

Lappeenranta University of Technology  
School of Industrial Engineering and Management  
Degree Program in Computer Science

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**A HUMAN-CENTRIC SERVICE APPROACH FOR ARCHITECTING  
AND REENGINEERING A GLOBAL SYSTEM**

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## **ABSTRACT**

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### **A human-centric service approach for architecting and reengineering global system**

Master's Thesis

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Supervisor: Professor Ahmed Seffah

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Production of a new system in any range is expanding dramatically and new ideas are thereupon introduced, the logic stands behind the matter is the growth of application of the internet and granting web-based systems. Before producing a system and distribute to the customer, various aspects should be studied which multiple the profit of the system. The process of productizing a new system from being unprocessed idea until delivers to the final user has been unambiguous. In this thesis, the systematize service in a way that benefits both the customer and provider, along with an effort to establish trust and diminish customer's risk and increase service productivity are in detail presented. Characteristics of Servitization and Productization as two faces of one coin have been interpreted. Apart from the above mentioned issues state of art, service-oriented architecture (SOA) and New Service Development (NSD) has been included in this report for solving the problem of gradually decline in value of companies.

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## **LIST OF SYMBOLS AND ABBREVIATIONS**

CRM	Customer Relationship Management
ERP	Enterprise Resource Planning
IDEO	Innovation, Design Engineering Organization
NPD	New Product Development
PMngr	Product Manager
SOA	Service-Oriented Architecture
SMART-SMF	SMART Service Migration Feasibility
SMART-ESP	SMART Enterprise Service Portfolio
SMART-ENV	SMART Environment
QFD	Quality Function Deployment
QoS	Quality of Service
SOC	Standard Occupational Classification
SMART	Service Migration and Reuse Technique
SLA	Service Level Agreement
WSDL	Web Services Description Language
WS	Web Service

# 1 INTRODUCTION

## 1.1 Background

The main goal of this thesis is to investigate how to productize a service, how a New Service Development (NSD) should be done as well as also how NSD and SOA can help to productize and servitize a software system. The thesis outlines the process of new service development. Taxonomy for productizing a product has been introduced to facilitate the process of productization.

In the chapter dedicated to NSD, the process of service innovation has been introduced. In addition, the management the NSD (which is important part of process) has been explained. SOA and its good patterns for migrating the service has been introduced.

The thesis contains four parts, productization, NSD, SOA and Servitization. Productization New Product Development (NPD), Servitization and NSD are while detailing for each of them the process to engineering software products. The SOA section in strokes a deep understanding if the company needs in terms of SOA migration. Three different migration patterns (Taxonomy, wrapping and SMART) with their advantages and drawbacks are mentioned.

SOA migration patterns help companies inclining to servitize their products. The advantages and disadvantages of each pattern are detailed in way that developers can decide which pattern is the most useful.

## **1.2 Structure of the thesis**

The first chapter details the procedure of productizing a new global system regulated and new thoughts has been added to make the entire procedure less demanding. The taxonomy and the whole process of productization are detailed.

The second and third part includes new service development and new product development, their definitions and processes. The process of developing a new idea is explained. Marketing and management aspects of the new service development as important aspects are detailed.

The third chapter explains (SOA) in the expression of productize new system. The impact of the SOA on productization is highlighted. Additionally how SOA has made the productization of a new global system less complex and manageable. Patterns for SOA migration has been introduced to reengineering applications to SOA using productization.

## **2 RESEARCH OBJECTIVES, PLAN AND METHOD**

### **2.1 Goals and delimitations**

The procedure of productizing the new global framework is fundamental for any new products before they reach the client. Furthermore, Servitization process to recovery the declined systems has been conferred. Loads of Products/ Services face obstacle, on the grounds that the business directors even do not think about this procedure and what precisely they ought to do in the period of productizing / servitizing a product/ service. The greater part of these procedure steps has been connected for the LTC-OTSO organization for their new insurance system as a new global system. Alongside to the stalk which ought to be taken for productize/ servitize a new system, the new thoughts have been added to each step. SOA in product service system has been displayed. Preferences and interruption of which have been characterized.

There are distinctive steps which have been characterized to productize a product and there is not a particular arrangement and productize the system. Combination of various exhibited procedures has been utilized and the best process steps are introduced. All the steps which has been presented and characterized in investigative papers are fundamentally the same. Various viewpoints and perspectives of alternate authors in distinctive articles have not been introduced since it relies upon the zone they have been worked (Mostly they have worked as a case study). Combination of the ways and adding new thoughts to their surveys have been exhibited and submitted as a conference paper.

The source and information about productization and specially servitization is too limited and the clarified process steps have not been published yet, only IBM Company characterized its rules and hence, for other cases it can be used.

## **2.2 Research questions**

The absence of rules regarding to Productization and Servitization point out following questions:

RQ 1: What are the key stages that successfully help in productizing a product?

RQ 2: How productization and new service development can be innovatively organized by using tools like IDEO?

RQ3: How Servitization and Productization are relevant to each other?

RQ 4: How SOA reengineering and migration tools can simplify the productization process and new service development?

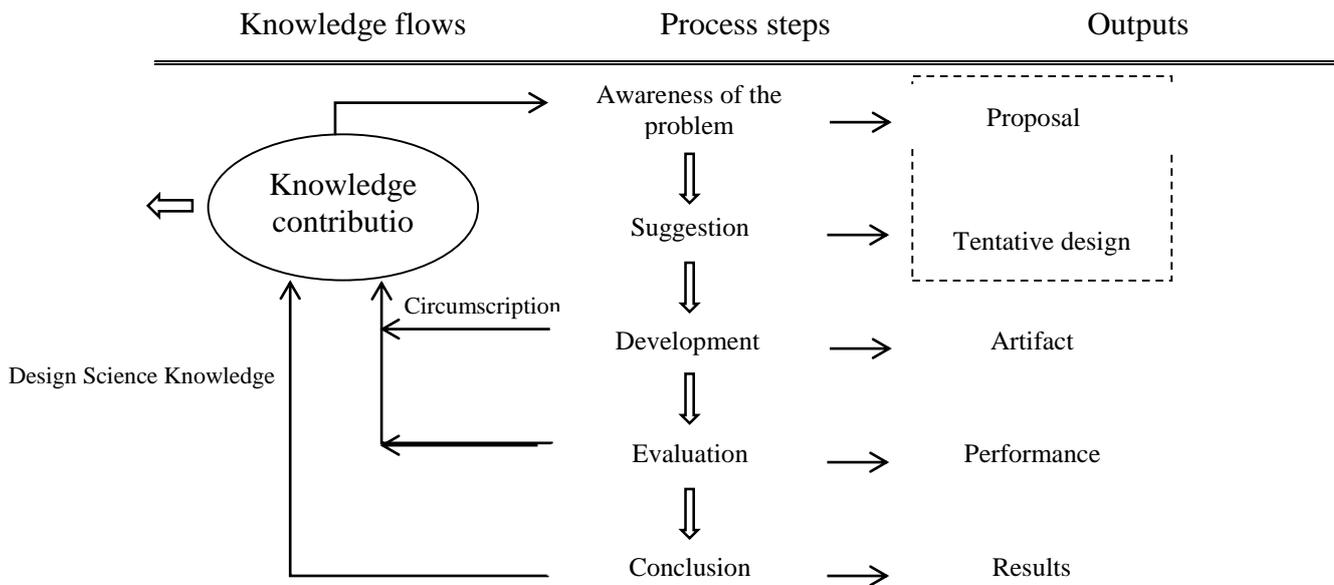
## 2.3 Research method

This research is mainly upon the exploratory research method. The first research question will provide a theoretical background about what productization is and what are its process and steps. The second question will result in new service development explanation which contains new product development as well. The last questions will be declaration of service oriented architecture and its dependencies on productization and new service development process. To create a preliminary framework, design science research has been used.

Design science research includes 7 steps of guideline:

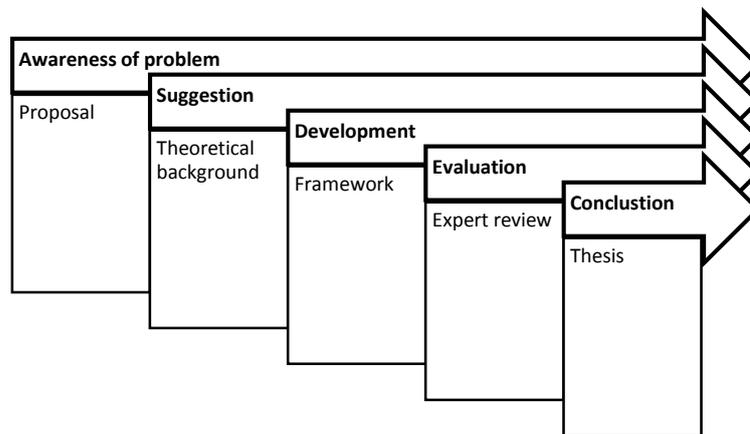
1. **Design as an artifact:** The conclusion of the design research should be IT artifact which solves organization problem or problems.
2. **Problem relevance:** It should solve a business problem.
3. **Design evaluation:** It should be evaluated by well-executed evaluation method.
4. **Research contribution:** It should provide contribution in the range of the design artifact, foundation and methodologies.
5. **Design as a search process:** Within the problem environment should be used.
6. **Research accuracy:** the structure and evaluation of the artifact should be rigorous.
7. **Transmission of the research:** The result of this research should be presented technically oriented and management oriented (Hevner, March, Park, & Ram, 2004).

For the execution of the research, design cycle has been followed. This chosen method consists of more concrete steps. The design cycle consists of five process steps having been shown in the figure 2.



**Fig. 1 Design science research process model** (Vaishnavi & Kuechler, 2004)

Figure 2 shows the description of how the design science process steps will be applied within the research.



**Fig. 2 Process steps with output of the research**

In the phase of awareness of the problem, the problem is discovered; the upcoming problems of the new service development and productization will also be mentioned. The benefit of this step is a research proposal. The problems summarized in 3 main questions with their sub-questions. In the suggestion phase the required information to create the artifact is collected. Theoretical background will be explained about literature of software product management and productization. Development phase is relevant to the result of the suggestion phase to create artifacts. The created artifact will be evaluated in evaluation

phase; this can be completed either in qualitative or quantitative methods. In the current investigation, the developed artifact will be evaluated with an expert review. The last phase of the process is conclusion which is clearly the conclusion of the research. The conclusion of the design science research process will be done in conclusion part of thesis.

### **3 PROBLEMS AND CHALLENGES IN REENGINEERING AND MIGRATING A LEGACY SYSTEM**

#### **3.1 Productization**

Productization is the major requirements introduced in software businesses. In the background of the software trade, productization generally consists of an improvement from exclusive customer service to tangible standardized software products which helps at international mass markets. It cuts down the hazard linked to the product, because customer can analysis the performance of the product before the asset decision is generated. (Alajoutsijärvi, Mannermaa, & Tikkanen, 2000)

Productization can be in the cover of standardization process which helps the high quality products or services production in the market. It adds values to the products and there are different ways to productize a product. Productization emphasizes on the quality of products, demands of the customers and market orientation.

The development of evaluating demands of customers in the target market, scheme the product and promoting the capability to produce it, can also be labeled productization. (Flamholtz & Hua, 2003)

Productizing the product has three main steps in all its types which are: Gathering information about service or product which will be developed, challenging the product/service and finally performing experiments to make it ideal and customized based on the customer requests and ideas.

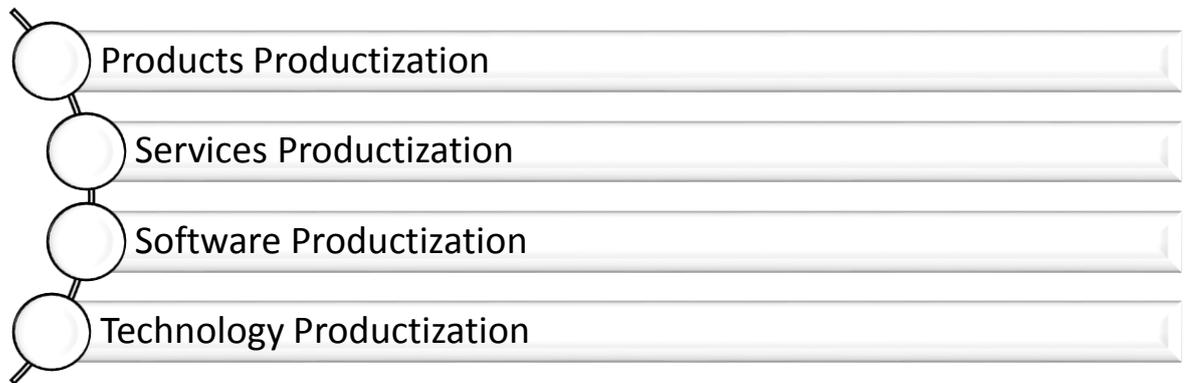
"The main objective of productization is therefore utilizing and re-using the know-how that has been gained from previous projects." (Ojanen, Salmi, & Torkkeli, 2007)

The point of productizing a service is not making the service flexible; the idea is to systematize the service in the way that benefits both company and customer. It reduces the customer's risk and establishes trust, it makes company's service stand out among competitors so it increases customer satisfaction. According to Jorma Sipilä "A service is productized when its ownership can be traded". While productizing a new product or service

the new values of them would be provided, standardized and customizable. In its process the blueprint of service would be defined and with online tools parts of service process will be automated. Finally, a simple pricing system will be defined and training people take part in fulfilling the customer propositions.

### 3.1.1. Taxonomy

The first step which should be taken at the start of productization is to define in which field company's product exists. Productization is categorized into four classes. Companies according to their field of service can define their product- related taxonomy. These classifications are shown in the figure 3.



**Fig. 3 Productization Classification**

## **Productization of Products:**

It mostly conveys productization as a phase in developing products including analyzing the demands of customers, product designing and expanding the capabilities to production. (Harkonen, Haapasalo, & Hanninen, 2013)

Generally products are evolved and produced to amuse demands with considering that compassionate the needs of customers perhaps is hard, principally during consideration of non-physical factors. Products have physical and non-physical elements. Production can scope from elementary to complicated systems, sometimes implemented along with supporting service, occasionally assigned to product-service systems. Product productization is also considered to have two outputs, one is the product that is delivered to the customer and another is awareness disclosed disclose to the product, knowledge about production and use (Johansson, Moehler, & Vahidi, 2013). Here is summarizing of product productization characteristics for making physical products: (Harkonen et al., 2013)

- A measure for R&D
- Standardization
- Hybrid value creation
- product definition based on customer need
- Making products marketable
- Process phase
- having two outputs

## **Productization of Services**

In this category of productization, the objective is abstract and intangible. Services can be customized for different customers and their needs; anyhow, in many situations, services are only partly customized rather than conventional results. Productization of services is discovered out to manage different objections, along with ineffective manufacturing of services, services being custom-made from blemish for each client, dilemma by customers and company staff members observing the service contribution (Valminen & Toivonen, 2012).

It aids for increasing customer interpreting, an action by which a community comprise a service with more touchable details, and makes purchasing simpler. In productization of services clients are identified as accumulate in generating the services.

Similar to product productization, productization of service is also discussed in conjunction with standardization and it is essential for implementing modular products (Miozzo & Grimshaw, 2005).

Generally, service productization implies to be confined and incomplete scope. The margins between products and services are identified to be departing while services are servitized and products are productized. Servitization is a theory which is identified with productization, still the relation amid services and products are somehow disparate. Servitization could be accepted as a transfer from trading products to selling unified product and service contributions that convey profit prevailing.

As a summary, characteristics of service productization are: (Harkonen et al., 2013)

- Services are more product-like
- Better definition of services
- Systemizing
- More tangible
- Improving services
- Standardization

- More efficient services
- Tangible product and service offering combination

### **Productization of Software**

Software based products are increasing dramatically beyond today's products. Software product is related to subsist of assemblage of computer programs, methods, identified authentication, and inputs for distribution to customers (Wallach & Scholz, 2012). Mostly, software product is malleable and comfy, granting approximately obvious modifications in a technological impression (Kilpi, 1997). Software product can also be commutable, subsisting of one or more software programs (Ajila & Dumitrescu, 2007). Productization of software is relevant to tendency and involves that software systems need to approve as soon as they develop into products, i.e. deployment, security, configuration, and usability among any others (Barzilay, Hazzan, & Yehudai, 2009).

Software productization is also seen as means for standardization and reproducibility (Sainio & Marjakoski, 2009). Productization of software discloses to wrapping software to a form that can be suggested to customers. It is a technique of recognizing ordinary software services into modules that can operate as pieces of building for various applications (Mason-Jones, R. and Towill, 1999). From the aspect of software corporation, productization has to have a transfer from particular service-demanding customer projects forwards to tangible standardized products which helps for global markets (Alajoutsijärvi et al., 2000). it means, productization of software is a shift process from customer customized software to a classic one, meaning that productization relates to delivering standardized software products.

Characteristics of software productization can be defined as below:

- Understanding of customers will improve
- Value demonstration
- Standardization
- Ability of reproducing
- To the required amount of support is related
- Suitable packaging
- A process phase

## Productization of Technology

Technology production is related to high-tech awareness in words of product and constructing automation (Thompson & Azvine, 2004). Productization, implies to technology renewal companies using their owned creative estate to others' scaffold technologies. Productization of technology as a piece of a dual-explosion circumstance which joint possessing enterprises are the first settles on technological enhancements. The first period has to be thruster by technological expectations and the second by marketing plans. Extraordinary to the overhead presented productization of technology and marketization of products in points of following technology, i.e. analyzing current technology and productizing the root without contravening related authorities.

Here is the summary of productization of technology despite of any terminology-related inconsistencies:

- Sometimes making marketable
- Development phase
- Technological knowledge
- Product offering relevancy

Summarizing all four steps has been shown in the below figure 4:

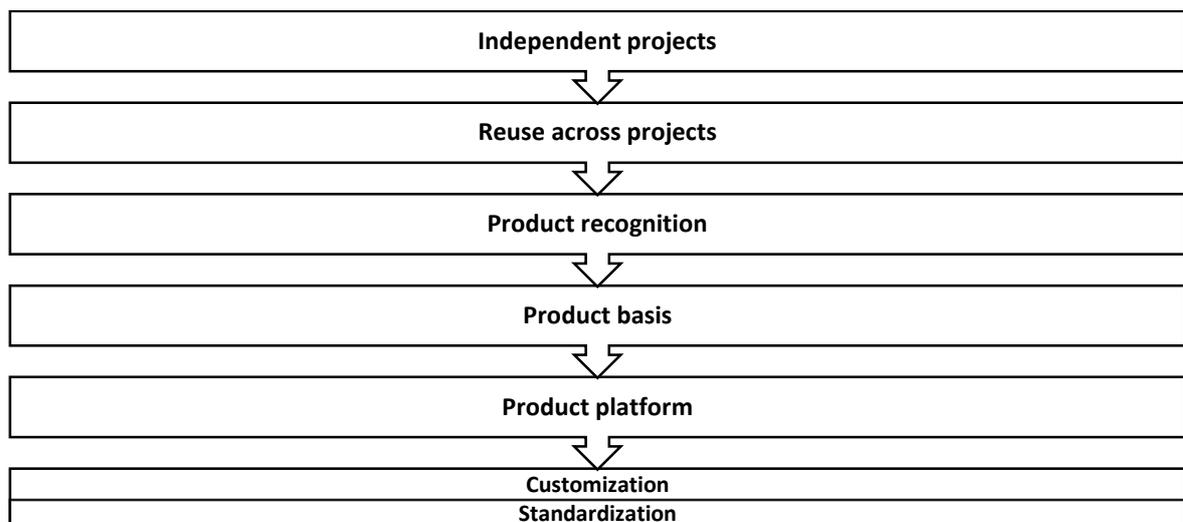
<b>Product Productization</b>	<b>Service Productization</b>	<b>Software Productization</b>	<b>Technology Productization</b>
<ul style="list-style-type: none"><li>• Process phase</li><li>• Standardization</li><li>• R &amp; D commercialization</li></ul>	<ul style="list-style-type: none"><li>• Standardization</li><li>• Systemization</li><li>• Modularization</li></ul>	<ul style="list-style-type: none"><li>• Process phase</li><li>• Standardization</li><li>• Reproducibility</li><li>• Packaging</li></ul>	<ul style="list-style-type: none"><li>• Development phase</li><li>• Markatable</li></ul>

**Fig. 4 Key points of productization categorization**

### 3.1.2. Process

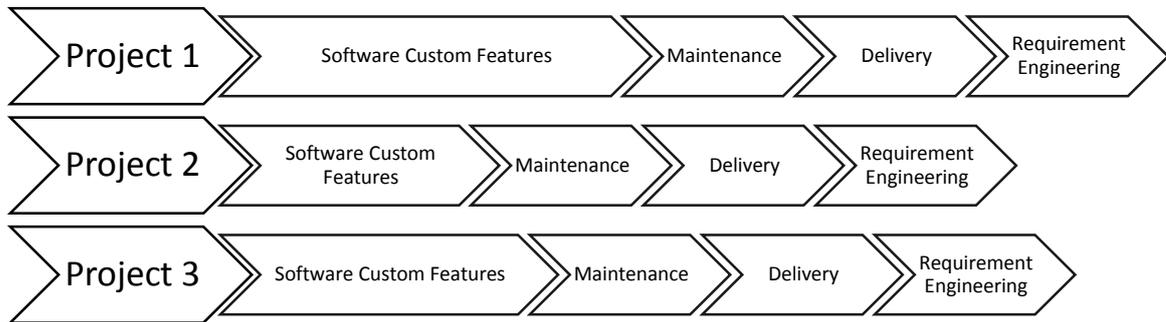
The productization process by Artz, Weerd, Brinkkemper and Fieggen (2010) has been declared below step by step with illustration the whole process.

The productization process is a progress from customer exact software to a software product. Systems are complimentary to penetrate in any steps of this process but these processes illustrate process from initially entered until one of the last stages (Figure 5). This process is applicable to an association which is producing software is based on a customer-driven development. Besides, when an organization is introducing new products for market, the strategy should be followed. As basis of the whole process, it focuses on protection the customer convinces during altering. “The models describe the productization process from being customer-driven (customized software) to becoming market-driven (product software).” (Artz, van De Weerd, & Brinkkemper, 2010)



**Fig. 5 Productization Process**

### 3.1.2.1. Independent Projects

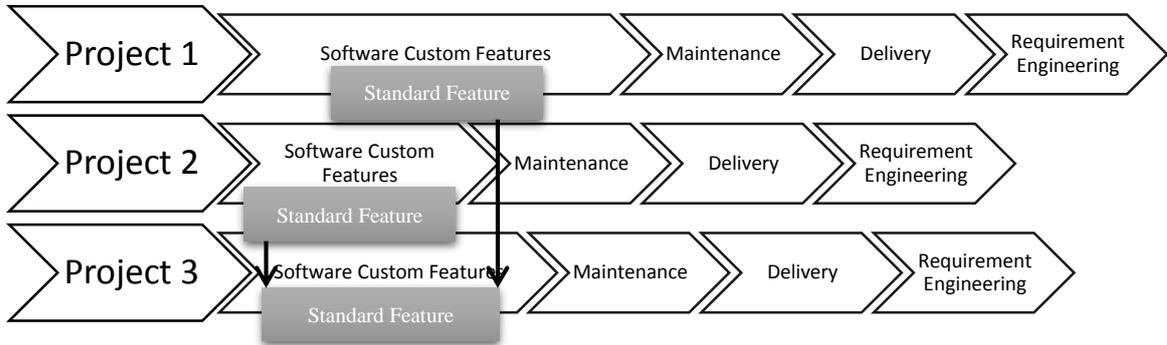


**Fig. 6 Stage 1 - Independent Projects**

As it is clear in the figure 6, projects are executed independently; therefore they have different budgets, technology and functionality. In this stage, projects rarely have standard shared functions of features. Customers are main keys in this stage and they are the main stakeholders. So, the measurement of successful project is customer satisfaction. Therefore, there is commonly a short environmental gap between clients and the developers (Keil & Carmel, 1995). Because of waterfall model of this stage, and executing independent projects, doing more projects makes it more complex to manage. Requirement resources for developing the system are based on customer and their wishes. The last step which is precondition engineering contains of the enterprises relevant to blueprint, compromise, and acceptance of concerns (Alves, Pereira, & Castro, 2006)

Observance of customer satisfaction at this stage is essential. When developing of the software would finish it is approved in sync with the client and afterwards accepting it then it is achieved. About life process of these projects, it is situated on one acquittal and then preservation for finding critical bugs. When new feature form customer will be requested, a new project will start.

### 3.1.2.2. Reuse across Projects

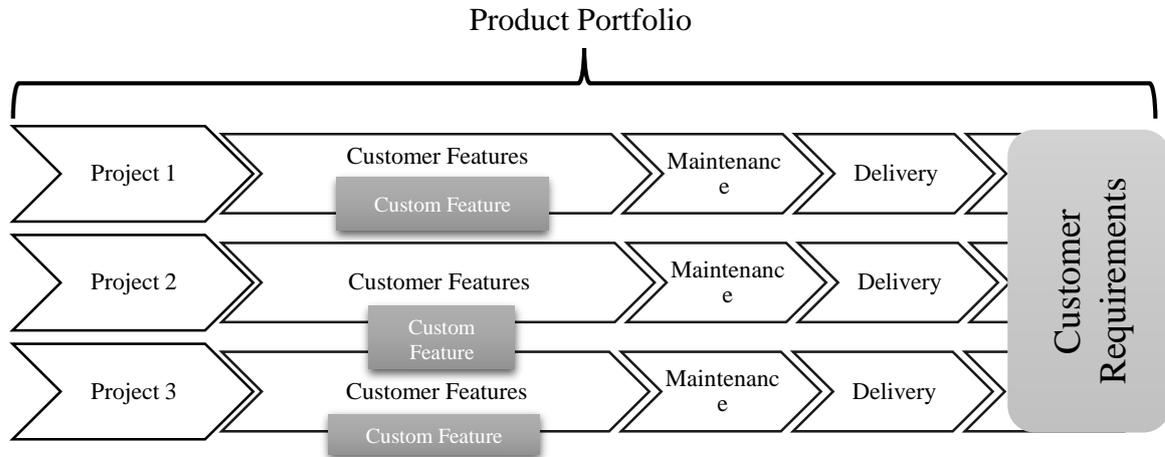


**Fig. 7 Stage 2 - Rstate across projects**

Restate beyond projects consists of projects which are executing variously and other projects features are reused across projects. It insists more on custom than standard features. When a company is starting to develop a new project for customers, stage 2 has been started. Standard features, functions, components from previous projects can be reused. One important advantages of using previous features and functions is that they have been tested and developed beforehand so the character and royalty of the software can be risen. The pattern of reusing previous features can form a set of standardized feature, even it can be considered as core functionalities. The important consideration in this stage is that when company is producing new codes, they should consider that the code should be conceived among the consideration of restate it. In a different way, it will be difficult to manage the code in the future and it will not have any advantages. As it can be seen in figure 7, projects should have custom features.

The next steps are similar to the stage 1 as maintenance, delivery and requirement engineering. Similar to the stage 1, at this stage, customers are main stakeholders. The innovative projects and research on latest technologies is not needed in this phase unless customers order it. The complexity of the portfolio increase when a project has been started on the base of the finished project. In order to gratify the customer the advancement path is based on construction.

### 3.1.2.3. Product Recognition



**Fig. 8 Stage 3 - Product Recognition**

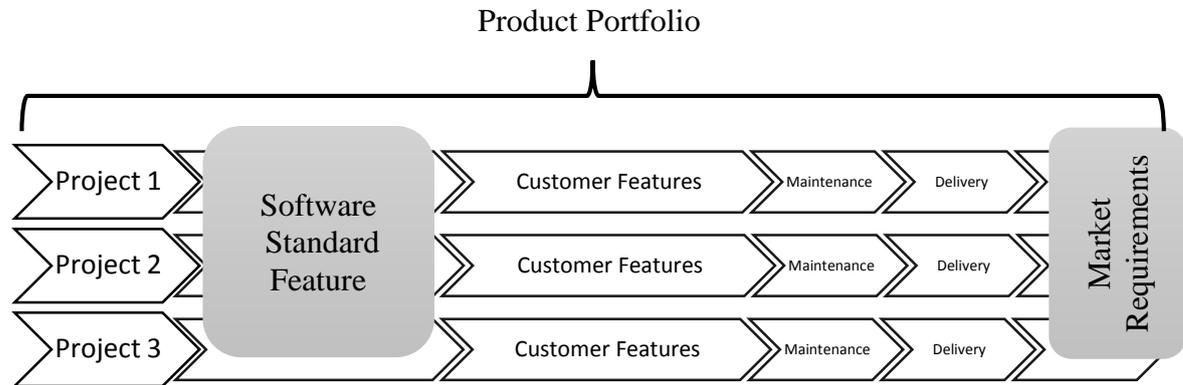
The main sections of projects are restating so a product breadth outlets to showing up from the core functionalities, so, factors among projects have been shared. In comparison to the stage 2, in this stage projects are more standardized and as it has been shown customer requirements are specific. Company in this stage is adept to diagnose the resemblance of clients which will be result of more unique concepts of a product. Evaluation to become market driven is important in this stage. Dorfman believes that SWOT method can be handled in this stage regarding to determining the weaknesses, opportunities, powers and menace of enhancing market driven (Dorfman, 1997).

Standardization is starting from this stage; this means when software starts to convert to standard software, phase three is the first step of constructing software. While this step has been taken, the major dividing lines of the product appear and based on these lines company could diagnose a specific product for a definite market. Requirement management should be bold in this stage because new requirements of customers can be stored and requirement management can be considered as a central place.

This management of requirement is necessary because of satisfaction of customers and the projects consist of standardization which is the main focus at this stage. Each project has its own customized part to satisfying customers. The united customized part is particular for each customer. Maintenance and delivery of the software is based on customer opinion. The important part of productization which should happen in this stage is the introducing Product

Manager (PMngr). In this stage, inside an association, member should be assigned to this situation. The PMngr is responsible for operational and critical decisions, if there will be any problem she/he is the first one to know. Not only for this stage, but also, for the next stages is PMngr important. In this stage no major changes happen with portfolio of project. Because of client-driven software development, company should amuse the customer by establishing their wishes. At this stage becoming market-oriented can be defined as an initial point. Stakeholder is changing while transforming into this stage. The customer involvements for developing a product is decreasing and involvements of domestic collaborators is expanding.

### 3.1.2.4. Product basis

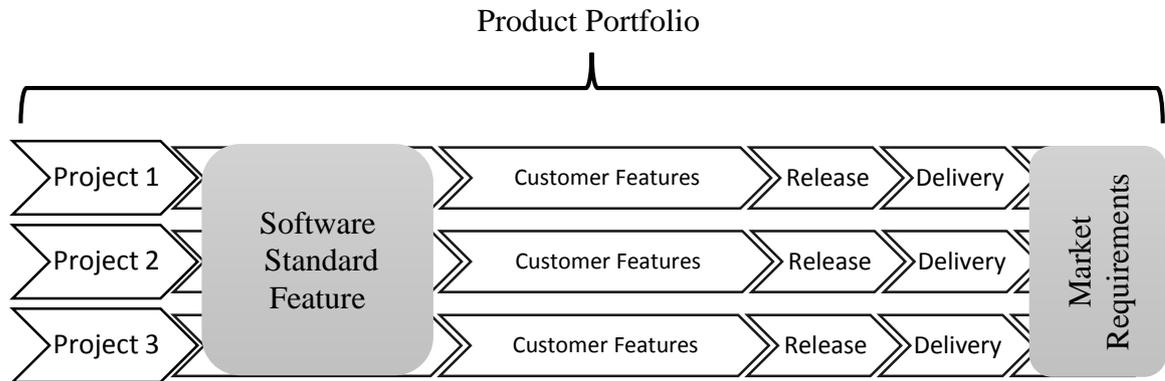


**Fig. 9 Stage 4 - Product basis**

This stage contains a set of elements which design a typical structure. From this feature the product can be regularly custom-made, developed and produced. To define a good future for software, companies should focus on future release of that so they will have bigger market share. Companies make road mapping as a function to generate long-term plan. Road map consists of the information as core assets for future development of the software. Themes and cores are used for product requirement which are situated on the market. In addition, themes give the clear direction to procedure.

The design should be done such that the customized parts of the project decrease during the forthcoming steps. In this stage, the target of gratifying the clients is reducing and marketing share has more importance. Instead of customer requirement gathering. The market concerns will be needed to actuate the software because as mentioned above, the made-to order part should be as small as viable. Customized features must decline because of start developing a standard product for all customer and even unified market and the conclusion of that can be customized for each customer separately. Product basis stage also can be classified as a universal product platform which is protracted by a broad customer specific row. As it is clear in the figure 9, the maintenance and delivery of product are still customer-based. Nevertheless, while deceiving which needs will be covered inside the platform, the PMngr should consider “over featuring” (Codenie, De Hondt, Steyaert, & Vercammen, 1997).

### 3.1.2.5. Standardization of Product Platform



**Fig. 10 Stage 5 -Standardizing product platform**

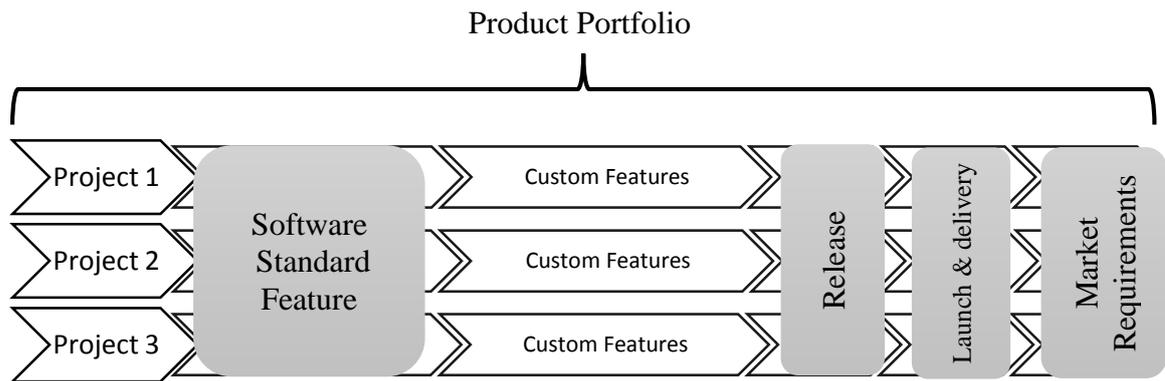
Standardization of product platform is incrementing the set of features that plan a routine structure and offering exonerations, from which a flood of evolve products capable of surely customized, developed and produced. This explanation is based on the interpretation from (Meyer & Seliger, 1998). The main target of this, is similar to previous stages which is customer-orientation. In this stage changing toward market direction and delivering the materialized product to be advertised has been started. It is clear that the company should create more standardized products that can be usable for more customers.

It is possible to develop specific requirements for each customer. The result of standardization product platform is standardized main product with additional event-base release. Customer features are still in this diagram since managing the customer fulfillments is important. Release process has been added to this stage, so the lifecycle of the product starts to upturn. For managing the lengthy lifecycle, main consideration of this stage is at the envelope management function. The most critical decision which should be made is: the organization should define that it wants to concentrate on trading standard product or auctioning the software product with customizable layer for specific customers. This decision which influences the next stage, so should appropriately be made in this stage. Delivery process is not scheduled, it is mainly ad-hoc and focused on events.

### 3.1.2.6. Customizable and Standardized Product

This stage compares differences and similarities of software product. There are two different sub-stages which should be considered. The first one is customization and another is standardization process. Customization sub-stage is mostly unified to the customers of present information system or framework (Hietala, Kontio, Jokinen, & Pyysiäinen, 2004). Standardization is due to serve the product to the market, structure is complete but it does not have any customization. The decision making for these two sub-stages should be taken earlier in previous stage as it has been mentioned. No major changes can be occurred in the portfolio management and product roadmap process; they should be modernized based on the changes which have been made.

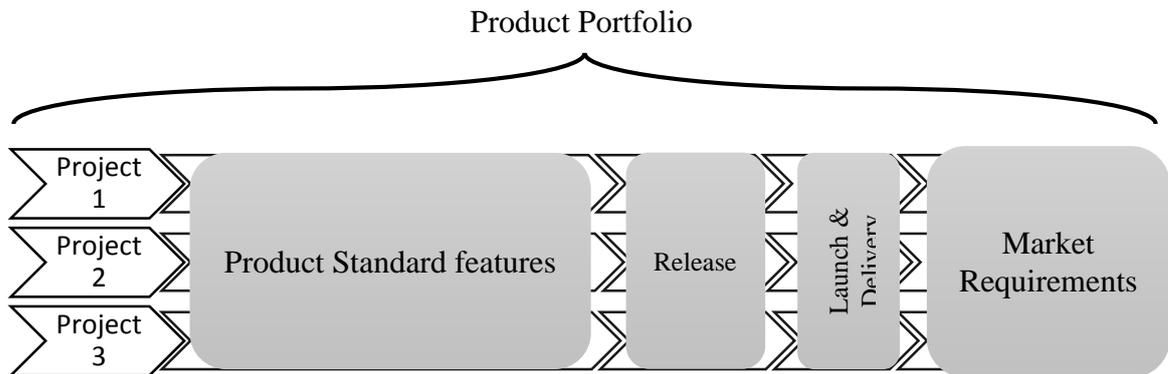
Since the center of this stage is the actions to deliver the product to the market, the process of identifying the market and its provision is important at this step. Customizable software product has been defined in the figure 11:



**Fig. 11 Stage 6a - Customizable Software Products**

It is a packaged Structure of a software-based service, with ancillary perceptible (Hietala et al., 2004). If there is specific situation to customize the software product, it can be categorized in this stage. However, this product type is too complicated to be sold. As it can be seen, it has custom feature, but this is a small customized layer. after ERP installation, 30% of total cost is allocated on the product authorization and 70% for providing professional service for product implementation (Hoch, 2000).

Standard software product defines universal product for all clients and is built for a unique market so the release would be structured. Software product is completely configurable and software business helps to sell the licenses.



**Fig. 12 Stage 6b- Standard software product**

Standard software product is a packaged structure of software basics, which is charged for and exchanged in a definite market. This explanation is based on the explanation for a software product (Hietala et al., 2004). A product for all clients and for a unique market would be developed. But this software is configurable and as it has been mentioned before software business aims at selling. We had five different stages and all of them focused on the customers, but this stage concentrates only on ordinary market.

Companies should bring the product to the market and concentrate on wishes of that market. The release process should be updated. The requirement management process should be adjusted from gathering information and requirements from unique customer to the whole market section. The software product is launched and delivered to market. All the customers of standard software product receive the exact product without any customized feature.

### **3.2. New Product Development (NPD)**

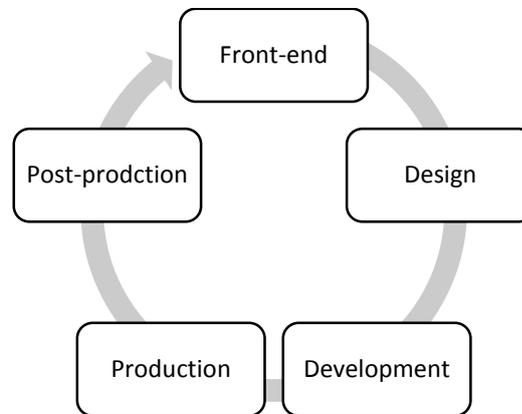
“A disciplined and defined set of tasks and steps that describe the normal means by which a company repetitively converts embryonic ideas into saleable products or services.” (Belliveau, Smit, & Bradshaw, 2006) NPD is the thorough process from the first step till the last step of delivering product to the market. This product can be tangible or intangible, provider company should have a good understanding of customer needs because the competitive environment impulse them to act in this way (Krishnan & Ulrich, 2001). While consolidation of customers need is admitted, time, cost and quality run these needs to the formative structure. Aspiration to those three elements, different companies accomplishing various practices to influence the process and satisfaction of clients with the new product (Kahn, Kay, Slotegraaf, & Uban, 2013).

Collection of models has been presented to get better intuition to the NPD and its management process. The process starts with a simple idea to build a product that fulfills specifications or innovative requirements based on the idea which has been defined by customers or manufacturers; it will end when the product is delivered to the market. It has many steps and these steps are different from model to model (Fallis, 2013).

The NPD process is totally different from market to market and from company to company. Undoubtedly, it has to be adapted to each company and industry regarding to meet and fulfill their needs and abilities (Booz, Allen, 1982). New product success still is the demanding challenge for businesses and companies that are mindful of the major rule of it in their future so they are frequently seeking for ways, to modernize, reconstruct and rebuild their NPD practice and process (Bhuiyan, 2011).

### 3.2.1. Process

NPD has five different phases of product life cycle which are:



**Fig. 13: NPD process cycle**

#### **Front-end:**

A classified business or technology inconsistency which is deal with the problems, is identified as an opportunity in front-end phase of NPD process. The idea about the new product should be defined as it can be early view of a solution for taking advantages of the convenience. Concept should have a well-defined form and definition in this section, the technology used should be understood besides understanding customer's benefits (Fallis, 2013).

The need for a new product opinion can be advances in technology, improving existing product for competitor actions or customer feedbacks and also management considerations. The desire for NPD can be internal or external. When there exist numerous of different ideas, there should be screening of those ideas to conclude which one can persist more. When an idea finalized for further search and analysis, product definition, project plan and project definition review can be done. The idea should be translated into technically and economically feasible one and aggressive product concept. Afterwards, the overall business goals for the NPD should be defined (what should the product do for the business). Over market research, customer requirements and preferences are determined. The concept should be generated with overall functions determination. Product platforms and modularization should be done at this stage. Project plan for time and resource allocation has to be executed

and then final analysis and evaluation of the product explanation and project roadmap need to be fulfilled (Fallis, 2013).

### **Design:**

The original achievements of this phase are distressed with arriving at excellent product architecture. The design phase associate many design activities in coordinate beside consideration of many product idiosyncratic. Design phase is varying constantly because decision-making for one product characteristics may have connotation for other characteristics. Design of a new product has three categories, design explanation activities, design assessments activities and design administration activities. Design definition contains product design details for increasing level of details and make it ready for production. Assessment activities help to find the best solution for advancement. Management aspect is involvement with administrating the design definition and activities calculation (Fallis, 2013).

### **Development:**

This step involves component and prototype of product for testing. It is primarily necessary when product associates with new technologies or when their applications are out of the range used previously. Tests handle engineering breadboards, service test models and rapid prototyping, they may envelop with environmental testing, reliability testing or pre-production test. After prototype preparation, a scope of test may be attended to certify the product achievement anticipation. This phase has two main goals. The customizable product, whose objective is to certify that the covet conduct that has been agreed as a part of contract between customer and company are met. If the anticipated performance drops below the covet performance, the development associates interpreting the reason of the dilemma and then arise a solution to fix it (Fallis, 2013).

**Production:**

At this lap the strategies which establish that product performance of products produced matches the prototype will be determined. The main strategies contain: process control being the process which can be either in control or out of control and forms the result of in control and out control we can refer to on line control. To ensure conformance or products, not only statistical process should be done but also several inspections and testing methods should be performed. For customizable products, the demands for accord may be so high. In such cases, the product should undergo a series of tests regarding the contract (Fallis, 2013).

**Post-production:**

The final step which can be considered as the most prominent one for standard products, involves the two sub-phases: marketing, product support. For the marketing; sale price, promotion, warranty, channel of distribution should be clarified. For the customizable products, product support should be considered. Price can be defined based on the two approaches: one is the price determined by the company to ensure the ambition profit and the next is the price based on the market demands and inventory consideration. Regarding the product, manufacturer can use different Media like television, radio, newspapers, and magazines to promote their product. If the product is expensive, product support can be a very effective promotional tool. Product support in this step is the most important action which can be taken. Customers who buy the product believe that they are buying an item more than only a physical stuff that should include maintenance, spare parts, training and upgrades and so on (Fallis, 2013).

### 3.3. New Service Development (NSD)

New service development (NSD) involves becoming aware of new service opportunities; new product development (NPD), business model design and marketing can be considered as subcategories of NSD. NSD has a similar process to NPD in which only compelling differences in the activities and research facilities exist (John & Storey, 1998). There are numerous reasons to use NSD and its following steps, these reasons are as follows:

- **Decrement:** Organization which provides services cannot extend to depend on their current range of services for their accomplishment. The existing services become outdated so their product life cycle decline. A modification is a way of life for the inventive service organizations.
- **Competition:** New services are required to maintain present sales success and customer allegiance as well as providing marketplace changes which is needed in competitive markets.
- **Extra capacity:** New service may be announced to use up extra space of the organization.
- **Seasonal effects:** Many organizations may have seasonal patterns of demands, so new service may be announced even in these oscillations.
- **Risk reduction:** NSD may be popularized to balance a current sales case where big dependency is placed on just a few services suggested within a scope.
- **Opportunities:** New conveniences would appearing through a challenger apart from market or market research.

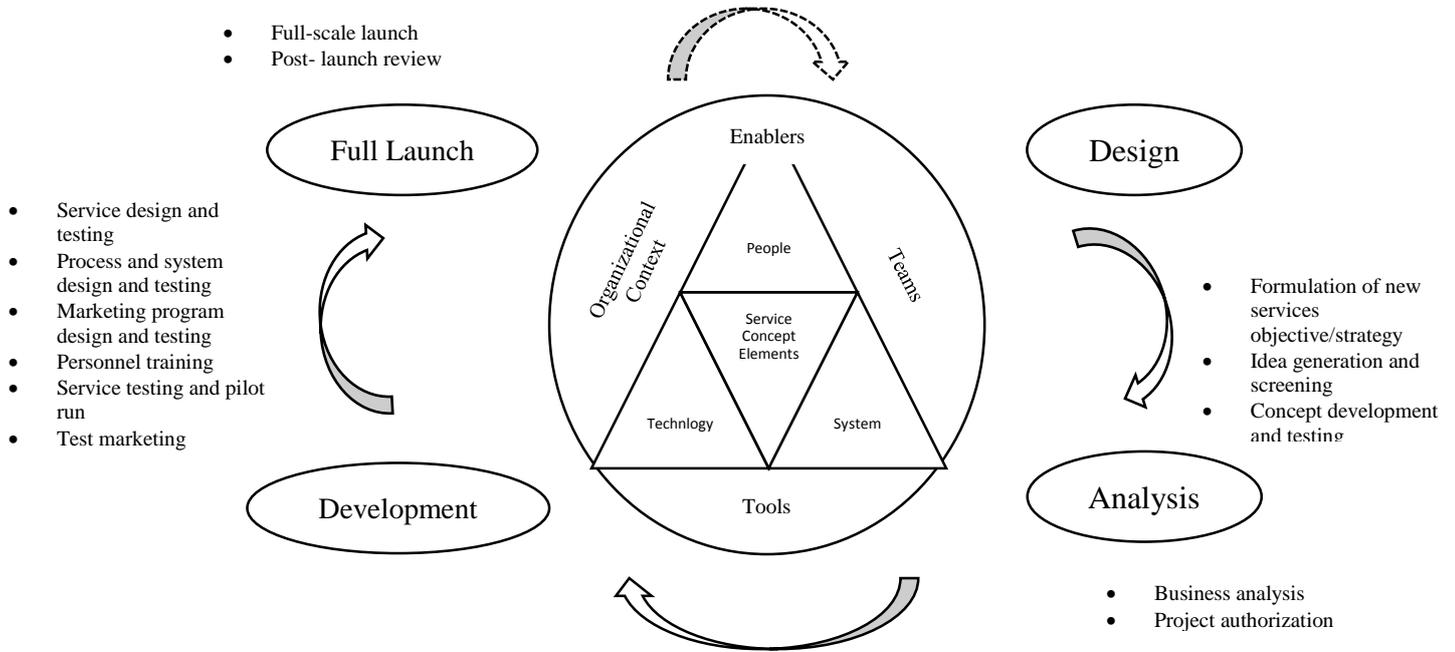
Whatever the reason to develop a new service is, there are mostly taken in two different ways. They may be gathered via global marketing or they may be developed internally, step by step of new service development. (Cowell, 1988)

### 3.2.1. NSD Process

The NSD process cycle demonstrates an advancement of planning, studying and running activities. (Menor, Tatikonda, & Sampson, 2002). The NSD process cycle presented in Fig 12 represents the NSD process. NSD process cycle illustrates the importance of “enablers” to make modernization of the service delivery system easier. The process is for most parts of NSD close to processes in the new product development (NPD).

The first two stages of the cycle, design and analysis, illustrate the *planning phase* of NSD when accords of market growth and capabilities are treated. Development and launch as the last two stages illustrate the *execution phase* of the NSD process cycle. In the execution phase, the service delivery system design, use of enablers, and cross-functional expansion efforts become critical NSD management issues (Roest, 2003). Expert’s skill in planning and execution phases of NSD process cycle is an symbol of NSD appropriateness (Menor & Roth, 2008). Each NSD project which needs to be successful requires an effective execution phase.

In the planning processes as it goes forward, it mostly focuses concentrates on production of new service, idea generation, screening, concept development and testing. In the analysis phase business analysis and project authorization happen. After analysis the whole idea and authorization, the new service will develop. During this phase, service design and its testing, process, system design and its testing, marketing programs design related testing, personnel training, the whole service testing, marketing test happens to ensure that final launch has been happened. When final launch phase which is within execution phase happens, then full-scale launch is ready and post-launch review will be accomplished. By finishing a new service another service based on the NSD process take place. The whole process involves customers, technology, systems and service concept elements. Enabler of the starting the whole cycle is people. People and systems can be considered as teams in this cycle. Systems and technologies are cycle’s tools and finally organizational context are people and technology.



**Fig. 14 The NSD process cycle, Johnson et al. (2000)**

### 3.2.2. IDEO (Innovation, Design Engineering Organization) Process

Conceptual models have been designed to facilitate the new service development process. The concept which has been presented by IDEO (a successful design and consulting firm), is one the most successful processes regarding the developing new services. Innovation is the decorative process of initiatives. In the developing of new service, it is important to be innovative because of competitors and also be more successful in the market. Here the IDEO process which is a widely admired, award-winning design has been presented. For instance, IDEO has brought the world the Apple mouse as an innovative product.

For developing and following IDEO process, a good team is needed. Team members can have these characteristics to be more innovative and successful in these processes. They should be technologists, entrepreneurs, cross-dressers (formal training different from what they do), troubleshooters and craftsmen. This process enables team members to identify opportunities for innovation and its function to develop unique innovative products and services. So the first step after understanding the life cycle is collecting members as an innovative team of the service. After that the IDEO process which is made up of 5 steps should be followed having been shown in the figure 15. (Moen, 2001)

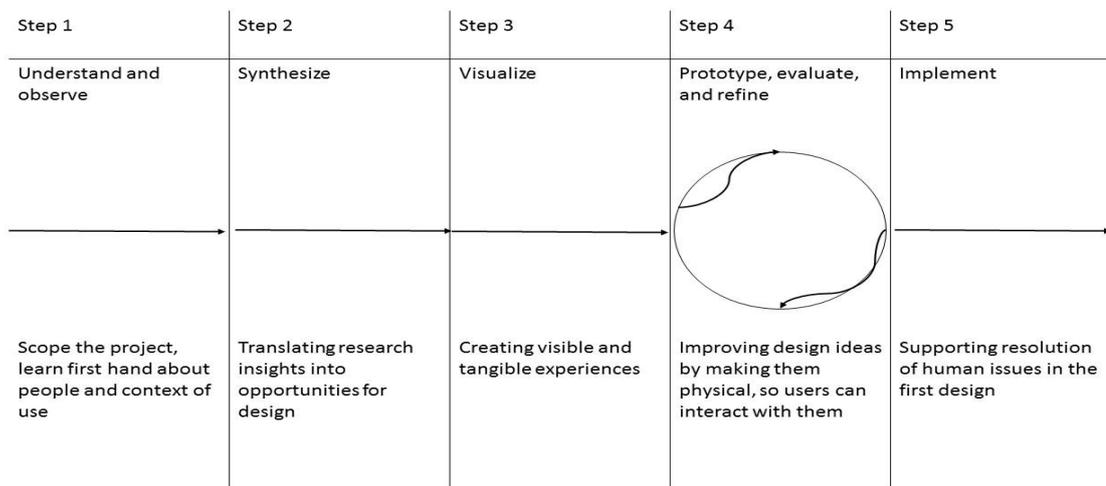


Fig. 15 The IDEO process (Moen, 2001)

**Step 1:** Team members in this stage should look and listen to people, clients, market and look what they are missing, what they like and dislike. Looking and hearing things with eyes and ears is the first and critical step in improving or inventing new tangible or intangible products. They should observe real people in real-life situation to find out what makes them offended. This issue must then be solved and the solution should be inspired to design and the way that experience broadcast to the outside world.

**Step 2:** The information which has been collected from the step 1 should be collected in the project room. All the information is the key tool for translation the information into opportunities to develop a new service.

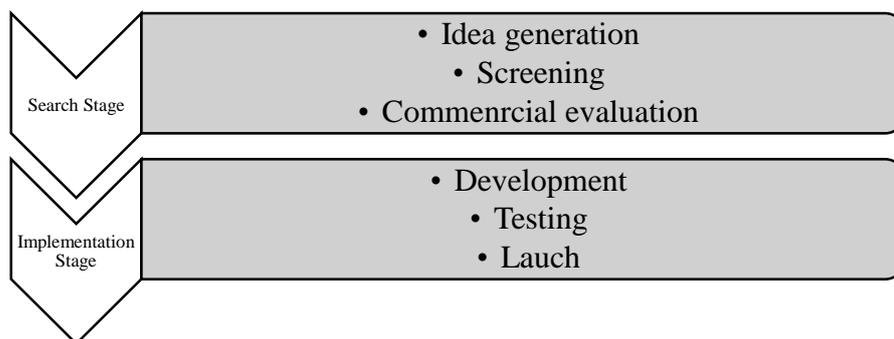
**Step 3:** Intensive idea generation based on everything which team has collected. The ideas should be written and brainstorming needs to be done. In this stage, sketching, mind mapping and diagrams should be drawn. Before going forward to the next stage, numerous ideas should be written and team members should consider that they should not take turns, instead, they should watch for chances to build.

**Step 4:** Prototype for shaping ideas should be made here since it is shorthand of innovation. The favorite ideas become real in this step in a rugged and ready way. These Ideas are immediately asserted in such forms that other people can see, touch and hear.

**Step 5:** All the skills should be synchronized to designer, engineer and developer's solutions to be compatible with production. Implementation is the longest and the most technically challenging phase (Bennett & Ideo, 2006) (Moen, 2001).

### 3.2.3. NSD Marketing Process

To reducing the risk of service/ product failure while developing and introducing new products, it has been found that systematic and authoritative direction can help. The procedure of NSD can be classified in two groups; the first group is formal which may carefully be arranged and another one is simple and informal procedure. The whole process from idea generation to pricing should be defined to be successful in the market place. The eight steps which will be declared below are to create as many good ideas as possible and then to reduce the number of ideas by analyzing and carefully selecting ideas which ensure that they have best chances of success into the market place. These steps are not necessary for all NSDs, it depends on the factors like the characteristics of the target market, time, resources and the degree of innovation being involved. NSD marketing process has been divided into two main phases: searching and performance, both covering several actions see figure 16.



**Fig. 16 NSD Development process (Bruins, Dolfsma, & Meijaard, 2003)**

### ***3.2.3.1.Idea Generation***

There are many ways to generate ideas. Ideas can arise from inside or outside the company/ organization. Ideas can be generated informally or formally like marketing research. They may assist the companies in creating the means of new service production or they may aid them in achieving rights to service products, like an authorization granted by government or company. The idea generation process contains detailed understanding of the idea. For idea generation, different techniques can be used like “Synectics” or “IDEO”. Generating new ideas is not a big issue for companies. Most of new ideas for the companies can come easily from inside of marketing functions. The environment requirement and customer demands can be easily declared since it has direct contact with customers constantly (Cowell, 1988).

Marketing and market research account for more than 40% of new service product ideas in service business. New service may be considered as a stressful reason in hard pressed operations staff. Outside of the business, like in advertising agencies, competitors and overseas markets for around 36% of ideas (Easingwood, 1986).

Many ideas come from holdings to traditional attitudes and values. They often concentrate on geographic development, “me too” ideas or upon minor modifications to the main service package. Most of new product ideas come from collaborating with different groups and using talented generation techniques. So encouragement to interact with customers, employees and others are recommended. Here are some of the techniques for creativity simulation:

- Attribute listing
- New contexts
- Mind Mapping
- Forced Relationships
- Morphological Analysis
- Reverse Assumption analysis

### ***3.2.3.2.Idea Screening***

In this stage, ideas should be controlled to find out which one perfectly meets time limitation, expenses and management engagement of more research and study. There are two aspects which usually are related to the screening stage. The first one is the usage of forming admitted evaluative criteria to enable the comparison between ideas which has been generated. For instance, ideas should be compatible with the company/ organization objectives. The second feature is rating the idea against the criteria used.

A simple checklist should be prepared in this phase to be collected and study on computing a group of data screening systems scope from the highly artificial ideas. It is essential to emphasize that no single set of criteria is applicable to all organizations. Thus, in this case, organizations should establish and accustom their own set of principle to their specific situations and status (Cowell, 1988). It should be considered these methods make difference between service parts and principally thorough procedures supposedly applied amid economic associations (Easingwood, 1986).

The main reason of this phase is to avoid drop-error and dismiss a good idea and continue with a poor idea. Idea is reviewed against a set of criteria in this stage.

### ***3.2.3.3. Development and Testing***

After idea screening, the ideas which has been survived, should be translated into service concept. So, concept development and testing as a service context should be applied here. Concept development is on fundamentals of converting the service idea into service concept. The unique subjective customer means that the organization tries to build the product idea, but it should be considered that service which has been defined should be functional and objective.

Concept testing in the service background is applicable as well as in goods background. Concept testing is a process to take the matured concepts after the stages of idea generation, idea screening and accessing feedbacks from groups of objective customers. Service positioning is the main action which might happen here. Locating is the visual presentation of the organizations image service relationship to aggressive service. It implements service characteristics in comparison with competitor's services and with the customer's conception of services relative to their needs. Some services are the best positioned against competition and other companies may intentionally develop effective strategies to make competition precisely and by serving oversighted market ledges. (Cowell, 1988)

Product concept means a mature version of the idea expressed in consumer terms. Presenting the product concept, symbolically or physically, to target consumers and getting their reactions is the concept testing responsibility.

#### ***3.2.3.4. Business Analysis***

The main concern of this stage is translating the proposed idea into business proposal. Detailed analysis of the idea and its chances to success and failure happen at this phase. This analysis would consider different aspects like the manpower required to new idea implementation, the additional physical resources required, cost, and profits over time, sale estimation, the new service contribution to the offered range, responsive to the competitors and reaction to the innovation. It has clarified that it is not possible to generate accurate forecasts and estimations. It has some degree of tolerance in search to allow wiping out related doubts and ambiguities. (Cowell, 1988)

This stage probably involves some initial technical and market research and also initial timing and costing for the new service launch. Therefore, estimation of total sales, costs and profits would happen at this level.

### ***3.2.3.5. Development***

Translation of the idea into an actual service for the market would take place at this stage. Increasing the investment in the project mostly happens at this stage. Staff recruited or trained, facilities construction, communications systems should be established at this stage. The tangible elements of the service should be designed and tested at this phase. Development stage of the new service involves attention to both tangible elements of the service and the service delivery system. Developers should consider that testing of the new service may not always be possible. Some systems has this opportunity to make a new service available initially on the regional base but some new services do not have such an opportunity so they must be available and operate to designed levels of quality and performance from their introduction level (Cowell, 1988).

“The American Express Bank, after the conduct of detailed prior research which indicated that opening a London branch would be successful, had ultimately to take the plunge and go ahead by establishing a branch with a range of services” (Jagongo & Mutswenje, 2014). Empirical evidence does offer that test marketing between service organizations is restrained (Easingwood, 1986). The goal is to run new service accurately rather than to arrange for national launch. Until this stage, the product existed in forms of a word and finally at this stage it steps into life. Quality Function Deployment (QFD) can be used which is a set of methods that helps to translate target customer requirements to working prototypes.

### ***3.2.3.6.Commercialization***

Organization's commitment to a full-scale launch of the new service would be represented. The scale of operation might be modest or large scale involving the national launch of fast services. In initiating the launch, some basic agreements are as follows:

When to announce the new service? Where to eject the new service (Locally, regionally, nationally or globally)? To whom launch the new service? How to launch the new service? Organizations may be guided by the wide range of literature and experience on innovation and publications with highly novel and innovative services. Although, in many areas of marketing, most documented experiences have focused upon tangible rather than intangibles.

There is absolutely finite information on proceeding companies which is used to determine the advantages of a new service after launch. There are two difficulties stem from service cost measurement where service distribution systems are communal and the other one is from the cannibalization (In marketing strategy, refers to a reduction in sales volume, revenue, or market share of one product as a result of the introduction of a new product by the same producer) of the company's other services due to the introduction of the new service (Cowell, 1988).

The last step of NSD process is a cycle of introducing the new service/ product to the market. In commercialization of NPD, internal and external launch preparation required while in NSD, admirable internal marketing needed to manage ardor for the new service (Shekar, 2007).

### **3.2.4. NSD Management**

Companies which want to grow and prosper must take an organized approach to manage NSD process and insist on innovation and developing new services. New service development can be based on four different situations for managers: Team-based, Customer-based, Systematic-based and Time limited development.

- **Team-based**

To be successful in developing new product in companies, working closely as a group helps to save time and increasing effectiveness of the development. In this case, the whole department works closely together in cross-functional teams. Departments of the company can be divided to legal, marketing, finance, design, manufacturing and customer companies. In team-based management if there is a problem, all the company should contribute to solve it.

- **Customer-based**

In this kind of NSD Management, company should mostly focus on finding a new way to solve customer problems. Making customers satisfied is an important consideration here. Most of the companies wrongly focus on technology in NSD process which is completely wrong direction, the real success is based on understanding customer values and their needs. In customer-based management, company solves the major customer problems. It directly engaged to customer.

- **Systematic-based**

The NSD should be systematic otherwise it will fail. Innovation is the main considerable topic in systematic-based management. The company appoints a person who is innovative and can encourage the company, employees, suppliers, distributors and dealers to become involved in finding and developing new products. After innovative ideas, cross-functional innovation management committee, evaluate new product ideas and help to bring it to

executable ideas. Systematic-based management brings new ways to create valuable new ideas for the customers.

- **Time limited development**

In the tough economic situation, usually good management reduces spending on new-product development. If there is restricted time for NSD, innovation can help to manage development. In such situation, making the company more competitive is a suitable idea. Positioning of NSD should be considered since it is beneficial to the future and offers customers products they need (Armstrong & Kotler, 2013).

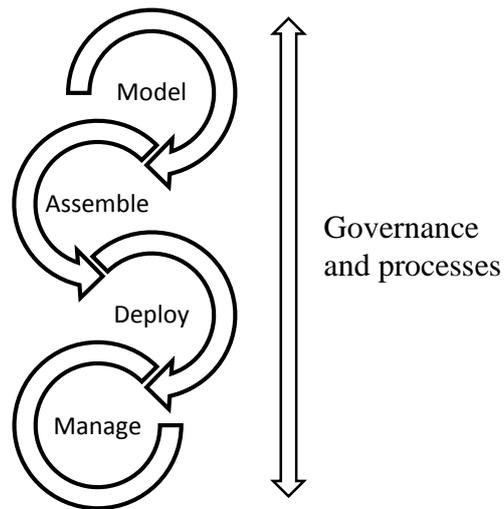
### **3.3. States of art on SOA technology and approaches**

Service oriented architecture (SOA) is a business-centric IT architectural approach which supports businesses as a linked, repeatable business tasks or services. This is not obligatory for SOA but web services provide a standardized and cost-effective implementation of such services. When a company wants to implement a service (internally or externally), it should completely understood by the IT department and the whole business (Gimnich & Winter, 2007).

“SOA is about describing, building, using and managing IT environment, at the same time concentrating upon the services it supplies, rather than upon the technology it employs.” When SOA is adopted by enterprises, they describe their IT investments in modular services, each delivering specific value. When SOA is well-architected, governed and managed, it activates enterprises to expeditiously create, merge and deploy services so as to react to rapidly changing business needs (Gimnich & Winter, 2007).

The lifecycle of SOA consists of the following items:

- **Model:** It gathers and analyzes business requirements, it also, designs, simulates and optimizes the business process.
- **Assemble:** It assembles new and existing services to the form of business processes.
- **Deploy:** it is clear from its name, it deploys the business process.
- **Manage:** Administering and monitoring business processes from IT and business aspects.
- **Governance and processes:** It feeds information collected while the manage phase backs into the life cycle to enable regular advancement of the process.



**Fig. 17 SOA program process**

Service oriented architecture is achieved in an evolutionary way; it means evaluating and migration the existing business area into an SOA in a series of distinct stages. Each stage can run its own advantages, such as higher reuse, faster time to market, maintenance efforts, etc. (Gimnich & Winter, 2007)

Developers consider that they can turn current components to web services by forming, sheeting and leaving the elementary component unaffected. Because component methodologies focus on the interfaces, many developers assume that these methodologies apply equally well to SOA. Software industry implements widely a thin SOA coating on the top of current applications or components that develop the web services, but this is not sufficient for commercial-strength enterprise applications. Nevertheless, the component's nature makes it suitable to be used as a web service and mostly do not properly deliver component's functionality through a web service taking serious redesign achievement (Mike, n.d.).

Software development methods which are not new for object oriented and component-based development (Bachmann et al., 2000) (Corp, Herzum, & Sims, n.d.) cannot be applied to SOA and web services without noticing that they do not address SOA's key elements which are services, information flows, and components realizing service (Arsanjani, 2004). The mentioned methodologies can only satisfy some of the requirements of Standard Occupational Classification (SOC) applications and fail when they attempt to develop

service oriented solutions separately (Papazoglou, Traverso, Dustdar, & Leymann, 2007).

### **3.3.1. SOA Layers**

It is necessary to understand different layers of SOA when developing a system with SOA. These layers would be presented in a greater detail and composition of each layer would be discussed.

**Layer 1- Operational systems layer:** This subsists of the current custom-built applications, differently called legacy systems covering existing Customer Relationship Management (CRM) and Enterprise Resource Planning (ERP) packaged applications and older object-oriented system implementations, likewise business intelligence applications. The composite layered architecture of an SOA can bargain chip of existing systems and accommodate them using service-oriented integration techniques.

**Layer 2- Enterprise components layer:** It is responsible for understanding functionality and maintaining the Quality of Service (QoS) of the proven services. These certain components are a handled and governed set of enterprise assets that are invested at the enterprise or the business unit level. As the enterprise-scale assets, they are culpable for ensuring conformance to Service Level Agreement (SLA) among the best practices of architectural application. This layer commonly uses container-based technologies like application servers to develop the components, workload management, high-availability, and load balancing.

**Layer 3- Services layer:** Services that the business chooses to fund, impart and indwell in this layer. They can be found statically limited and then invoke, or possibly, compose the sequence of steps and move into a composite service. This service offering layer also provides the structure to take enterprise scale components, business unit definite components, and in some cases, project-specific components, and gives external existence to a subset of their interfaces in the form of service explanations. Therefore, the enterprise components administer service awareness at runtime using the functionality provided by their interfaces. The interfaces get published out as service explanation in this layer, where they are disclosed to use. They can exist in detachment or as a composite service.

**Level 4- Business process composition (choreography) layer:** Services are categorized into a flood through composition, and so act with each other like a single application. These applications backing definite use cases and business processes. Visual flow composition tools, such as Business Integration Modeler or WebSphere Application Developer Integration Edition, can be used for the design of application flow.

**Layer 5- Access or presentation layer:** However this layer is commonly out of range for consulting the SOA; it is constantly becoming more related. It has been mentioned here because there is an expanding concurrence of standards, like Web Services for Remote Port lets Version 2.0 and other technologies which seek to leverage Web services at the application interface or presentation level. SOA separates the user interfaces from the components, and that basically demanded to provide an end-to-end solution from an approach channel to a service or composition of services.

**Level 6- Integration (ESB):** This layer implement the integration of services over the introduction of a decisive set of efficiency such as intelligent routing, protocol mediation, and other transformation mechanisms. Web Services Description Language (WSDL) defines a binding, which implies a location where the service is provided.

**Level 7- QoS:** It arranges the capabilities needed to monitor, manage, and maintain QoS such as security, performance, and availability. This is a background process through react mechanisms tools that monitor the health of SOA applications, inclusive of the all-important standards implementations of Web Service Management (WS-Management) and other admissible protocols and standards that implement quality of service for an SOA (Arsanjani, 2004).

### **3.3.2. Patterns for migrating to SOA**

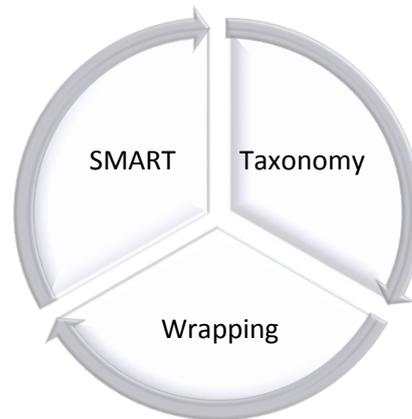
Over the course for time, more systems become outdated. New technologies are introduced and the old systems do not fulfill the purposes or desire outcomes, not only because of technical challenges, but also maintenance became costly and complicated. These issues may force companies/organizations to change their old systems. The first way is to replace the existing system with a new one. However, the approach seems to be precise but there is one significant issue in the way which is cost. Replacing the old system is very costly from the time perspective and money which is required to create a new system almost from the draft (Lucia, Lucca, Fasolino, Guerra, & Petruzzelli, 1997). Migration of large projects is a serious and risky task that requires precise analysis of possibility and required efforts (Lewis, Morris, & Smith, 2006). An example of seriousness of migration is provided by Scott Bolling (Bolling & Xiao, 1998). He participated in migration of a system. The migration had 25 unsuccessful migration attempts. The second approach is to migrate from old systems to new systems that use the newest software development paradigms and follow the recent technologies.

Successful migrations toward SOA have been achieved in many areas such as banking, electronic payment applications and development tools. In spite of all successful migrations, an organization which decides to migrate towards SOA has to be conscious that migration to SOA is not the final solution to all problems with old systems. Migration to SOA needs an additional time that is needed to understand this concept. Misunderstanding raises misconceptions which can be costly. Choice of SOA illustrates both technical and design challenges, because not every system can be presented as a set of reusable services or the cost of such adaptation disqualifies SOA as a solution.

There are different types of migration to SOA as can be seen in figure 18. In this research three of the methodologies will be presented:

- Taxonomy Analysis (which analyzes existing code)
- Wrapping Analysis (which is suggested to treat legacy systems as a black box and wrap its code into services)

- Service Migration and Reuse Technique (SMART) (which is rather a family of five approaches)



**Fig. 18 SOA migration methodologies**

### ***3.3.2.1. Taxonomy Analysis***

Taxonomy Analysis is a method that uses an existing code and documentation as an input. Analysis of the documentation, sets edges of the system and identifies services. The services are described on business level. Analysis of the available code provides a tree diagram. This diagram in form of a tree presents the most often-used terms and relations between them. This approach is semi-automatic because of a person who decides. For example, an architect has to set cutting points that divide the tree into sub-trees. Those sub-trees are further implemented as services (Zhang & Yang, 2004).

### ***3.3.2.2. Wrapping***

Wrapping is another technique of migration to SOA which is similar to migration towards Object-based environment. The migrated system is wrapped into a set of services that cover all the use cases covered by the actual system. The wrapping technique conducts a three step migration which are listed below. (Canfora, Fasolino, Frattolillo, & Tramontana, 2008)

1. Identify use cases and candidate services that cover those use cases. The description of this step does not provide own way of identification of services, instead it refers to

works of Sneed (Sneed, 2006) or SMART (Lewis et al., 2006) (Papazoglou et al., 2007).

2. The identified services are wrapped into services during the second step.
3. Finally, deployment and validation. This step establishes infrastructure and deploys already created services. The services are further tested in order to assure that the migrated system fulfills the requirements.

### **3.3.2.3.SMART**

SMART is a family of five approaches of migration towards SOA (Papazoglou et al., 2007).

- The basic SMART approach is SMART-Migration Pilot (SMART-MP). It identifies services and their components. This technique estimates potential risks and tries to provide a migration pilot with strategies for migration of the whole systems.
- SMART Service Migration Feasibility (SMART-SMF) focuses mainly on possibility of migration and its risks.
- SMART Enterprise Service Portfolio (SMART-ESP) dedicated for companies that decided to migrate their system but they did not identify all the services.
- SMART Environment (SMART-ENV) defined for companies that did not select the target platform for migrated system. This approach aims at selecting of this platform with analysis of its implications like risks and cost.
- The last family member is SMART System. This technique supports migration from initial estimations and analysis, through implementation and selection of environment till the end of migration.

The SMART family provides guidelines for migration, but the guidelines are not complete (Aboulsamh, 2009).

Each methodology has its own advantages and difficulties. Here is the table of comparison between these methodologies provided in the table 1.

**Table 1 Advantages and disadvantages of SOA migration patterns** (Kaliniak, 2012)

Method	Advantages	Drawbacks
Taxonomy	<ul style="list-style-type: none"> <li>- Identifies relations between services.</li> <li>- The technique is systematic</li> <li>- Execution of the technique can be performed semi-automatic</li> <li>- Provides a lot of information about the migrated system</li> </ul>	<ul style="list-style-type: none"> <li>- The technique does not consider architectural patterns that are applied in architecture of migrated systems</li> <li>- Requires documentation - this causes problems because documentation of an old system may be missing or not maintained</li> </ul>
Wrapping	<ul style="list-style-type: none"> <li>- The technique is systematic</li> <li>- Execution of the technique is semi-automatic</li> </ul>	<ul style="list-style-type: none"> <li>- The technique does not consider architectural patterns that are applied in architecture of migrated systems</li> <li>- A full list of use cases is needed. The use cases are described in documentation that may be missing or not maintained</li> <li>- The technique bases on inputs and outputs of the system. It is hard to define all possible combinations of input-output pairs.</li> </ul>
SMART	<ul style="list-style-type: none"> <li>- The technique is systematic</li> <li>- The technique produces many artifacts that help in understanding the migrated system</li> <li>- SMART has a few variants that are tailored to different needs</li> </ul>	<ul style="list-style-type: none"> <li>- The technique does not consider architectural patterns that are applied in architecture of migrated systems</li> <li>- Application of the technique requires a lot of time</li> </ul>

### 3. KEY FINDINGS AND RECOMMENDATIONS

New Service Development (NSD) is the development of services which can be product which are new for supplier. NSD revolves development of offers in different fields, health care; telecommunication services, information services, travel services; educational services. Offers of NSD can be sold either to customers directly or to a business or even both (John & Storey, 1998). It has been become a significance competitive concern in the industries with services. NSD has lots of benefits including enhancement the profitability of existing offering, motivating new customers to the company, improvement of loyalty of existing customers and opening markets of opportunity (Storey & Easingwood, 1999). Enhancing the profitability of existing service with the support of servitization has been explained in this paper. The process and concept of NSD have not been understood and concentrated in recent years. Even there is not a defined and complete NSD process while New Product Development (NPD) recently is the core of concentrations. Manufacturing companies which are developing services should consider that they must perform activities related to not only services innovations but also products (Gremyr, Witell, Löfberg, Edvardsson, & Fundin, 2014), since NSD covers NPD too.

As it has been mentioned before there is not a significant process for NSD, but after reviewing the existing documents, it has been derived six key steps in NSD marketing are exists, which are:

- 1) **Idea generation:** Recognition of the needs of business and giving innovative ideas offering with detailed understanding of the idea, the idea can come from inside or outside of the company.
- 2) **Idea screening:** Ideas should be checked out and select the one which is perfectly fits the time, expenses and management. A simple checklist should be prepared in this stage.
- 3) **Development and testing:** The survived idea from the previous stage should be translated into the service concepts which can be used in the service development.
- 4) **Business analysis:** Translating the proposed idea into business proposal is the main concern in this stage. Since it involves to business it should contain initial technical, market research, initial timing and costing.

- 5) **Development:** The idea becomes totally translated to the actual service for the market. Investment of the project would happen in this stage. In addition, tangible elements of the service should be designed and tested.
- 6) **Commercialization:** Organization's commitment to a full-scale launch of the new service will represent in this stage. The time of new service introduction should be defined here and also where and to whom launch the new service would be defined in this stage as a final stage (Bruins et al., 2003).



**Fig. 19 NSD Process**

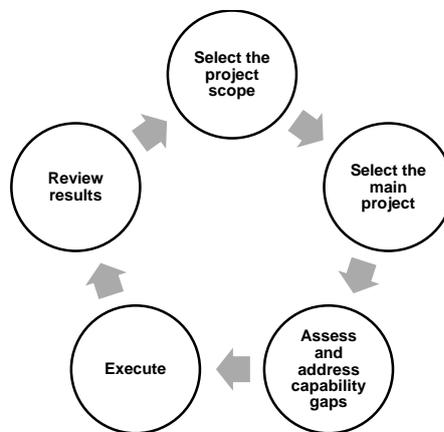
Service Oriented Architecture (SOA) is an approach which has been used to create architecture of a system based on the use of services. The services perform some small functions like producing data, customer validation and so on. SOA has the power to force these services again and again. Therefore, SOA is really about fixing existing architecture by dressing most of the major systems as service and express those services into a single domain where they are formed into solutions. SOA architecture allows reusing services if it is necessary and also making it useless to start from the zero. This is one of the advantages of SOA which saves money and time for the businesses (SearchSOA, n.d.). SOA is an architectural paradigm and discipline that may be used to build infrastructures which enables customer needs and provider capabilities to interact with services (Duane Nickul, Laurel Reitman, James Ward, 2007).

SOA gives this opportunity to the companies to be prepared for the future. Business processes which has been derived from business services can be managed easily for time satisfaction. SOA provides flexibility and responsibility for firms which is necessary for business success. Migration to SOA from the existing service is not simple, so it is better option instead of migrating the all service at the same time to SOA, migration happens for sub-systems which is necessary to have it. Some of advantages of developing a system with SOA are: Leverage existing assets, Infrastructure a commodity, faster time to market,

reduced cost, risk mitigation, continuous business process improvement, process centric architecture and etc. (Channabasavaiah, Holley, & Tuggle, 2004)

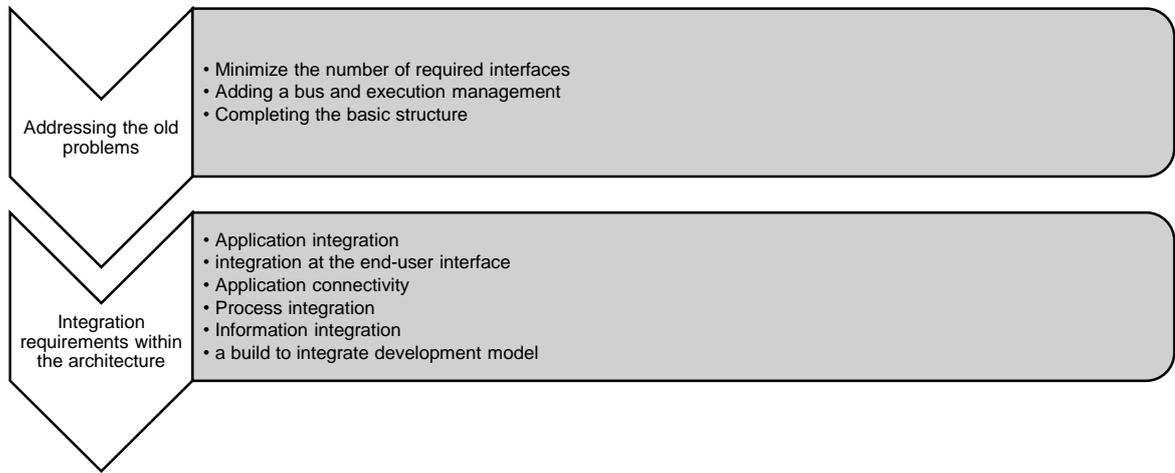
SOA migration can happen in different situations, but the most serious situations which shows that migration can rescue the business are firstly, complexity of the existing system, secondly, redundant and non-reusable programming, and the last situation which needs to be revise is multiplicity of interfaces (Channabasavaiah, K. Tuggle, E. & Holley, 2003). SOA adoption process helps in developing a path toward a successful migration to SOA. IBM has been defined the process steps as (Credle et al., 2007):

- 1) Select the project scope
- 2) Select the main project
- 3) Assess and address capability gaps
- 4) Execute
- 5) Review results



**Fig. 20 SOA migration process (Credle et al., 2007)**

The main process for SOA migration in this guideline has been shown in figure 21.



**Fig. 21 SOA migration process in two main categories**

SOA is the important wave of application development. As it has been mentioned SOA is about designing and building systems using heterogeneous network addressable software components. SOA is an architectural service which contains special properties, comprised of components (Channabasavaiah et al., 2004).

## SERVITIZATION

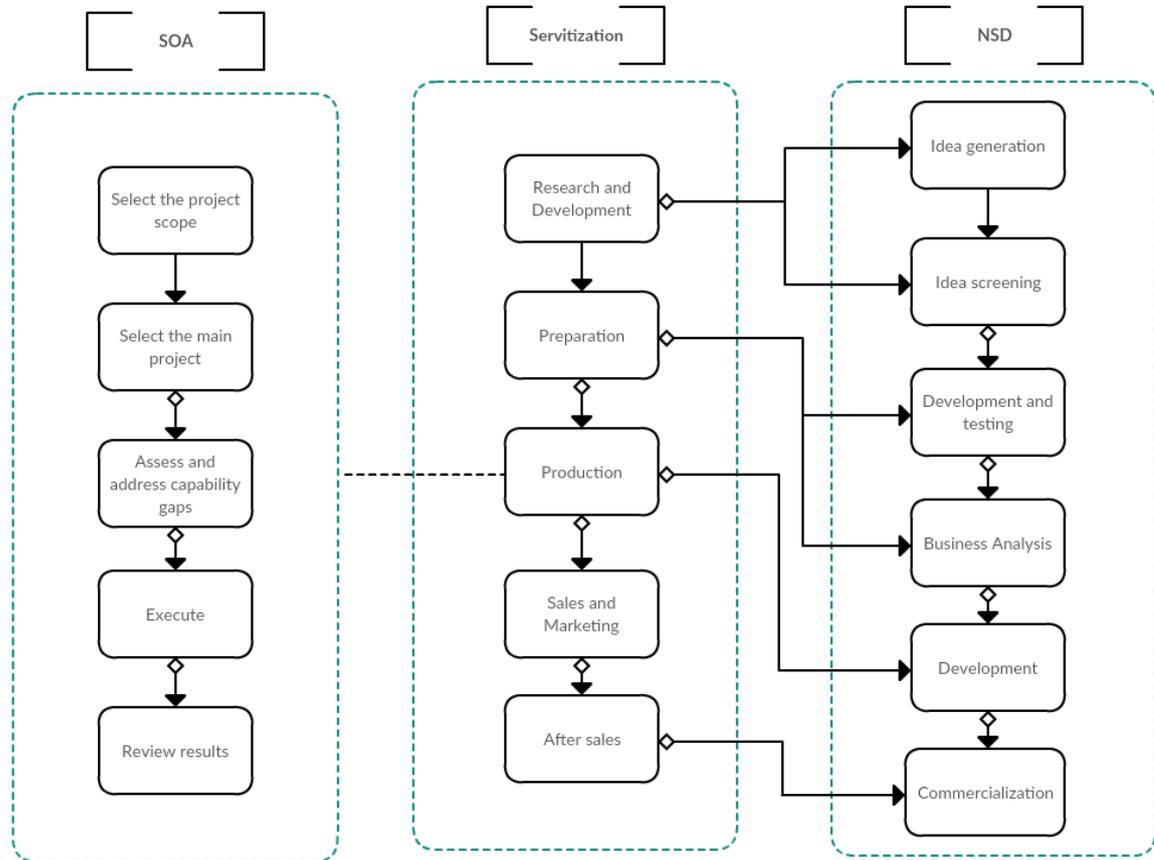
In developed economies and firms, servitization is one of the most key strategies. Industries with high technology are under pressure and they face difficulties to achieve profit only from selling products, so they have to moving up value chain of the business and being innovative, so they create more sophisticated products and services. In such a situation, many of big companies have started to sustain themselves by transferring their market share from manufacturing to more service systems. The mentioned value chain concept has been introduced firstly in 1980s (Ahamed, Inohara, & Kamoshida, 2013), which nowadays recognized as a structured process which rescue a failed system by adding values to it.

The servitization process needs numerous of organization changes, processes should be renewed and strategies should transfer from product development to a service-focused. The process of the servitization can be defined in five different stages (Ahamed et al., 2013):

1. Research and development to determine customer needs: It would explain what new values this service would bring to the customers.
2. Preparation: Make a service blueprint for supply chain into value chain extension.
3. Production: Companies should improve its resources in the aspect of capabilities and employee skills to create high quality services for its customers. In this phase more concentration is in staffs and processes to increase capability of the company. The company which is going to be servitized should be full of talented people who have unique expertise. In service providing the significant concentration is not product, it is not important how to sell the product, selling capability and innovation would happen in servitization.
4. Sales and Marketing: A strong market place is needed in this stage of servitization. A simple and complete pricing system should be defined and managed.
5. After sales: A consistent look for tangible services element should be done and also staff training to fulfil the customer proposition should be done at this stage. In this stage a full package for after selling should be provided which includes technical supporting, training management, self-help solutions, customer supporting for consultancy, etc.

As it has been mentioned servitization is “the process of innovation of an organization’s capabilities and processes to shift from selling products to selling integrated products and services that deliver value in use” (Lightfoot, Baines, & Smart, 2013). As we know servitization should be apply to the organizations which have been failed or faced problems and needs to shift from only selling products to selling integrated products and services for delivering value in use, so it should have innovation while developing and changing processes because it is necessary in nowadays markets and among competitors. I have used NSD and SOA migration rules while servitized a system. Combination of NSD and servitization gives power to renovate the whole system structurally. Applying NSD while servitization a system brings enhancement to the system and motivate new customers, in addition, it would be the cause of improvement of loyalty. While we are servitizing a system we can follow its steps with consideration of NSD and SOA rules, so the result will be more

structured and reliable since SOA and NSD have been injected to the servitization process (Figure 22).



**Fig. 22 Servitized SOA migration and NSD**

The first step of servitizing a system is research and development to customer need determination. Of course, the system faced a problem and then servitization started to rescue it, so it should be defined that what is customer's problems and what they need. While this step is doing by experts as a research, the first and second steps of the NSD which are idea generation and idea screening can be done, because innovative ideas for solving customers problems is the highlighted aspect of servitization.

The group of staff who are doing research and development should be innovating and talented to bring new ideas and have successful mind storms for analysing the whole system. The special techniques can be used for this stage, for instance, attribute listing, new contexts, mind mapping, morphological analysis and so on. After research and idea generation, ideas should be checked out and the best idea for development will be selected. Second step which

is preparation is related to supply chain into value chain and at the same time with the consideration of development and testing of NSD, the survived ideas should be translated into service concepts, so development (final preparation) and testing of the service should be done at this stage. Preparation contains analysis of the system too which proposed idea become completely into business proposal. Detailed analysis and success and failure chances would define. Since it is preparation step so initial market research, time and cost, are important to completely clarify.

In the production step, business analysis from NSD process and SOA migration process should be applied, so this is very highlighted and important step. Development consists of staff recruited (if necessary); facilitate construction, communication system and everything which is related to full developing the system and finalizing the system to transfer to the market. While managers are doing production step, they should consider SOA migration process for automate parts of the service process. SOA migration starts with defining the project scope that fits the SOA. So the scope should be defined carefully to avoid any future failures. Select the project has been done already in preparation phase of servitization, so we know where the problem is, the SOA life cycle for modelling, assembling, deploying, managing and governance should be done in execute part and the result will be the final solution using one migrating patterns like SMART, Taxonomy and Wrapping (Bollig & Xiao, 1998).

For sales and marketing of servitization part, commercialization of NSD can make it more formal and structured since organizations commitments to a full-scale launch of the new service would present in this stage. It is cycle of introducing the new service to the market. So the problem of servitized system has been solved and it will become into the market more powerful because of NSD and SOA injection patterns.

The final step of servitization is after sales, so the problem has been solved and the needs of the customers has been defined and developed and transferred to the market now maintenance is the most important part (Bruins et al., 2003).

## 4. CONCLUSIONS

Professional services companies which are among the first in their industry and productizing their services have a distinct competitive advantage over their competition. Firms who follow can still close the gap by productizing their own services, especially by offering innovative service products that differentiate them from the early productizes. As services are difficult to evaluate, productization of services is easy so it helps to productizing services. In productization the products have the pre-defined prices so clients can easily make buying decisions. Productization of services makes it profitable in the aspect of delivery of productized services are stable. It has been proved that it is easier to train personnel in productized service delivery so it is more reliable. The process of productizing has been declared step by step so companies by following these steps can successfully finish productizing their services.

New service development has a comparable development to product development, but there are compelling characteristics in the enterprises and the research capabilities. New service development interests all the activities associated in actualizing new service convenience. Service development is particularly considered as growing an enterprise among a number of marketing solutions. The two main questions decisive to this access are: How do we find, reach, and approach customers? How do we conduct these customers convinced with new desirable services? Ingenious technology administers necessary opportunities for new service development (Johne & Storey, 1998). Companies can follow the NSD process, marketing and management (which have been declared in this research) to be successful in marketing competition. IDEO is a technique to be innovative in NSD process and recruit innovative minded people to catch new opportunities to develop.

What would happen if the company already has been started the development of the new product and they failed? The clear answer of this question is using SOA migration patterns to rescue themselves from failing. When companies productizing their services or NSD actually they are following the SOA process as standardization of product platform (The fifth step of productization process), so we can call SOA and SOA migrating patterns as a redeem approach for some organizations.

## **5. SUMMARY**

The contribution of the thesis is the list of new service production, new service development and also how it is applicable with SOA migration patterns. The target NSD and productization and the migrated architecture are based on architectural pattern. Additionally, in the productization process as a standardization which is related to service oriented architecture the guideline is outlined. Target was to find out new ways of service thinking and ways for changing business environment, especially in customer satisfaction and profitability aspect. The case study is following the new service development process phases from the productization view.

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