific way to approach them since they strongly depend on the selected modularization approach.

Modularization refers to the practice of creating modular components (and processes) that can be configured into a wide range of processes to meet specific customer's needs. A modular structure is a structure consisting of self-containing, structural elements with standardised interfaces in accordance with a system definition [5]. A keyword search in Scopus, Web of Science and EBSCO databases using "service process" and "modularization" as search input was carried out. As in the case of standardization procedures, the search results were not applicable in the context of product-oriented services. Indeed most of the existing research on modularity focus on product rather than service [38].

The first work on service modularity belongs to [39], the following researches refer to *service modularity* through multiple approaches where the unit of analysis (i.e. the module) is different: it can include the entire process, specific software connections, activities or value proposition [40] [38] [41] [42] [43].

For what concerns explicitly *service process modularity*, research is still in its infancy and there is not a clear understanding about the subject, the modules, their features, and the way in which they must be used. [44] study the impact of IT service process modularization on customers and their preferences. [45] highlight the possibility to separate service processes into different modules in line with different processes. However, no definition of service process modules is proposed neither mentioned.

As a conclusion, in the light of standardization, the lack of methods for the service delivery process modularization can be highlighted.

3.2. State of the art on reference models

According to [30], an approach to devising a univocal documentation about process flow, structures, and resources is the adoption of a reference model. Indeed, it can contribute to fasten the implementation of the standardization approach, while providing a better understanding of the processes. A reference model can be defined as "an abstract framework for understanding significant relationships among the entities of some environments" [46]. Its main objective is to provide a consistent breakdown of the process under analysis while using a nomenclature suitable for different implementation across and between different industries. Although different reference models have been developed, such as [47] [48], some examples (summarized in Table 1 adapted from [49]) can be analysed in relation to the service domain.

<Insert here Table 1>

According to the table, the most relevant reference models belong to three main clusters. The first group includes the models developed by the Supply Chain Council, an independent, no-profit global corporation. Such models guide the process design and performance measurement throughout the different areas of the supply chain. Among them, no one specifically refers to service activities but "customer-support" business processes are encompassed in the CCOR-model. It provides a unique framework that links business process, metrics, best practices, and technology features into a unified structure. It is based on four hierarchical levels that collect customer support processes (plan, relate, sell, contract) and the related specific activities.

The second group of reference models collects those from the Federal Enterprise Architecture (FEA). The FEA is a business and performance-based framework for cross-agency, which provides a new way of describing, analysing, and improving the federal government. The main objective that pushes the FEA effort is the improvement of the government's service delivery both to and for the public. However, the scope of such models is mainly on data, technologies and IT assets.

Additional reference models that support the integration of customer support inside the supply chain constitute the third group. The Value Chain Group (VCG) [55] aims at releasing a unified reference model for the entire enterprise able to expand beyond the domain of supply-chain management. The ITIL [57] stands for "IT Infrastructure

Library" and refers to a framework whose aim is to provide a wide accepted guide of Best Practices for the IT Service Management. ITIL architecture is centred on the continuous measurement and improvement of the quality of the services delivered, considering both the business and the customer perspectives. Finally, the Enhanced Telecom Operations Map (eTOM) [56] is a framework adopted in the telecommunication sector that categorizes the business of the services providers. eTOM Business Process Framework considers both business and customers' point of view.

Although several reference models exist, none of them refers specifically to the service delivery process. Existing works partially refer to services (e.g. linking services to strategy or to technologies) but they do not take into account the specific activities to exploit the service delivery. In fact, neither they are focused on the service delivery process nor they are able to manage the process complexity, i.e. the various activities required, the associated software and tools, and the resources required to perform such activities.

In order to understand if a common nomenclature in service process management has been proposed, the literature related to ontology in the product-oriented service domain was also screened. As documented by [60], "a common ontology has not been released" yet. Hence, according to the results obtained, none of the identified reference models can be used as a reference to guide the service delivery process standardization because it does not take into account the service delivery process activities and peculiarity. Thus, in their current form, they are not suitable for the scope of this work.

In conclusion, the literature analysis shows that references models, standard nomenclature, and methods for process modularization are missing in the field of service delivery process. In order to fill this lack, a technique for service process delivery standardization has been proposed in the next chapter, leading to a step-by-step procedure to implement this approach in a company.

4. Theoretical artifact: the proposed technique for service process delivery standardization

As emerged in the previous session, the topics of process standardization and reference models for the service environment are underexplored. However, it sheds the light on the current practices in traditional business process standardization that can support the identification of methods to be adopted in this field. In particular, modularization boasts relevant advantages to define the process archetype (RQ1) while reference models are used in different fields to set nomenclature and interconnection of entities in diverse environments (RQ2).

Based on these findings and targeting the research questions, this section proposes:

- a structured approach to identify a final service process archetype, encompassing an approach to service delivery process modularization;

- the structure of a reference model framework that supports the definition of the nomenclature and relationships of the standard service delivery process within a single organization. In turn, this supports the replicability of the standard process archetype in various units of a company.

Furthermore, a procedure to support the implementation of these two concepts in a real manufacturing company is proposed.

4.1. Definition of a structured approach for process standardization

According to literature finding, the main critical step in defining a process archetype, and then to represent a standard process, is process modularization. However, in the extant literature an approach specific for service delivery process modularization does not exist yet. Hence, based on existing concept of modularization, this paper proposes a structured approach to service delivery process modularization. The sequence of process modules will constitute the process archetype that represents the standard process for a specific service offer. According to [38] a modular system is "a system built of components, where the structure ["architecture"] of the system, functions of components ["elements", "modules"], and relations ["interfaces"] of the components can be described so that the system is replicable, the components are replaceable, and the system is manageable".

The service domain elements are scaled accordingly. The modular system is represented by the decomposition of the service process into modular sub-processes. The delivery process of a single service is the *structure architecture*. The "*modules*", or the elements, are defined as a set of activities that are homogeneous and have a high cohesion. Indeed, "a module is a unit whose structural elements are powerfully connected among themselves and relatively weakly connected to elements in other units" [61]. Accordingly, each module of the proposed service process modularization approach contains activities that are strongly connected to each other (e.g. are performed by the same resources skills) and are weakly connected to activities belonging to other modules. In other words, each module can be defined as an elementary building block that, combined with others, creates the overall structure architecture: the delivery process of a single service. Similarly to the approach adopted by [62] for the design process, the modules identified in this work are like "black-boxes" characterized by specific inputs and outputs. The inputs and outputs of the activities inside the modules are the *interfaces*; each module should have one single input and one single output. Being a set of activities, the modules can be then connected to each other's based on specific sequences into the process archetype.

<Insert here Figure1>

Figure 1 shows the proposed concept of a standard module based on a group of activities. Each module represents an atomic and instantiable task, or set of activities, that are performed during the service delivery process. The resources needed to pursue these activities are also associated with each module. These modules are fundamental in configuring the standard process, namely the *process archetype*. Indeed, the process archetype is defined as a sequence of standard process modules. In addition, possible variants to the process archetype can be set adding additional modules or combining them in a different sequence.

Hence, once the standard modules are identified, each company can define its service delivery process by picking and putting them in the most appropriate sequence. Thus, the aim of these standard modules is twofold: they can be used to set the standard activities (and then the service delivery process) inside a company or to easily engineer new service delivery processes. Indeed, the latter would be constituted by a defined sequence of modules ensuring the efficacy of the process in providing a specific service.

4.2. Definition of a reference model structure

In order to properly represent the service delivery standard process (RQ2), the definition of a reference model is of utmost importance [31]. The reference model summarizes all the available modules into a company and contextualizes them into the overall business. It also sets a unique nomenclature for the modules creating a common understanding of the processes. In the light of this, it constitutes the domain specific ontology for the company that is going to adopt it. Hereafter, the structure of the service process reference model to be coupled to the process archetype and modules is proposed. This structure is meant to support each company in establishing the relationship of the service processes into an organization and in setting up service concepts and definition. The proposed model is hierarchically structured as in figure 2.

- **"Level 1: Top Level"** identifies the business area for which the reference model is set. For example, after sales services area.
- **"Level 2: Offer Level"** defines the offer proposed by the company at Level 1. For example, inside the after sales business a company can offer different services, such as spare parts provision and/or warranty extension.
- **"Level 3: Process Element Level"** represents the process archetype linked to each company offer. The process archetype structure and its modules constitute this level. E.g. the level 3 associated to Level 2 offer "spare part provision" could be composed of 4 modules describing the service process high level structure: offer generation process, order management process, spares delivery process, payment process.
- **"Level 4: Implementation Level"** includes all the detailed activities defined in each module (Level 3). Usually, it describes the specific activities of a company.

<Insert here Figure 2>

The reference model summarizes the relationship of the building blocks (i.e. the modules in level 3) of the service delivery process with respect to the offer and to the services offered by the company (i.e. level 2 and level 1). It constitutes the basic knowledge about the service delivery activities and represents the common background upon which the service delivery processes are built. Indeed, the main modules of the reference model can be used: i) for the comparison of a process with respect to a standard and ii) for the engineering of new processes or instances that can be designed putting together the modules belonging to the reference model.

In conclusion, the objective of the proposed modularization technique and the reference model above mentioned is twofold. First, they can be used in order to identify internal standards. Second, it can lay the foundations for the definition of standards to be widely used in the context of product-oriented services. The next section provides the procedure for their application in a company.

4.3. A step-by-step procedure to implement the approach in industry

A step-by-step implementation procedure allowing companies in adopting the above-mentioned approach aiming at internal standardization is proposed in this section. This procedure supports companies in identifying their standard service delivery process starting from the analysis of all the existing processes. Indeed, each company can analyze its own service delivery processes and define the process archetype and its internal reference model. Here are the steps:

1. **Definition of the modules**
    a. **Data collection**: Analyze all the existing processes (one for service offered) through the service blueprinting mapping [37].
    b. **Modules identification**: Based on the blueprinting structure, identify the modules as groups of activities strongly connected with each other. The first proposal of process modules is set.
    c. **Modules update:** Other variants of the same service delivery process are analyzed (e.g. the same service delivery process performed in other countries or units) and their own modules are identified and compared with those identified in the previous step. The first set of modules can be consequently updated and/or improved. According to such procedure, the modules are iteratively adapted every time a new process of the same service is analyzed. The modules can be label as “standard”, meaning that they must be performed for delivery the service, or “variant”, meaning that they are optional.
2. **Definition of the process archetype**: The analysis of the service delivery process maps leads to the identification of a standard sequence of process modules that constitute the process archetype of the service under analysis. The different variants of the service delivery process could be characterized by a different sequence of modules. It is up to the company rules and best practices to identify the standard order of them (i.e. the process archetype). Figure 3 summarizes the iterative process to identify the module and the subsequent identification of modules’ sequence that constitutes the archetype process.

<Insert here Figure 3 >

3. **Alignment between reference models and process archetype**. Lastly, the process archetype has to be associated with the nomenclature in the reference model. The process archetype and the content of the modules refer respectively to Level 3 and Level 4 of the reference model. If the company already has a reference model in place, the archetype information must be aligned with the ones defined by the reference model. If the reference model is not available or not fully defined, the archetype will be used as the main base to define the missing part.

5. Evaluation of the artifact: Industrial case application

The validity and the practical feasibility of the proposed approach have been tested following the previously defined step-by-step procedure in ABB, a multinational company whose service operations are spread worldwide. ABB is a global leader in the power and automation technologies and its product range varies from robots to low voltage breakers, and high voltage motors. ABB puts on the market an extent service offering throughout the entire product lifecycle (installation, commissioning, maintenance, repair…). Two important goals of ABB are generating value for customers and enhancing company value. Therefore, if, on the one hand, ABB has to beware of the customers' requirements, on the other hand, internal efficiency is crucial to ensure a profitable business.

ABB has embarked on its service transformation journey and is facing several challenges in service operations and delivery. In particular, the complexity of its portfolio, the number of locations where it operates and its technology-centered culture make it a suitable case study where to apply the theoretical findings. First, it is organized based on product types and the service areas of different product lines rarely communicate with each other. Second, given the large spread of its products and the differences between them, ABB has many units located in different countries. Third, the products are so heterogeneous that they may imply different service activities. Furthermore, the cultural background together with the experience of the people involved in the service operations make the level of maturity relevantly different among the units; this can generate dissatisfaction with global customers who are expecting comparable services in different units of the same company, even if geographically spread. The situation is even more complex considering the uncertainty in service demand. For all these motivations, the standardization and the subsequent homogenization of service processes would imply a relevant improvement for the current business of the company. The sections hereafter describe the application of the proposed approach for the standardization and the homogenization of the ABB service processes. It follows the specific step-by-step procedure.

5.1. Step 1: Definition of the modules

According to the step-by-step methodology (STEP 1 - section 4.3) the ABB service delivery processes have been analysed. Multiple service offerings in more ABB units have been screened. Each of them has been analysed with the people accountable for the delivery and described through the service blueprint structure. Each map has been developed through multiple semi-structured interviews involving employees from different functions: service operations managers, sales managers, field service operations managers and back office employees. Within each process study, three meetings took place. The first 1-day introductory meeting aimed at: i) introducing the overall project; ii) collecting general features about the service delivery process (structure, timeline and resources) and iii) drawing a first map of the service process with post-it. The second meeting, a workshop, was intended to review and modify (if necessary) the first draft of the map. The third meeting was designed to validate the service process. This first activity was the most critical one since it entails the gathering of procedures and data adopted in each unit. Furthermore, people with different roles into the unit stressed different phases of the process providing different perspectives and details.

Six different service offerings have been analysed. For each of them, the delivery processes carried out in several business units located in Italy have been evaluated and compared. In table 2 a list of the services along with the responsible units is reported. In total twelve detailed process maps have been drawn.

<Insert here Table 2>

For each service reported in table 2, the iterative analysis of processes and modules has been fulfilled in all the units reported and a final list of the ABB standard modules has been defined. Table 3 reports the list of the modules with a brief description of them. From a general point of view, the analysis of all the service maps revealed that service delivery practices across the several units are almost similar. The main difference found is that the resources (humans) responsible for specific activities and the language adopted to describe activities are quite different. Moreover, activities that in one unit are considered as extremely important, in some others are negligible.

<Insert here Table 3>

For example, the administrative checks that the company does on customer solvency, are almost standard and they are common among the units. On the contrary, the customer approach is highly variable and varies from one unit to another. In the robotics unit, for example, the customers are engaged with a contract whereas in others unit (low voltage and motors and generators) customers usually ask for ABB support only when they need it, without having a contract. These discrepancies complicated the definition of standard modules and activities. The corporate research centre played a key role in this phase and set the activities that can be defined as “standard” and those that instead are “variants”. For example, the two modules “proactive sale” and “handle customer request” were identified, respectively, as “variant” and “standard”. Whenever discrepancies in the process maps emerged, multiple interviews were held to identify what is standard and what is not.

Moreover, as foreseen by the procedure, inside each module a set of standard activities has been defined. An excerpt of the activities at the bottom level for the module “Perform service job at customer” is reported in figure 4. The activities inside this module refer to the execution of the service job and the inspection of the ABB product. As shown in the figure, in case the inspection reveals a failure that can be immediately fixed, maintenance could be directly performed.

<Insert here Figure 4>

The final list of the activities included in each module is reported into the complete reference model of ABB reported in Table 4.

The identification of activities to be included in a single module was also a critical phase of the study. Although the activities performed are similar throughout the units, some discrepancies have been recorded because the activities are performed in different ways and they were described by the people involved at different levels of granularity. In order to define a common level of detail of all the activities and to identify standards applicable in all the units multiple meeting and interviews were held.

5.2. Step 2: Definition of ABB archetype process

After the analysis of all the delivery processes of all the six services in the three business units, a common sequence of modules to be followed, i.e. the ABB service delivery process archetype, was defined.

From a high level analysis, among the analysed services some have exactly the same process archetypes: preventive and corrective maintenance, retrofit, replacement, commissioning, and installation. The only difference among them was the specific activities performed at customer's site. For this reason, these services were grouped in one common module to exploit the modularization potential: "service job on site".

Figure 5 shows the process archetype of the "service job on site", where the main modules are highlighted in different grey shades. The figure shows the exact sequence of modules to be followed in the service delivery process.

<Insert here Figure 5>

The definition of the process archetype was based on existing mapping of the processes and was meant at identifying a common sequence of modules into the overall process. Afterwards figures 6, 7, 8 report some example of the initial maps created to identify the modules and to define the process archetype. The analysis of all the maps revealed some differences among the processes since the identified "modules" were positioned in different areas of the process. As it could be observed, in the robotics units the "manage order" module follows the "perform service job" module whereas in the low voltage unit and in the other units the order is managed before any kind of service job. These differences in the sequence of modules further complicated the identification of the process archetype.

<Insert here Figure 6>

Figure 6 Low voltage process mapping with a general scheme of modules

<Insert here Figure 7>

Figure 7 Low voltage system process mapping with a general scheme of modules

<Insert here Figure 8>

Figure 8 Robotics process mapping with a general scheme of modules

5.3. Step 3: Alignment between reference models and process archetype.

In parallel to the analysis of the service delivery process, the terminology and the nomenclature adopted in different business units have been investigated. A common thread across the units has been the usage of a local terminology that from other units turned out to be complex and meaningless (e.g. the terminology used in low voltage unit was quite different from the terminology used in robotic unit and people involved had some issues in understanding each other even if speaking the same language). This demonstrated the strong need of ABB to align the nomenclature and to define a common language across the units. The reference model structure has been used as a template and a joint effort between the university and ABB researchers has led to the identification of a customized reference model. The terms adopted, the description of the offering and of the activities are the results of an in-depth consideration and analysis. Indeed, a tradeoff between ABB practices and an easily understandable language has been sought. In regard to this, it is worth mentioning the complexity in identifying a common taxonomy that could be understood by all the people throughout ABB. The language adopted in different units indeed is quite different and, sometimes, strongly depend on the product managed in the specific unit and on the country to which the unit belongs. Here is the final outcome of the analysis leading to the nomenclature homogenization.

1. “Level-1: Top Level” is the macro-area where ABB foresees the main advantages coming from the standardization of the service delivery process: “*Field Service*”.
2. “Level-2: Offer Level” includes the service offering in the field service area: *Remote Support* and *Service Job on site* (as mentioned before, one offering has been created for all the services that share the same process archetype).
3. “Level-3: Process Element level” represents the way in which the offer (Level-2) is provided: the archetype process. The order in which the modules are listed at Level-3 of the reference model reflects the process archetype structure and composition. At this stage, the archetype modules have been associated to a specific name and description and resources linked to the activities have been grouped in common roles.
4. “Level-4: Implementation level” corresponds to the activities inside the modules.

The final ABB reference model is displayed in table 4. For each element of the reference model, a specific description clearly explaining each term was also defined. The complete reference model together with the descriptions is reported in Appendix. As it could be observed from the table, the reference model sets the overall list of activities in the domain of service delivery process, defining their names, their formal description and their interrelationships (set by the hierarchical structure). According to this, it also represents the nomenclature to be used. Hence, it can be also seen as a domain specific ontology for product-oriented services.

<Insert here Table 4>

Although the definition of standard activities and the set-up of the reference model did not show special criticalities or complexities, the overall company transition toward this standardization is taking a large amount of time and the actual implementation of all the required changes is under development. As hinted before, the current processes are similar in scope and organizations but the actual change of activities and tools requires time and a strong managerial commitment. Intuitively, the habits of an organization are rooted in the people's experience and this makes the people resistant to change. To move in the direction of standardization the company is homogenizing and streamlining the software and tools to be used through the process. Such changes are spurring the introduction of new standards. Once all the processes would be aligned with the process archetype and the reference model, a quantitative estimation of the performance improvements would be possible to achieve.

6. Discussion: Theoretical and managerial implication

This research presents a structured standardization technique that guides the identification of a standard service delivery process. The results obtained contribute to both theory and practice. First, they contribute to the service engineering literature suggesting an approach to support or integrate the available design methodologies in the context of delivery processes. According to the proposed approach, service delivery process can be seen as a sequence of process modules. This implies that, once the service process modules are identified (a first proposal could be the reference model proposed for ABB) the engineering activities are quicker and less expensive. Hence, the process engineering phase of the service delivery for which methods and tools are not available is reduced to the simple selection and the connection of existing process modules. It is well demonstrated that a modular engineering approach has many advantages among which: i) the re-use of existing design modules reducing time of parallel engineering, ii) the ease of structure updating due to the utilization of modules, iii) the increased variety of design solutions and iv) the ease of design updating [63]. Further developments and research in this direction are related to the analysis of the first proposal of the reference model and expand or verify it to make it generally valid for product-oriented services across many industries. This would act as a common reference for all the companies that wish to implement a new service and do not have the proper knowledge to do it.

More than setting up a reference model and defining re-usable modules for future engineering activities, the proposed approach provided relevant advantages with respect to the process standardization inside a company. The ABB case brought to the fore the following advantages associated with process standardization through modules:

- The identification of a standard process archetype has been used in order to standardize and manage service processes in several units all around the world. Local units have been aligned with the global guidelines; local managers can better justify their decisions and organizations and are sure that their activities are approved by the company. On the other hand, this implies a coherent and equal approach to the global customers increasing the image of ABB.
- The homogenization of the processes based on a standard revealed a good opportunity to capitalize on existing global investment. Having a standard approach of working implies a better and easier applicability of the knowledge developed.
- The interconnection of the standard process modules with the identified reference model allows a standard and common identification of resources associated with the service delivery process. This could support benchmarking of the units against each other's and the monitoring and the resources' efficiency.
- The homogenization of processes throughout all the units can create the basis to move toward the digitalization of the business. Information has been collected in ERPs or CRMs systems but they can obtain much more value by continuing the effort and envisioning new capabilities and process changes to reap larger returns from their foundational investments. In particular, the digitalization of a standard process can imply performance improvement and the enablement of employees to work anywhere and anytime and to take advantage of broader communication.
- The identification of a standard process based on a modular structure will facilitate future service engineering activities. This implies lower costs and lower time to launch a new service on the market.

7. Conclusions and further developments

In the age of globalization, competition customers' requests are growing and becoming more specific. Thus, services focused on responsiveness and quickness in meeting customer wishes enclose a possible strategy to fight rivalry and boost profitability for manufacturing companies.

On this wave, the present work originated from the need to effectively and efficiently standardize service delivery processes in order to better manage service operations around the world. The intent is not to create organizations all working in the same way but instead to re-use best practices and share business optimization. To overcome these complexities, two research questions have been fulfilled.

First, a standardization approach for service process has been proposed (RQ1). It is based on a modular engineering approach and argues that service process standardization can be achieved through the definition of a process archetype, based on a set of unique and interchangeable modules. The modules are meant to represent atomic and instantiable “building blocks” that could be used in different kind of services.

Second, a reference model structure has been defined (RQ2). This is aimed at constituting a general framework that should be adopted by companies that wish to standardize their own service delivery processes. It reveals itself as a comprehensive framework that enables the description of concepts, modules, and activities within the organization structure. This facilitates a seamless replication of the standard process (i.e. the process archetype) in multiple units. To complete the standardization technique, an implementation procedure has been proposed to guide the application of the standardization within each company.

The standardization approach together with the guidelines to define a reference model have been validated in an industrial case. Among the positive implications of their joint exploitation, a prominent relevance is related to the possibility to show a single face to customers and suppliers, to yield economies in support activities, to perform benchmarking across different units and a host of other benefits.

Based on this, the paper boasts a twofold contribution. From a theoretical perspective, it proposes a service process standardization approach contributing to the extant literature which at the moment is limited in the service domain. This approach, in practice, could help companies in identifying their internal standards to be used for standardization and for subsequent engineering activities. Second, the paper proposes a standard service process and a reference model developed in the area of service. Even though it is developed specifically for the ABB context it can also be used for other companies with similar features.

Even if the test case highlights the major benefits of the study, it also presents some limitations: both the modularization approach and the reference model structure have been tested in a single company. Further analysis of other service processes, following the identified iterative procedure would demonstrate the validity of the service process modularization. Then, starting from the ABB reference model, a standard and general service process reference framework could be identified. It would set the basis for the definition of “instantiable” modules that could be used by a wide variety of companies in a variety of industries for their service engineering activities.

To reach such reusable reference model that would act as a “standard” it is necessary to expand the study and to enlarge the ABB specific reference model to a wider variety of services and processes. Regarding the next step, the reference model proposed in this paper is currently lacking a set of Key Performance Indicators to monitor and evaluate the performance at all the level of the reference model. Thus, further research will be concerned with the definition of robust performance indicators for each component of the reference model. This would support a deeper analysis of the service delivery processes and a better benchmarking across units.

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O. FIELD SERVICE

FS1. Remote Support

The process of enabling customers to perform after-sales support for products offering remote assistance. This includes receiving and responding to customer's inquiries or claims, trying to suggest a solution for problems deployable by the customer himself. All these tasks are held directly on phone.

FS1.01 Handle customer's requests

The receipt and logging of assist requests from the customer. Assist requests can be received through e-mail, phone or fax. This phase includes the validation and authorization of the assist request with warranty/contracts verification and customers' verification.

FS2. Service Job on Site

The process of providing after-sales support for products provided to the customer at the customer site. This includes receiving, logging, assigning support resources and responding to customer inquiries.

FS2.01 Handle customer request

The receipt and logging of assist requests from the customer. Assist requests can be received through e-mail, phone or fax. This phase includes the validation and authorization of the assist request with warranty/contracts verification and customers' verification.

FS2.01.01 Take on the responsibility of the ticket

The process of validating and authorizing customer's request, when the product is out of warranty period.

FS2.01.02 Check administrative, legal and ethical situation

The process of verifying whether a new and unknown customer is reliable in terms of administrative, legal and ethical issues.

FS2.01.03 Codify the customer

The activity of codifying the new customer, inserting him on SAP, if no legal and ethical issues arose.

FS2.01.04 Communicate ticket refusal

The communication to the customer of the request refusal. This activity is performed whenever a check fails and a ticket cannot be processed.

FS2.02 Assess the feasibility and create the offer

The submission of further request details and the definition of service rate which can be negotiated with the customers

FS2.02.01 Define quotation based on service rate

The process of defining the intervention tariffs (hourly rate, material costs…). This activity is performed immediately after the verifications of customer situation, either a technical evaluation is required or not.

FS2.02.02 Send quotation

The task of sending the quotation to customer, generally through an e-mail. ABB needs to wait for customer's approval before performing the intervention.

FS2.02.03 Negotiate the conditions

The process of negotiating the conditions defined in the service rate. Occurring when the customer has not completely accepted the tariffs. Generally, a negotiation is asked by local ABB since it will charge a further mark up on their final customer.

FS2.03 Manage order

The issue of the order from the customer and the registration of the request in company's system.

FS2.03.01 Register the order

The activities associated to the registration of the order on SAP and the opening of the sale WBS, where any kind of cost, related to the intervention, can be charged.

FS2.04 Mobilize and plan

Agreement with customer on the intervention detail with the following identification and reservation of resources needed for an intervention based on service levels agreements.

FS2.04.01 Ask for planning requirement

The interaction with the customers aimed at getting informed about preferences on the intervention date in order to start activities scheduling.

FS2.04.02 Plan activities
The process of scheduling the activities that should be performed by the technicians, trying to balance customer requirements and internal resource availability.

FS2.04.03 Verify technicians availability
The process of verifying the availability of technicians capable to perform the required job.

FS2.04.04 Prepare documents
The activities performed at Zurich headquarter related to the release of specific documentation authorizing the travel to high risky country (L1, L2). For this purpose all the necessarily details are submitted to the headquarter that releases the authorization of technician travel. This phase includes also the preparation of visa.

FS2.04.05 Arrange travel
The process of organizing the technicians' travel, once all the documents required are ready, trying to balance customer's requirements and internal resource availability.

FS2.04.06 Employ external resources
The task of employing external resources, from other local ABB, when there are requests, which cannot be completed with internal resources. In case external resources are employed the resource scheduling is in charge of third party.

FS2.04.07 Communicate plan The communication of the plan to the customer once all the details of intervention are defined.

FS2.04.08 Revise plan
The activity of revising the plan in case the customer does not agree on the scheduling proposed.

FS2.04.09 Receive approval
The activities of receiving the plan approval from the customer.

FS2.04.10 Order spare parts
The placement of an order to the supplier when the spare parts are not available. The time spent for this activity includes also the shipment of spare parts to customer's site, performed directly by the supplier.

FS2.05 Prepare job
Preparation of materials shipment with related documentation, expediting of materials and final on-site checking of shipment by the customer.

FS2.05.01 Pick and prepare the equipment for shipping
The series of activities including picking the equipment and preparing it for the shipment in response to a planning. This phase is critical since it includes the preparation of documentation and tag required by destination country legislation.

FS2.05.02 Check on-site conditions
The interaction with the customer aimed at receiving feedbacks about the on-site availability of the materials needed for the intervention and assessing whether everything is ready for the intervention.

FS2.05.03 Revise the shipment
The task of checking shipment progress and material availability on-site, performed in case the condition at customer's plant do not allow the intervention execution.

FS2.06 Perform service job at customer
The process of preparing, decomposing the product, replacing the part and re-assembling the product at the customer site. This phase can be performed more than one time, until the product is fully operational upon completion. In this case, the intervention should require a re-scheduling.

FS2.06.01 Execute the service job
The series of activities performed at the customer's plant, necessary to satisfy the customer requests, concerning maintenance, commissioning or diagnosis. Sometimes these activities are reiterated until the conclusion of the service job. For this reason, a re-scheduling could be needed.

FS2.06.02 Execute the inspection
The series of activities, performed at customers' plant, necessary to satisfy the need for further information about the failure, if it is complex. Sometimes no further intervention is needed, but when failures are detected, technicians can immediately perform the repair or they postpone the intervention later.

FS2.06.03 Create on-site report

The process associated to the documentation of the activities performed, the materials replaced and the time spent in order to perform intervention activities. The technician is entitled to write it on-site, upload it on the specific tool (ServIS) and wait for customer approval and sign.

FS2.06.04 Create inspection report

The process associated to the documentation of the motor conditions during the inspection in order to provide useful information for the following intervention. The technician is entitled to write it on-site and upload it on the specific tool (ServIS).

FS2.07 Complete job (billing)

The activities associated with closing the assist request. This may include asking the customer to provide feedback on the effectiveness of the assist offering, sending a signal to the financial processes that the internal or external billing process should begin and archiving the assist request in support of analysing the performance of the assist processes.

FS2.07.01 Create the final technical report

The task related to the creation of a detailed technical report of the activities performed by the technician, starting from the draft previously written.

FS2.07.02 Create the final accounting

The activity that represents the first step of the billing process. It comprehends the examination of the reports and the preparation of the final accounting, which includes all the expenses incurred.

FS2.07.03 Create the internal invoice

The task of arranging an internal invoice when costs are not charged on customer because of warranty.

FS2.07.04 Review the final accounting

Activity that allows the customer to ask for an ultimate bill review.

FS2.07.05 Create the invoice

The concluding task of the billing process, including the examination of the reviewed final accounting and the preparation of the invoice