Service development for product services: a maturity model and a field research

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Abstract –This paper presents a research work investigating the level of maturity of New Service Development (NSD) processes of manufacturing companies for the development of product services. A preliminary Maturity Model to assess the maturity level of companies in NSD is proposed. Three case studies have been carried out, and companies were involved hands-on in a workshop to discuss ongoing projects and NSD practices. This empirical approach allowed also to touch a second issue concerning the role of external stakeholders, e.g. consultants and research centres, and of structured tools and methodologies in helping companies moving forward towards the adoption of more structured approaches to NSD. The maturity model was helpful in assessing how the case companies carry out their NSD processes, and which are the main gaps concerning the different key dimensions and elements. Such a model can support the definition of improvement actions by company managers.

1. Introduction

In recent years manufacturers have been forced to develop innovative ways to compete with low-cost competitors. One of the strategies adopted to meet various and rapidly changing customer needs and creating more value for the customers, is the provision of services added or integrated to the traditional product offering (Martinez et al., 2010; Sundin, 2009, Sakao et al, 2006) with the aim to provide a function instead of a product. Integration of products and services has been a matter of great concern for manufacturers (Park and Lee, 2009) and companies such as IBM, General Electric, Xerox, IKEA, Rolls Royce, Ericson, Toyota Material Handling have transformed their business and their offers in such direction (Vladimirova et al., 2011; Isaksson et al., 2008). Some of them are getting a significant share of revenues and profit from such kinds of offers, which include a combination of services, products, networks and infrastructures delivered as a system to the customer.

The integration of product and services into a complete offer have been termed in different ways: “functional sales”, “functional product”, “system solutions”, “integrated solution”, “industrial services”, “service package”. A popular term is “Product-Service System” or PSS (Isaksson et al., 2009; Park and Lee, 2009). Several definitions of PSS are available in literature, generally it can be thought of as a market proposition that extends the traditional functionality of a product by incorporating additional services, often embracing sustainability aspects (Bianchi et al., 2009).

Even if the shift from a product-oriented perspective to a more service oriented one promises extremely interesting benefits, its practical adoption has been prevented by many different obstacles (Bianchi et al, 2009). Many manufacturers are hindered by the inadequacy of their corporate structures and processes which has not been designed to enable services to be efficiently developed and launched on the market (Bullinger et al., 2003). Therefore, in manufacturing companies, compared to physical products, services are generally under-designed and inefficiently developed (Froehle et al., 2000). Companies face a challenge in designing and developing competitive PSS. They need to re-organize the entire business process, and mainly the design and development processes in a PSS perspective, and accordingly adopt tools and methods that can support these new processes (Janthong, et al, 2010). In the last 20 years a new discipline, Service Engineering, has born with the aim to support the design and development of services and PSS. Service Engineering (SE) can be defined as: “a technical discipline concerned with the systematic development and design of services using suitable and innovative models, methods and tools” (Bullinger et al, 2003).

In a SE perspective it is fundamental to firstly define the design and development process model with the aim to create and share knowledge at an early stage between product and service designers and then to achieve the greatest possible process efficiency before the service is actually offered. The aim is to eliminate activities that do not add value and remove unnecessary interfaces and media discontinuities (Fähnrich and Meiren, 2007). Several process models are available in literature (Bullinger et al., 2003), however they are poor implemented and used in industrial context. Moreover engineering and technical methods and tools are quite limited (Kim and Meiren, 2010) and mostly unknown in industrial practice.

2. Research background

2.1. New service development models

Since the seventies and eighties, it is possible to find some seminal publications in the service development and service design fields in the Anglo-American literature. (Bullinger et al, 2003). This field of research, called “New Service Development” officially started in the USA with the “Service Design and Service Management” Model of Ramaswamy (1996) (Torney et al, 2009). The main concern of this field was mainly related to the success factors and obstacles preventing the development of new services but only few concrete instruments that could be applied in practice have been developed (Fähnrich and Meiren, 2007). Since the last decade more attention is being paid to the service development subject both from a theoretical and practical point of view, as shown by the increase in publications in the last few years (Bullinger et al, 2003; Fähnrich and Meiren, 2007; Luczak et al., 2007; Torney et al, 2009). In particular, due to the need of a more technical oriented discipline dealing with the systematic development of services, the term service engineering was coined in the mid-nineties in Germany and Israel (Bullinger, 1995; Mandelbaum, 1998). In this sense, the term “Service Engineering” implies a strong engineering know-how. It originates from the assumption that services can be designed and developed using the same approaches of physical products (Bitran and Pedrosa 1998; Chai et al., 2005; Tan et al, 2006). In fact, the formalisation of a systematized design and development

process is a critical success factors in NSD. NSD, like any development process, is more likely to succeed if supported by a systematic approach: however, in some research the terms NSD and SE are used as synonymous (Kim and Meiren, 2009). In this paper we will use the term New Service Development (NSD) as a structured approach supporting the introduction of structured methodologies (Service Engineering) for the development of new services.

Some New Service Development and Service Engineering process models have been developed in recent years, briefly reviewed hereafter.

As mentioned before, in 1996, Ramaswamy in the "Service Design and Service Management Model" firstly identified a service development process. He divided the whole development of a service into design and management phases. Ramaswamy considered the whole process of service design as an integrated and iterative process, in which the management phase includes measurements and testing strategies which provide feedback for further improvements (Morelli, 2002). In the same year, Edvardsson (1996) proposed a model focused on the Service life cycle phases from idea management to implementation. Few years later, Meiren (1999) proposed a model composed of five steps: idea management, requirements analysis, service conceptualisation, service implementation and market lunch. In 2003, Bullinger et al., added to the previous process model a phase: Post-Launch Interview. In the following years the same model has been updated few times and today it has 6 main phases (Meiren and Barth 2002). In a work of 2004 updated in 2006, Alonso Rasgado et al., suggested that there are three stages in the service design process: (i) Concept development (ii) system design (iii) testing and implementation. Aurich et al. (2006), considering the strong interrelations between the physical and non-physical components of Product-Service Systems suggest to adapt already existing product design processes to account for the special characteristics of PSS. Six phases have been identified, namely: Customer demands identification, Feasibility analysis, Concept development, Service Modeling, Realization Planning, Service Testing.

Although service development is now a high-priority topic, in the past it was not a prominent focus of either business or engineering research. By simply emphasising the importance of developing new services, most of the work published to date fails not only to offer concrete support but also to anchor this process in strategic and operative enterprise management.

2.2. Maturity models

Maturity is defined, literally, as the "quality of being in a full development state" [www.webster.com]. Maturity models (MMs) can be viewed as staged roadmaps for assessing the capabilities of a firm/organization with respect to a specific management domain (Becker et al.2009). The aim of MMs is to support improvement through the identification of best practices, the provision of guidelines and of common assessment frameworks. The basic idea behind any MM is that higher levels of maturity are the basis for an increase in the process capability of the organization. Because organizations are not supposed to implement all the best practices at once, MMs provide cumulative requirements to be achieved in order to increase management capabilities through a staged approach. In other words, to achieve a higher maturity level, the organization must satisfy, as a pre-requisite, all the requirements of the lower stages.

A seminal maturity model is the Capability-Maturity Model (CMM), by SEI (Software Engineering Institute at Carnegie Mellon) (Paulk et al., 1993). CMM, as well as its evolution CMMI (SEI, 2002) is finalized to assess, according to a five-level scale, the maturity of organizations in software development processes. The most of MMs applications are in the field of Software Engineering, Information Systems and IT Infrastructure Management : as reported by Becker et al. (2009, 2010), over the last few years over a hundred MMs have been developed to support IT/IS management. Notwithstanding, MMs have been successfully revisited to cover other management issues. For example, Rosemann et al. (2004) propose a model for assessing how different organizations are advanced in Business Process Management. Niemi et al. (2009) proposed a staged models for improving inventory management practices. Fraser et al. (2002) develop a model for new product development processes, and Berg et al. (2002) for the domain of R&D. Even in the recent ISO standard for quality system management (ISO 9004: 2009) a grid for correlating the key elements in quality system management to 5 different maturity levels is presented.

Despite the vast amount of MMs applications, to the best of our knowledge there is still paucity of models to be used by manufacturing firms in order to address their New Service Development process capabilities. This is related to the fact that this field of research and the broader area of Service Science, Management and Engineering (SSME) have emerged in the recent years, as reported in the previous section.

3. Research framework

3.1. Research questions

Given the background provided in the previous section, the aim of this paper is to explore how the organizational readiness and maturity in NSD of product-centric organizations can be assessed, and how it can be improved through the introduction of specific NSD practices, frameworks, methods and tools. In particular, a case-based research has been carried out, to address the following research questions:

- *how can the maturity of product-centric companies in NSD can be assessed?* A maturity assessment model will be presented in section 3.3 to serve this aim. Some case studies have been investigated in the light of the model (section 5) to explore the internal validity of our assumptions.
- *what is the role of external stakeholders, especially consultants and research centers, that can provide methodologies and tools in helping companies moving forward towards the adoption of more structured approaches to NSD*? To this purpose, a NSD model will be presented in section 3.2 and its use in a workshop with a group of company managers will be presented in sections 4 and 5.

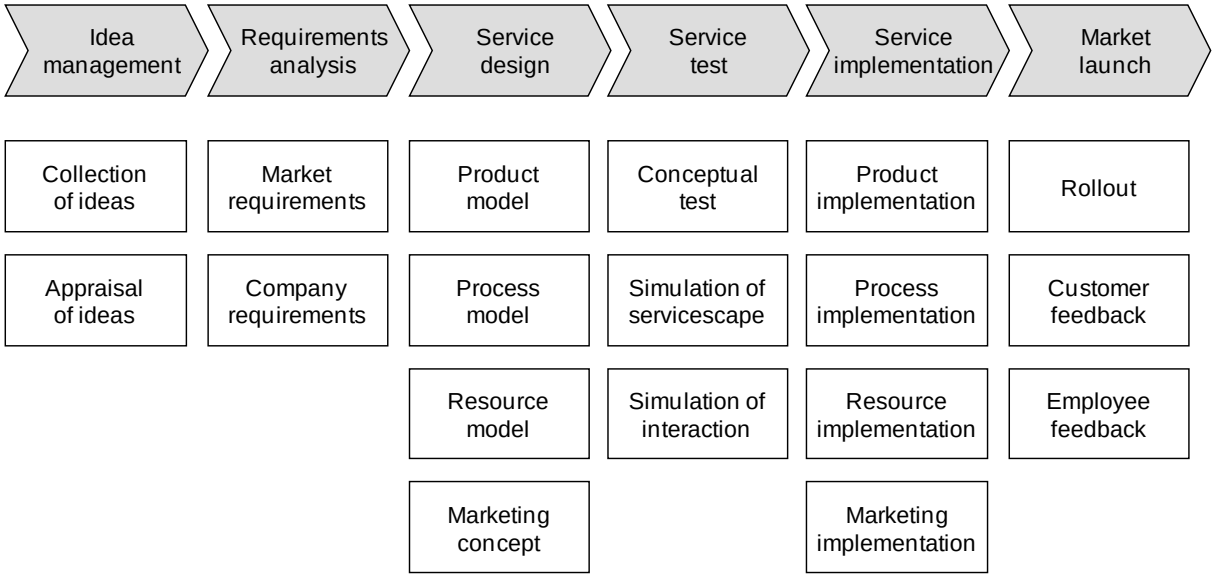
3.2. New Service Development model

In contrast to marketing-oriented New Service Development frameworks, the proposed model entails applying the appropriately modified engineering know-how es-

tablished in the field of conventional product development to the development of services. As such, the model tries to overcome the limit of some models reviewed in section 2.1, too far from being of operational advice and support to companies. In the proposed model, depicted in figure 1, the overall development process is subdivided into six broad phases (Burger, Kim, Meiren, 2010):

- Phase I: Brainstorming and appraisal of the idea (Idea Management),
- Phase II: Requirements collection and analysis,
- Phase III: Concept development and Service Design,
- Phase IV: Testing,
- Phase V: Implementation,
- Phase VI: Market introduction & Roll-out.

Fig. 1: The proposed new service development model, developed at Fraunhofer IAO (Burger, Kim, Meiren, 2010):



Phase I - The first step in the service development process includes brainstorming and appraisal of the idea. The process begins with a collection of ideas for new services. These ideas are then filtered and crystallised. In particular, preliminary concepts are elaborated for suitable service ideas.

Phase II - The second phase, the requirements analysis, marks the start of the actual development project. The requirements from the stakeholders' point of view are recorded and compared with one another. These observations moreover represent the starting point for detailed planning of the new service.

Phase III - The third phase consists of the conceptualisation. Concept development is made up of the Service definition (Scope of services, technical description), the Organisational concept (Processes, roles and resources, training concept) and the

Marketing concept (Product policy, price policy, place policy, promotion policy).The main goals of this phase are to describe the services in detail, to define organisational parameters for the future provision of these services and to plan the deployment of resources. The conceptualisation phase also serves to elaborate a marketing concept, to enable market and customer aspects relevant to the future market launch to be taken into account at an early stage of the development process.

Phase IV - After the concept is developed, it should be tested (Burger et al., 2010) . Conceptual tests verify the consistency and plausibility of the service documentation (e.g. business plans, process models, training material). Apart from a few exceptions (e.g. process simulations), these activities are usually restricted to paperwork, i.e. the test is not carried out with real customers. Usability tests are used when the new services involve the use of new operating resources (e.g. new hardware or software). It is possible to measure the user friendliness of these resources by applying test methods derived from usability engineering. A central question is likely to be whether or not the company's employees and customers are able to handle the new resources. Prototyping and simulation allow to visualize customer contact points, where interactions and processes are tested with real customers under realistic conditions, either in test branches or special virtual laboratory environments. Observation and feedback techniques are used to sequentially optimize the service concept and to identify conceptual mistakes before implementation and roll-out. A fourth alternative is to test the new services in a pilot market. In this case, the services concerned are offered to a limited number of customers, so that the company has a chance to adapt them if necessary prior to the general market launch.

Phase V - Testing is followed by the implementation phase, in other words the conceptualisation and testing work carried out in the previous phases is now translated into practice in the company. Among other things, this necessitates the definition of organisational rules (e.g. the creation of procedures), training for affected employees and the procurement of necessary operating resources. It also includes the operative implementation of the previously elaborated marketing concept.

Phase VI - The market launch phase for new services mainly encompasses internal and external communication and information measures. From the point of view of service development, this phase also serves to monitor the start-up period and review the efficiency of the service. Final adaptations may be necessary depending on feedback from the marketplace, customers and employees. Furthermore, this phase comprises post-launch support for the services. In particular, any problems or complaints have to be reacted to in a continuous improvement process. In addition, possible change requests from customers must be collected, evaluated and – if appropriate – taken into account when the services are further developed. Last but not least, this phase entails deciding when services should be removed from the market or, if appropriate, replaced by new ones.

We argue that this model presents some advantages compared to some other models reviewed in section 2:

- It has practical value, since, although rigorous it is practice-oriented, and makes explicit reference to tools and methods that can be adopted in the new service development process (e.g. the virtual reality method developed at Servlab – Fraunhofer IAO) (Ganz and Meiren, 2010).

- It has been already tested in practice through projects carried out between companies and the Fraunhofer IAO, and in company workshops (such as the one described later in this paper).
- It is easy to be understood, since it is positioned at an “high level”, in between a service engineering and a marketing approach, and can be applicable to different industries, organizational roles and company functions.

3.3. Maturity assessment model

As previously stated, to properly develop and engineer a service, a product-service or a PSS, it is important to follow a formalized, structured and systematic process, using suitable models, methods and tools. For example, the NSD process model described in the previous section is composed of six structured phases. These phases can be carried out or not by a company in its project-based NSD processes. The adoption of structured process models is an element revealing the maturity of the firm in approaching NSD. According to the foundational theories of Maturity Models (MMs), we assume that the maturity of an organization in NSD is related to the process capability with respect to the management of NSD projects, i.e. to initiate, assign, plan, execute, control and review the project objectives, its programs and outcomes, and to implement a management system that support its execution and improvement. In other words, we assume that higher levels of maturity for NSD correspond to a higher capability in running the relevant NSD processes. According to some authors (Bullinger et al. 2003, Sakao and Shimomura, 2007, Pezzotta et al., 2011), the NSD capabilities are based on the following elements: 1) the adopted organizational approach, such as the presence of formal roles and management practices, 2) the availability of specific (not shared) resources/skills and dedicated tools , 3), the degree of customers and stakeholders involvement, 5) the performance management systems. With respect to these views, the maturity of the organization in NSD will vary from the lower stages (i.e. chaotic and un-coordinated processes, low availability of resources and tools, absence of stakeholders’ involvement), to the higher stages (i.e. systematic and well-structured processes that are supported by dedicated resources and tools, involvement of customers and suppliers, etc), as showed in figure 2.

For the purpose of this paper, we used a five-scale maturity assessment grid derived by the SEI CMM and by other grid-based maturity models (see Fraser et al., 2002 for a detailed review). The grid uses the well-known five maturity stages, namely (1) Initial state, (2) Repeatable, (3) Defined, (4) Managed, and (5) Optimized. In each stage, the maturity in NSD process of a firm can be described as follows:

Maturity Level 1 (Initial state). In this stage, NSD projects usually run as ad-hoc and chaotic initiatives. The organization usually does not have a stable environment/process to support NSD projects, neither tools or specific resources. The outcomes of these projects depend on the individual competences and heroics of people, rather than the use of proven management practices and tools. The recipients and the implications of new services are not totally addressed.

Maturity Level 2 (Repeatable). In this stage, basic project management techniques are adopted, but NSD projects are poorly managed and lack in adopting robust methodologies and tools as well as in the execution of the most relevant phases,

such as involving the stakeholders, blueprinting the service concept, etc. By intuition, some key-elements (e.g. data collection from market analysis) of the most successful initiatives are identified and repeated on similar projects. Nevertheless, market requirements are poorly addressed. As a consequence, the basis of the NSD approach can be described as an immature “learning from failure”. In other words, the NSD processes are not performed according to well established models and frameworks, neither there is a common understanding of how a service should be designed and engineered.

Fig. 2: The maturity levels of NSD processes of an organization

Low	*Maturity levels for NSD*	*High*
Un-coordinated processes, poor managed projects No best practices Absence of supporting tools Low skills/available resources Manual (heroics of people) Internally focused (no clear view of customers and stakeholders) Naive comprehension of the effects of bad decisions and poor management (“we suppose that”) Dominant traits of NSD culture: static, reactive and chaotic	**5. Optimized** **4. Managed** **3. Defined** **2. Repeatable** **1. Initial Stage**	Co-ordinated processes, rigorous projects management techniques Use of best practices Use of dedicated tools Highly skilled competences Automated (design & engineer) Externally focused (clear statements of customers and stakeholders) Complete understanding of the causal relationships among the quality of the project, of the process and of the outcome(“we know why”) Dominant traits of NSD culture: innovative, proactive and systematic

Maturity Level 3 (Defined). In this stage, projects are planned according to documented and approved models to make the relevant NSD processes run. Exceptions to this are necessarily justified. Nevertheless, neither good practices nor adequate resources or tools are adopted in comparison to the budget devoted to other activities (e.g. New Product Development). Key-competences for successful NSD are not totally exploited, and the understanding of the NSD contents is limited to the most relevant issues. As a consequence, processes are not under control, and the outcomes of NSD project are not predictable.

Maturity Level 4 (Managed). In this stage, NSD processes are managed with use of specific competences and best practices. Each project is planned according to standard frameworks that have been deployed and tailored. The NSD process receives the proper commitment by senior management, as well as investments for introducing Service Engineering methods and tools. Resources are trained to achieve higher skills. This way, NSD processes are systematically understood, controlled and managed. Although processes may produce predictable results, the results may be insufficient to achieve established objectives, especially if continuous improvement of the performance level is requested.

Maturity Level 5 (Optimized). In this stage, the organization is able to continually improve its NSD processes (i.e. models, tools, resources) based on a qualitative and quantitative understanding of each component. The organization focuses on

Table 1: Description of key-elements at different stages of maturity

DIMENSION	ELEMENT	1. INITIAL STAGE	2. REPEATABLE	3. DEFINED	4. MANAGED	5. OPTIMIZED
ORGANISATIONAL APPROACH	**Internal relevance of NSD**	no, focus on NPD	focus on NPD, service elements added as occasional	focus on NPD + supplementary services	focus on integrated development of products and services	focus on developing customer solutions or PSS
	Roles	no formal nor informal roles	project based teams, extemporaneous, ad-hoc identification of participants	project based recognized teams, interfunctional perspective	formal role responsible of NSD projects + project-based teams	formal role or function + project-based teams Roles (e.g. quality) dedicated to the evaluation and improvement of methodological aspects
	Management practices	no formal procedures, chaotic and non-systematic approach	basic project management	advanced project management	standard advanced project management (standard = shared between the resources; advanced = uses specific project management SW tools)	standard advanced project management + benchmark procedures for continuous improvement
RESOURCES	**Budget**	NSD not seen as requiring budget	minimal budget for ad-hoc projects	specific budget (allocated yearly)	specific budget allocated according to mid-term plans	budget consistent with the objective to achieve the best performance for NSD
	Tools and methods	no methods and tools	no standard methodology (ad-hoc, project-defined) general purpose tools	some methods are derived from NPD. General purpose tools	NSD methods/framework in place development process formalized specific supporting tools (idea generation, …)	NSD methods/framework in place development process formalized specific supporting tools (idea generation, service and process design, simulation) best-of-breed tools, continuous improvement of methods (customization/declination of existing methodologies to the specific needs of the company)
	Skills	no awareness of the skills required to develop new services	self-training of involved people. Ex-post, informal evaluation of competence gaps	formal training activities (general purpose, e.g. project management)	Investment in training in specific NSD-related skills Recruitment focused on critical skills for successful NSD	skills assessed periodically. Investment in training in specific NSD-related skills Recruitment focused on critical skills for successful NSD

DIMENSION	ELEMENT	1. INITIAL STAGE	2. REPEATABLE	3. DEFINED	4. MANAGED	5. OPTIMIZED
STAKEHOLDERS	**Customers**	customers not involved	some customers are randomly involved in the definition of requirements	customers are surveyed for market analysis and requirements definitions	customers are also involved in verification and testing of new services prior to definitive launch	some customers are also involved as codesigners, even for broader-scope solutions
	Other stakeholders (internal and external)	stakeholders are not involved in NSD projects (e.g. requirements definition, process blueprinting). No attention of possible contribution of and impact on other supply chain actors	only internal representatives of impacted functions are involved in (or listened to) NSD projects	Internal stakeholders that can be helpful (e.g. in defining the market requirements, in designing the service contents, in modeling the delivery process, etc.) are involved in the NSD projects. Some external stakeholders (e.g. delivery network) may be listened prior to proceed to detailed tasks	Both internal and external parties that could be interested in/impacted by the new services are identified and, if possible, involved	Both internal and external parties that could be interested in/impacted by the new services are identified and involved. Relationships with highly-skilled external parties (i.e. research centers, consultants) are established, maintained and exploited to improve the NSD processes and management system.
PERFORMANCE MANAGEMENT	**Feedback systems (satisfaction, acceptance and impact of new services)**	no feedbacks are collected corrective actions are based on subjective intuitions rather than on objective data analysis	Even if data are collected, feedbacks are poorly used. Corrective and preventive actions are performed according to internal procedures rather than being totally aware of the reported issues.	Feedbacks are achieved and discussed. Due to the poor understanding of the field/customer phenomena, feedback-based decisions are always disputable. Nevertheless, there is consistent use of monitoring for measuring and, tentatively, improving the NSD	Feedbacks are systematically used to identify the weaknesses of the newly developed services, in order to make robust the design of service contents and delivery processes. Improvements and innovations are performed in a systematic way.	Feedbacks are systematically used, to identify NSD process weaknesses and to improve the NSD organization and management system. Continuous improvement and innovation are carried out throughout the organization.

DIMENSION	ELEMENT	1. INITIAL STAGE	2. REPEATABLE	3. DEFINED	4. MANAGED	5. OPTIMIZED
	KPIs	No measures in place	Few and ad-hoc measures, mainly related to costs and resources' productivity, in order to point out cost-savings opportunities	standard KPI dashboard Cost and time measures are considered	standard KPI dashboard Balanced measures (internal, and external, customer orientation)	standard KPI dashboard Balanced measures (internal, and external, customer orientation)

continually improving its performance through incremental and/or radical innovation, striving to achieve the best available resources and technologies in order to enhance its ability to act as a service provider.

Starting from this general definition, in order to assess the maturity of an organization for any key-element of NSD processes, a detailed, although preliminary, grid has been developed (see Table 1).

Through the maturity model illustrated in this section, a maturity assessment can be carried out and performed by external or internal auditors (self-assessment). The maturity assessment should be focused to compare the current situation to the examples that are listed in the grid, and to highlight the key-elements that have been already applied. For this issue, the use of radar charts and graphics in reporting the results facilitates the communication of information and enables the identification of improvement activities that are requested to move to a higher level (ISO 9004:2009).

4. The empirical research

The self-assessment of maturity levels are perhaps more beneficial if performed by inter-functional groups, in order to overcome the bias of single-informants and build cross-functional consensus; some authors (Chiesa et al., 1996, Cooper, 1992) have reported the importance of team applications and workarounds as the audit tools in NDP. In particular, Emst, H. and Teichert (1998) recommend using a workshop for the improvement of NPD cross-functional linkages. For this reason, the empirical research was built around a workshop on New Service Development held at Fraunhofer IAO (Stuttgart) in February, 2011. The authors and six company managers took part to the workshop. Among the six companies, three have been the object of detailed case studies, aimed at assessing their level of maturity in NSD and exploring the role and impact of structured methodologies such as the one proposed in section 3.2 and of structured workshops.

The empirical research followed the four steps described hereafter.

1. Participant selection

The participation to the workshop was proposed to companies taking part to the ASAP Service Management Forum (www.asapsmf.org), an Italian-based community of researchers and practitioners dealing with product services. In choosing the participant companies, based on their specific interest to the activity, it was decided to keep a relevant degree of variation in terms of industries, roles in the supply chain (manufacturers vs. Product service providers), size, nationality of the company. Characteristics of the companies and managers taking part to the workshop are listed in Table 2.

Table 2: Companies taking part to the workshop

Company	Industry	Country of origin of the mother company	Role of participant	Size (unit of analysis)

Company A	Spare part wholesaler for household appliances	Italy - national company	Managing director	Small
Company B	Production printing manufacturer	Europe	Service director of the Italian subsidiary	Medium (Italian subsidiary)
Company C	Printers, consumer and professional electronics OEM	Asia	European Service Manager	Medium (Italian subsidiary)
Company D	Car-wash equipment manufacturer	Italy	Managing director German subsidiary	Medium (German subsidiary)
Company E	Household appliances manufacturer	Italy	Service Manager for Italy	Large
Company F	Contact center service provider for helpdesk support	USA	Business Development Manager Italy	Large (Italian subsidiary)

2. Preliminary data collection

All participants were asked prior to the workshop: i.) to distribute some slides about a new service idea or project they were planning or carrying out at the moment. They were asked to specify the objective of the project, the involved team, the activities already carried out, on-going and coming next; ii.) some information about the company and how they usually carried out New Service Development activities was also collected, although informally, by the authors, in order to get a preliminary understanding of the level of maturity of the participating companies.

3. Workshop

The one-day workshop took place in February, 2011 in Stuttgart. A get together and a dinner were organized on the day before the workshop in order to create an informal environment among participants and with the authors. The workshop was led by the researchers at Fraunhofer IAO. After an introduction about the activities of Fraunhofer IAO and the ASAP SMF, the first part of the workshop (around 1h30') was devoted to give some common background to participants about New Service Development, to present the NSD model described in section 3.2 and to show the ServLab, a highly technological environment for prototyping and testing new services developed at Fraunhofer IAO. Each participant was then asked to briefly present her/his company and the NSD idea he wanted to discuss. A long discussion followed, facilitated by the authors. At the end of the workshop all participants were asked to comment about the interest and contribution of the workshop to their project and their professional knowledge and understanding of NSD.

4. Post-workshop follow-up

Three companies were chosen after the workshop, based on availability and interest in the topic, to go more in-depth into the NSD project discussed. A follow-up interview with the managers was carried out three to six months after the workshop. This allowed the authors to verify if and how the workshop influenced the next steps in the

NSD project, with particular reference to the dimensions and key elements pointed out in the Maturity Model described in section 3.3. This allowed to identify the directions the companies were undertaking, if any, in their maturity growth.

5. Case studies

5.1. Company A

Company A is a family-owned business started over 45 years ago. Founded as a Technical Support Centre, the company started in the mid 60's to distribute spare parts for home appliances. It deals with the distribution of spare parts for household appliances in Italy (its main market) and in more than 50 countries. It employs around 25 people and has a turnover of around 5 million €. The company headquarters and warehouse are located in northern Italy. The success factors of the company can be considered the wide product range and the efficient logistic system. The company consider a central issue also customer service, and it is very committed to communication activities.

The new service discussed by the company during the workshop concerned the development of a new brand for distributing a range of accessories and general purpose parts not related to specific appliances' brands. In particular the idea was based on how to relate the new brand with natural environment protection and energy saving. The project was at an early stage (*idea generation / requirement analysis*), and a team and a detailed plan were not defined at the moment the workshop was carried out.

5.2. Company B

Company B is a leading multinational firm operating in the professional printing sector through production printers, wide format printers, professional plotters, etc. The company sells also accessorial products/services, such as media that can be printed on, packaged and custom software for production printing processes and document management, consulting services, maintenance services and financial services.

The company operates with its own direct sales and service organisations in more than 30 countries and employs more than 22,000 people worldwide. Its total revenue in 2010 amounted to over € 2,500 million. In particular, our unit of analysis is the Italian subsidiary of the Company.

The company presented two ongoing projects at the workshop. The first one concerned the visit avoidance (i.e. reduction of on-site visits by technicians). The project was at an advanced stage (*Service Implementation* on some pilot product lines), with already defined call handling procedures and performance measures of the outcome (number of visits avoided). The second project was broader and ill-defined, and at a very early stage: the objective was to increase the service revenue of the company by "servitization" initiatives. Although not a specific NSD project, it allowed for a rich discussion on how to transform strategic objectives into specific new service ideas and development plans.

5.3. Company C

Company C is the Italian subsidiary (our unit of analysis) of an Asian multinational OEM, with more than 74 thousands employees and a yearly turnover of more than $10,000 million in 2010. Most of this large world-wide business is made through the manufacturing and distribution of printing equipments (e.g. inkjet printers, large-format printers and related supplies, color image scanners, mini-printers, POS systems) and other professional and consumer electronics products (e.g. video projectors). Even if the company portfolio includes products for production printing, most of the revenues come from consumer markets. Printers as well as consumables (e.g. ink-jet cartridges, photo-quality papers), are sold through both specialised trade operators and dealer-shop networks. These players are seen as the primary customers of the company. Technical services are provided resorting to qualified external suppliers (i.e. Authorised Assistance Centers, around 40 in Italy).

The service discussed by the company concerned a prepaid card for selling services to be offered through dealers and technical support centres to the customers (the main target were professional customers). The service was already in the *market launch* phase.

5.4. Maturity assessment

Based on the information collected prior and during the workshop, a qualitative classification of the maturity level of the case study companies has been made, and is reported in table 3. From Table 3 it is possible to classify Company A as being between an *Initial Stage* and *Repeatable* maturity level. Most activities are, in fact, not structured and carried out informally. Nonetheless the company is a family run, small business, and revealed a high interest in the topic and a high commitment to the service projects carried out.

Companies B and C have more structured approaches to NSD, although with several gaps compared to the most advanced maturity stages of the proposed model. Company B can be classified at a *Repeatable Stage*, leaning towards the *Defined* stage. Company C is more advanced, with an established *Defined Stage*, and with some elements projected to a Managed stage.

Table 3: Maturity assessment of the case studies company

DIMENSION	ELEMENT	Company A	Company B	Company C
ORGANISATIONAL APPROACH	**Internal relevance of NSD**	service elements occasional	focus on both solutions, products and services as accessorial business, depending on the business units	focus on NPD + supplementary services
	Roles	no formal role (family business) project based informal teams	project based recognized teams, interfunctional perspective	project based interfunctional teams, coordinated by service marketing manager
	Management practices	basic project management	basic project management	basic project management
RESOURCES	**Budget**	minimal budget for ad-hoc projects	minimal budget, to be negotiated with the country manager	budget consistent with the necessity of deploying projects at a sovranational level
	Tools and methods	no methods and no tools	no specific methods nor tools for Service Engineer-	no specific methods nor tools for Service Engineering

DIMENSION	ELEMENT	Company A	Company B	Company C
			ing	
	Skills	no attention to specific skills of people involved	recently developed attention to deploy a general training program in service marketing and service concepts	internal training program
STAKEHOLDERS	**Customers**	customers not involved	customers are not involved	customer are surveyed for satisfaction in relations to services
	Other stakeholders (internal and external)	no involvement in the identification of requirements	only internal stakeholders from other functions/business units are involved, if impacted	NSD projects are carried out at a sovranational (EMEA) level, under the coordination of the EMEA service director. Several internal stakeholders are involved according to a cascading deployment roadmap. External stakeholders such as technical assistance centers are yearly met for the annual convention, but this occasion is not exploited to achieve new idea generation and requirements for NSD
PERFORMANCE MANAGEMENT	**Feedback systems (satisfaction, acceptance and impact of new services)**	no feedback from the field	feedbacks such as claims and customer satisfaction surveys related to new services are indirectly achieved from a third part company	feedbacks are collected, in non structured way, by the service director, while he visits the large accounts/customers as part of his job
	KPIs	performance measurement of time and cost (ex-post)	elements not assessed	elements not assessed

5.5. Post-workshop assessment

The second aim of this paper concerns the role of structured methodologies and tools, such as the NSD framework presented in section 3.2 and the workshop described in the previous section in contributing to the evolution of skills and maturity growth of the companies.

Workshop assessment

The workshop revealed that, for all the participant companies:

- NSD projects were carried out from a totally unstructured way to a rather formal definition of activities
- All the involved managers (except partially for company C), however, showed the absence of a broader picture of NSD phases and steps, such as the ones reported in the NSD model of section 3.2 and often misperceived the actual phase their NSD projects were about. In some cases in fact, the actual project phase turned out to be less advanced than initially reported by the participating managers.
- Thus, the NSD framework presented in section 3.2, and used as a reference framework during the workshop, was considered very useful by all participants

and contributed to their awareness and knowledge about how to plan and carry out NSD projects.

- On the overall, the participants reported very favourable comments on the workshop contribution to their personal knowledge and their projects, thanks also to the open discussion with other managers

Post-workshop actions

The three studied companies implemented some actions in the months following the workshop, concerning the NSD project discussed during the workshop or the way NSD projects were carried out in general. These actions testifies an increased awareness of the companies' management about the need to approach in a structured way NSD projects and to move forward in the maturity scale.

Company A acted on the Stakeholders dimension: formalized meetings were organized with company agents and some customers (shops selling accessories for appliances) in order to better define the requirements of the new service and the outcomes on the different actors.

Also *Company B* acted on the Stakeholders dimension, but not only. First of all, a more formal and focused Idea Management phase was carried out for the second, more blurred, servitization project. This resulted in the concept of a revenue-generating document management service tailored to a specific segment of customers. It also entailed the decision to involve potential customers in a structured way into the Requirement Analysis phase. The company, moreover, contacted a Research Centre to design and support this activity from a methodological point of view.

Company C. Although the project presented during the workshop by Company C was thought also as a way to support the service delivery network to generate revenue and increase customer loyalty, these stakeholder were poorly involved in the development process. After the workshop, the company decided to organise a workshop addressed their service delivery and dealers' network in Italy, with the aim of defining new service ideas to be developed, in conjunction or not with the pre-paid card object of the NSD project described earlier. The workshop was carried out with the methodological support of a Research Centre, and following the guidelines of the NSD framework described in this paper.

In all cases, moreover, the managers declared their intention to put in place a more structured NSD process in their firms, showing an increased awareness of the importance of this issue.

6. Conclusions

This paper presents a research work investigating the level of maturity of NSD processes of manufacturing or product-related companies for the development of product services. A maturity perspective is adopted in the paper, and a preliminary proposal of a model to assess the maturity level of companies is proposed.

The approach of the research is empirical: three case studies have been carried out, and companies were involved hands-on in a NSD related workshop to discuss ongo-

ing projects and NSD practices they adopt. This approach allowed also to touch a second issue concerning the role of external stakeholders, e.g. consultants and research centres, and of the structured tools and methodologies they can provide in helping companies moving forward towards the adoption of more structured approaches to NSD.

Although preliminary, the research shows some promising results. Firstly, the maturity model was helpful in assessing how the case companies carry out their NSD processes, and which are their main gaps concerning the different key dimensions and elements. Such a model can support the definition of improvement actions by company managers. The workshop experience described in the paper, moreover, shed some light on the potential support of external stakeholders and structured discussion moments to the improvement of real-world practices in NSD.

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8. References

Alonso-Rasgado, T.; Thompson, G., Elfstrom, B. (2004). The design of functional (total care) products. *Journal of Engineering Design* 15, 6 (December), pp 515-540.

Alonso-Rasgado, T.; Thompson, G., (2006). A rapid design process for Total Care Product creation. *Journal of Engineering Design* 17, 6, pp.509-531.

Aurich, J C, Fuchs C., Wagenknecht C. (2006). Life cycle oriented design of technical Product-Service systems. *Journal of Cleaner Production* 14, 17, pp 1480-1494

Becker, J., Knackstedt, R., and Pöppelbuß, J. (2009). Developing Maturity Models for IT Management - A Procedure Model and its Application. Business & Information Systems Engineering, 3.

Becker, J., Niehaves, B., Poeppelbuss, J., and Simons, A. (2010). Maturity Models in IS Research. ECIS 2010, Proceedings. Paper 42, http://aisel.aisnet.org/ecis2010/42

Berg, P., Leinonen, M., Leivo, V. and Pihlajamaa J. (2002). Assessment of quality and maturity level of R&D. Int. J. Production Economics 78 (2002) 29}35 35

Bianchi, N.; Evans, S.; Revetria, R.,; Tonelli F., (2009): Influencing Factors of Successful Transitions towards Product-Service Systems: a Simulation Approach. *Mathematics and Computers in Simulation* 3, no. 1.

Bitran, G.; Pedrosa, L. (1998). A Structured Product Development Perspective for Service Operations. *European Management Journal* 16, 2 pp. 69-189.

Bullinger, H.-J. (1995). Dienstleistungsmärkte im Wandel. Herausforderungen und Perspektiven. In *Dienstleistung der Zukunft*, ed. H.-J. Bullinger, 45-95. Märkte, Unternehmen und Infrastrukturen im Wandel.

Bullinger, H.J; Fahnrich, K.P.; Meiren, T. (2003): Service engineering—methodical development of new service products. *International Journal of Production Economics* 85, 3 (September): pp.275-287.

Bullinger; H.-J.; Scheer, A.-W. (Eds.) (2005): Service Engineering: Entwicklung und Gestaltung innovativer Dienstleistungen, Berlin und New York: Springer.

Burger, T.; Kim, K.-J.; Meiren, T. (2010): A structured test approach for service concepts, International journal of service science, management, engineering, and technology : IJSSMET, Vol. 1, No.4, pp. 12-21.

Cai, H.; Chung J.; Su, H. (2008): Relooking at services science and services innovation. *Service Oriented Computing and Applications* 2, 1 (March) pp. 1-14.

Chai, K.H.; Zhang, J.; Tan K. (2005). A triz-Based method for new service design. *Journal of Service Research* 8, no. 1 (August), pp. 48-66.

Chiesa, V., Coughlan, P. and Voss, C. (1996). Development of a technical innovation audit, Journal of Product Innovation Management, 13(2): 105-136

Cooper, R.G. (1992). The NewProd System: The Industry Experience, Journal of Product Innovation Management, 9(2): 113-127

Edvardsson, B.; Olsson, J. (1996). Key Concepts for New Service Development. *Service Industries Journal* 16, no. 2: 140-164.

Emst, H. and Teichert, T. (1998). The R&D/Marketing interface and single informant bias in NPD research. An illustration of a benchmarking case study, Technovation, 18(12): 721-739

Fähnrich, K.; Meiren, T. (2007). Service Engineering: State of the Art and Future Trends. In *Advances in Services Innovations*, pp.3-16.

Froehle, C. M; Roth, A.V.; Chase, R.B.; Voss, C.A. (2000). Antecedents of New Service Strategic Operations Choices. *Journal of Service Research* 3, 3.

Ganz, W.; Meiren. T., (2010). Testing of new services. In *Proceedings - 2010 International Conference on Service Science, ICSS 2010*, 105-109. Fraunhofer Institute for Industrial Engineering, Stuttgart, Germany.

Isaksson, O., Larsson, T.C.; Rönnbäck A.O. (2009): Development of Product-Service Systems: Challenges and Opportunities for the Manufacturing Firm. *Journal of Engineering Design* 20, 4 pp. 329-348.

ISO 9004: 2009 Managing for the sustained success of an organization. A quality management approach.

Janthong, N.; Butdee, S. (2010). Design Methodology for Industrial Product toward Service Manufacturing. In *Asian International Journal of Science and Technology in Production and Manufacturing Engineering*, 3, pp.1-13.

Kim, K.; Meiren, T. (2009). New Service Development Process. In *Introduction to Service Engineering*, 253-267. John Wiley & Sons, Inc.

Luczak, H.; Gill, C.; Sander, B (2007). Architecture for Service Engineering – The Design and Development of Industrial Service Work. In *Advances in Services Innovations*, 47-63.

Mandelbaum, A. (1998). *Service Engineering: Modelling, Analysis and Inference of Stochastic Service Networks.* .

Martinez, V.; Bastl, M.; Kingston, J.; Evans, E. (2010): *Challenges in transforming manufacturing organisations into product-service providers.* Journal of Manufacturing Technology Management*, 21 (4) pp. 449-469.*

Meiren, T. (1999). Service engineering: Systematic development of new services,. In *Productivity & quality management frontiers VIII. Referred papers presented at the Eigth International Conference on Productivity & Quality Research*, 329–343. Bradford: MCB University Press.

Meiren, T.; Barth, T. (2002): Service Engineering in Unternehmen umsetzen. Leitfaden fur die Entwicklung von Dienstleistungen, Stuttgart: Fraunhofer IRB.

Morelli, N. (2002). Designing Product/Service Systems: A Methodological Exploration. *Design Issues* 18, 3, pp.3-18.

Niemi, P., Huiskonen, J. and Kärkkäinen, H. (2009). Understanding the knowledge accumulation process – implications for the adoption of inventory management techniques, Int. J. Production Economics 118 (2009) 160–167

Park, Y.; Lee, H. (2009): Towards integration of products and services: Literature review and phraseology. In *Proceedings - International Conference on Management and Service Science, MASS 2009*. Department of Industrial Engineering, Seoul National University, Seoul, South Korea.

Paulk, M. C., Curtis, B., Chrissis, M. B., & Weber, C. V. (1993). The Capability Maturity Model for Software, Version 1.1 (No. CMU/SEI-93-TR-24): Software Engineering Institute.

Pezzotta, G.; Regazzoni, D.; Cavalieri, S. and Rizzi C. (2011), Enhancement in Industrial PSS Design based on TRIZ: a Case Study. 3rd Int. Conference on Industrial Product Service Systems, Braunschweig, 2011.

Ramaswamy, R. (1996). Design and Management of Service Processes – Keeping Customers for Life, Reading.

Rosemann, M., de Bruin, T. and Hueffner, T. (2004). A Model for Business Process Management Maturity, in Proceedings of ACIS 2004, Hobart (Australia).

Sakao, T.; Shimomura, Y.; Lindahl, M.; Sundin, E. (2006): Applications of service engineering methods and tool to industries. In *Innovation in Life Cycle Engineering and Sustainable development*, ed. Brissand D., 65-83. Springer.

SEI, 2002. Capability Maturity ModelIntegration (CMMISM), Version 1.1. SEI, CMU/SEI-2002-TR-029.

Sundin, E. (2009): Life-Cycle Perspectives of Product / Service- Systems: In Design Theory. In *Introduction to Product/Service-System design*, 31-49.

Tan, A.R.; Maloone, T.C.; Andreasen, M.M. (2006). What happens to integrated product development models with product/service-system approaches? In 6th Integrated Product Development Workshop, IPD2006 (IPD2006) - 6, 2006, Schönebeck/Bad Salzelmen, Magdeburg.

Torney, M.; Kuntzky, K.; Herrmann, C. (2009). Service Development and Implementation - A Review of the State of the Art. In *1st CIRP Industrial Product-Service Systems (IPS2) Conference*, 24. Cranfield, 1-2 April 2009.

Vladimirova, D.; Evans, S.; Martinez, V.; Kingston, J. (2011): Elements of Change in the Transformation towards Product Service Systems. In *Functional thinking for value creation*, 27-32.

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