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Analysis of PSS Design Development Models in Turkey

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Abstract. The article aim is observing and framing I-am associates' process model as an example of in the context of Turkey while comparing it with the existing models. Product Service System (PSS) design is a new field in Turkey and best example to observe PSS development in there is I-am Associates because it is a local company, created and developed in here and when we looked their existing work so far. Because of this article specifically focused on PSS design development models, first ones that come up in the literature should have been analysed. For better understanding how companies developed their ideas, work, as a flexible method semi-structured interview has been made with the selected company. Questions was generalised for not to frame their answers. Two founder of the company briefly explained how their process works and in which phases they are going deeper. The research identified that the PSS design process reported by literature is not representative, lacking on some sub-phases. Seven models had been analysed and seven common phases identified with 18 total sub-phases for creating a process model for the selected company. Those findings helped to frame basic steps in the process.

1. Introduction

Quite recently, current markets, firms and businesses have been demanding more complex and integrated business models and solutions. For that demand, Product-Service System (PSS) design had been created various, effective and sustainable solutions for the customer, by extension to the companies. For a sustainable PSS design, it makes the process faster and more innovative for the designers and companies to categorize and work depending on a PSS model.

According to Tan and McAloone [1] by offering a combined product-service system that continuously provides value to the customer, companies can develop innovative and individual solutions to attract customers and compete on the global market.

In the last few years, there has been a growing interest in PSS design, especially in Europe. In addition to that, this field spread to Turkey but still there are only two main companies working and developing actively and only one of them is Turkey-based. It is a new concept and business field compared to the European countries. I-Am Istanbul, which is originally based in Turkey, is one of

them. Knowledge of this field is limited in that context and need to be improved for future developments. Thus, this paper focuses on best and only example as PSS design specified company.

This paper focuses on all PSS categories and process models in the literature for being able to explore a specific company development process for PSS design by looking and analysing existing studies. There are some existing models and concepts for the process. For making the interviews clear and classifying results taken from the firm, those categories should be mentioned deeply. Results can offer a new specified model for the selected company itself and can affect the new project developments for PSS.

Our experience in Istanbul work in Turkish firm, that focuses on PSS and architectural design of the brands. They have several of works with different weight from product to service. Although they do not have system design for industrial product line, the process can be quite different from the existing models. While analysing, all the information taken from the design managers from all projects one by one about the development process, will be categorized according to the existing models. As a result, it should be seen which model is appropriate or they have their own. For being able to analyze all, PSS design definition should be clear and should be the first step for better understanding.

2. Literature Review

2.1. PSS Design
The literature on PSS design shows a variety of approaches to define the field (industry, branding, management etc.). When the concept of PSS is defined in a wide perspective, it can be simplified as that; researching consumer needs and demands for being able to improve effective and sustainable solutions for business and companies. In other words, PSS covers tangible products and intangible services designed and combined so that they cooperatively have the opportunity to be sustainable and to fulfil specific consumer needs [2].

In a simple way, most services are connected with tangible products (phone) or services (insurance for phone). In both cases, services and products are involved in offering value to the customer, furthermore user experience, result of sell or service etc. According to [3] for some years now, the trend in most industrialized economies is that the service content of business is increasing and the material product becomes less important. Thus, recently business models offer using product and service together for creating more sustainable models and long-term customer relations.

For further understanding, current business models are offering us some design that can help us the describe PSS with examples. One of them is Velib, it's a bicycle share system in Paris for exploring the city, instead of owning one. Users are taking the bicycle in certain destinations and they can leave the bicycle in other points that they want to reach. Costing depends on the time that users spend. One another example is Amazon selling kindle (e-book) documents instead of selling real books, which is, can be an example of eco-efficient PSS design. The last one, which is created in the context I choose (Turkey), Yemeksepeti.com. It is a website and App, which all the restaurants are listed for home delivery food and users can choose every specific detail about their food. Users can pay through to App or in hand to the delivery driver. Instead of calling the restaurants one by one, this system offers to the users faster and easier way.

There are countless descriptions about PSS design from specialists from different fields. Table 1 shows some of those descriptions and focus areas of PSS design.

Ref.	Definition	Focus	System's components					Objective	
M.J. Goedkoop et. al. (1999)	'A PSS is a system of products, services, networks of "players" and supporting infrastructure that continuously strives to be competitive, satisfy customer needs and have a lower environmental impact than traditional business models'.	system	products	services	networks of "players"	supporting infrastructure	comp etitive	satisfy customer needs	lower environmental impact than traditional business models'
Centre for sustainable design, (2002)	'A pre-designed system of products, supporting infrastructure and necessary networks that fulfil users' needs on the market, have a smaller environmental impact than separate product and services with the same function fulfilment and are self-learning'.	pre-designed system	products	services	necessary networks	supporting infrastructure		fulfil users' needs on the market	have a smaller environmental impact than separate product and services with the same function
O. Mont et. al. (2001)	'A system of products, services, supporting networks and infrastructure that is designed to be: competitive, satisfy customer needs and have a lower environmental impact than traditional business models'.	system	products	services	supporting networks	supporting infrastructure	comp etitive	satisfy customer needs	lower environmental impact than traditional business models'
E. Manzini, et. al. (2003)	'An innovation strategy, shifting the business focus from designing (and selling) physical products only, to designing (and selling) a system of products and services which are jointly capable of fulfilling specific client demands'.	innovatio n strategy	physical products	services				jointly capable of fulfilling specific client demands	
M. Brandstotter, et. al. (2001)	'A PSS consists of tangible products and intangible services, designed and combined so that they are jointly capable of fulfilling specific customer needs. Additionally PSS tries to reach the goals of sustainable development'.	combinat ion of	tangible products	intangibl e services				jointly capable of fulfilling specific customer needs	tries to reach the goals of sustainable development
M. Wong et. al. (2004)	'Product Service-Systems (PSS) may be defined as a solution offered for sale that involves both a product and a service element, to deliver the required functionality'.	solution	product	service				to deliver the required functionality	
ELIMA, et. al. (2005)	'A product service-system is defined as a system of products, services, supporting networks and infrastructure that is designed to [be]: Competitive, Satisfy customer needs, & Have a lower environmental impact than traditional business models'.	system	products	services	supporting networks	supporting infrastructure	comp etitive	satisfy customer needs	Have a lower environmental impact than traditional business models

Figure 1. Characteristics of the main PSS definitions [4]

All the way through, from the product to the service, called PSS, when the product and the service are integrated. Inevitably, those systems have different weights either as service or as product.

2.2. PSS Categories
PSS design process includes a complex intersection of different fields. Over the years, this process is defined and covered in different types and modules. Because this is a concept born with the overlapping of different fields, this processes may change depending on which product and services are being provided or improved. For categorizing these fields, [5] came up with a model, which explains and simplifies if the value is more on service or on product in an existing or developing system. That classification depends on three subcategories; products oriented, use oriented and result oriented.
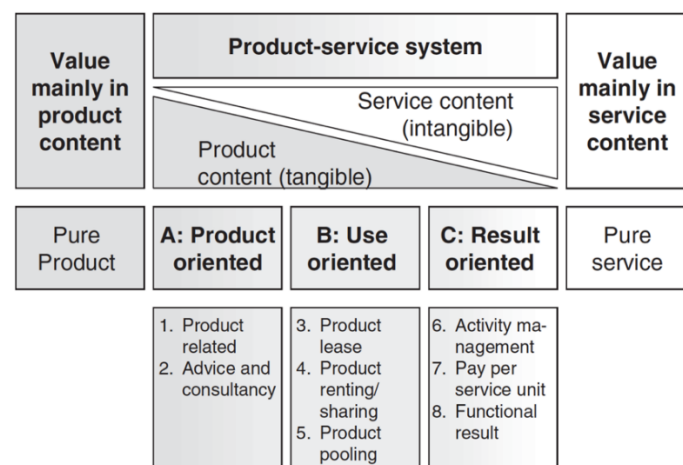
Figure 2. PSS Categories [5]

2.3. PSS Design Process Models

On PSS developing process, there are various models for the steps that should have been followed. In the literature, there are ten different process models existing so far, which have different weight on product or service, furthermore some depends on sustainability or eco-design.

Table 1. PSS process models modified from [11]

PROCESS MODEL	AUTHOR
Proposed Model with Design Thinking and Business Analytics – PM01	Scherer et al. [6]
Fast-track design process – PM02	Alonso-Rasgado and Thompson [3]
Integrated product and service design processes – PM03	Aurich et al. [2]
Design of eco-efficient services methodology (DES) – PM04	Brezet et al. [7]
The Kathalys Method – PM05	Lutien et al. [8]
The Design process for the Development of an Integrated Solution – PM06	Morelli [9]
Methodology for Product-Service System (MEPSS) – PM07	[10]

PM01 offers steps of inspiration, ideation, process prototyping, process validation and the last offering implementation and learning in the process [6]. All of those steps have their sub-categories inside them and were built with help of different concepts e.g. Design thinking, Business Analytics etc.
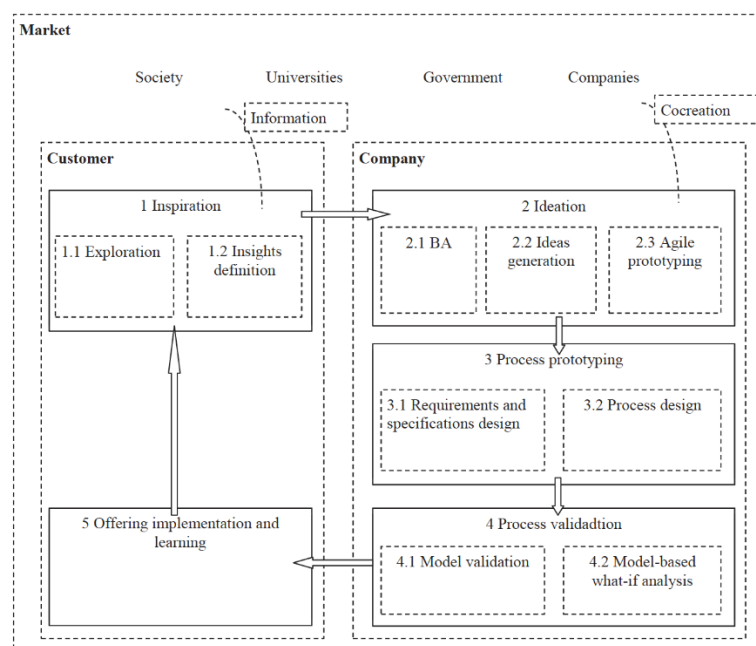

Figure 3. PSS process model [6]

On the other hand, those process models of PSS design can be created by analysing different columns of PSS (e.g., only product oriented). As a result, steps would be clearer and will be specifically arranged by which concept would be more valuable for the system.

Alonso-Rasgado and Thompson [3] also proposes a design model to support   development for designers and companies to follow, which covers Total Care Products, that can be considered as the same as PSS development. There are three main stages with some sub-steps in PM02.

Figure 4. PSS process model (Scherer et al., 2006)

On the other hand, PM03 offers a technical service design process, which is organized as two categories as Product and Technical Service design [2]. Both of them have the similar process, which include six stages.
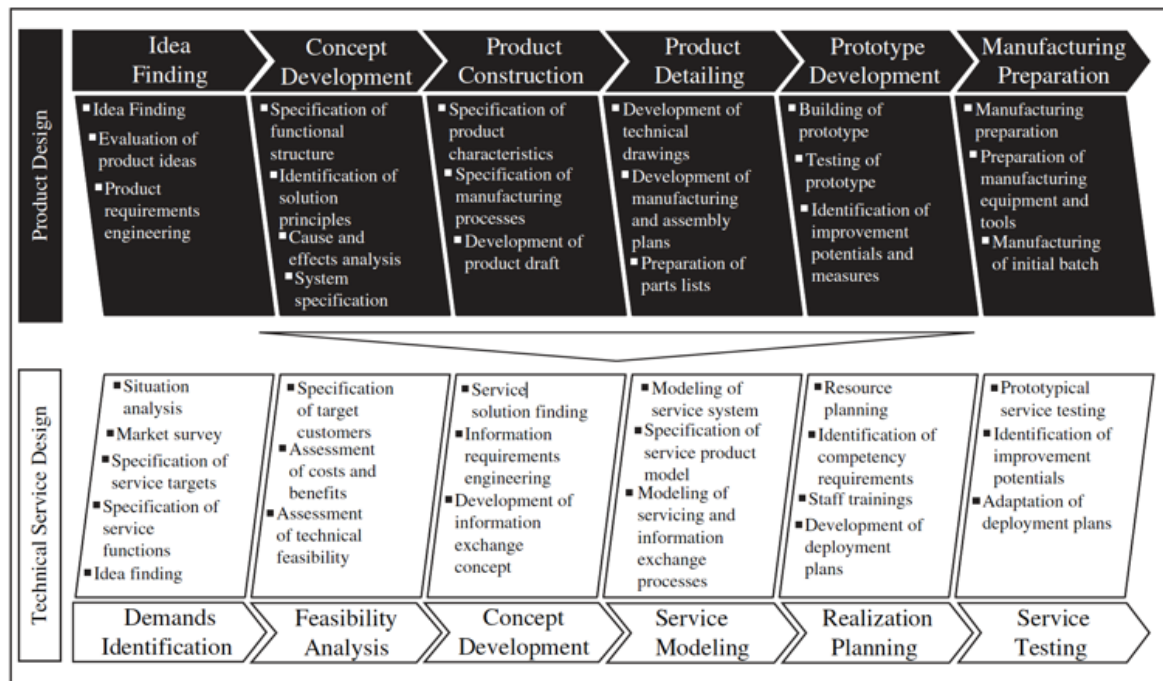

Figure 5. PSS process model by Aurich [2]

Brezet et al. (2001) use the term 'eco-efficient services' as replacement of PSS with clear environmental considerations. They design PM04, model of six stages and called DES (Designing Environmental Systems). Even though it looks like a linear model, all the steps can be repeated according to the development process more than once for achieving more a sustainable model.
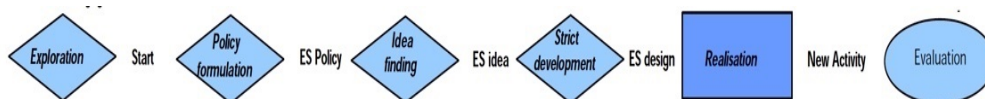

Figure 6. PSS process model DES [7]

Lutien [8] presents The Kathalys method, which is similar to the DES in terms of environmental concerns. PM05 method is organized in five stages to guide the development of sustainable PSS. The deliveries of each stage are classified in five categories.

Tracks ⟍ Phases	The product / service system	Sustain-ability	Organi-sation	The user	The econo-mical feasibility
1. Future explora-tion	Innova-tion vision	Environme-ntal bottle-neck(s) and vision on the environ-mental opportunity	Actor overview	Vision on needs and consu-mer trends	Econo-mical opportun-ity
2. System Design	System definition	Quantita-tive environ-mental targets	Commit-ment by partners for the project plan	User profile	Turnover target
3. Product / Service specifica-tion	Testable product / service combina-tion	(hypotheti-cal) environ-mental assess-ment	Partner agree-ment	Evaluation of accep-tance	Econo-mical assess-ment
4. Drawing in detail and testing	Tested product / service combina-tion	(practical founded) environ-mental assess-ment	Business agree-ment	Practical foundation for accep-tance and use behaviour	Investme-nt and exploi-tation estima-tion
5. Implemen-tation	Develope-d product / service combina-tion	Environ-mental gain	New Business	Fulfilment of needs in a sustainable way	Profit

Figure 7. The Kathalys method [8]

Morelli (2002), proposes 'The Design Process for the Development of an Integrated Solution'. PM06 is structured in seven stages and subdivided in two categories: the solution space, which comprises four stages; and the problem space, which comprises three stages.
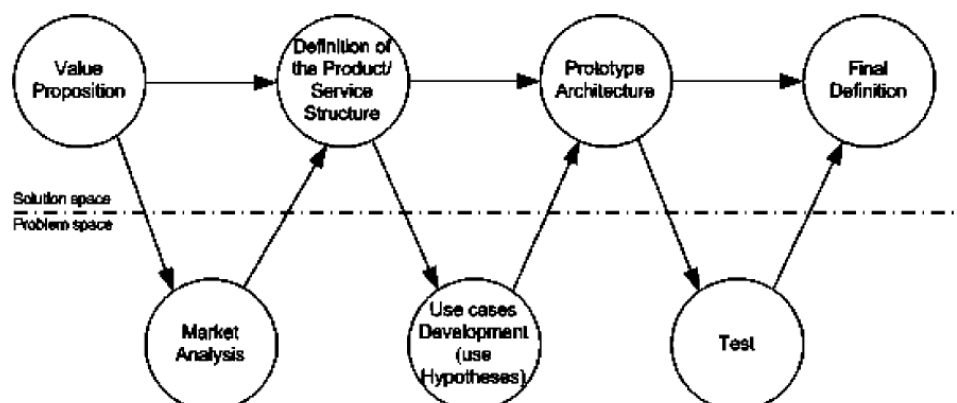

Figure 8. The Design Process for the Development of an Integrated Solution [9]

MEPSS model is similar to DES, developed within the PSS research community with a focus on designing more sustainable product-services whilst Morelli [9] focuses on methodological issues for the design profession. On PM07, all phases have additional steps with inputs and outputs.
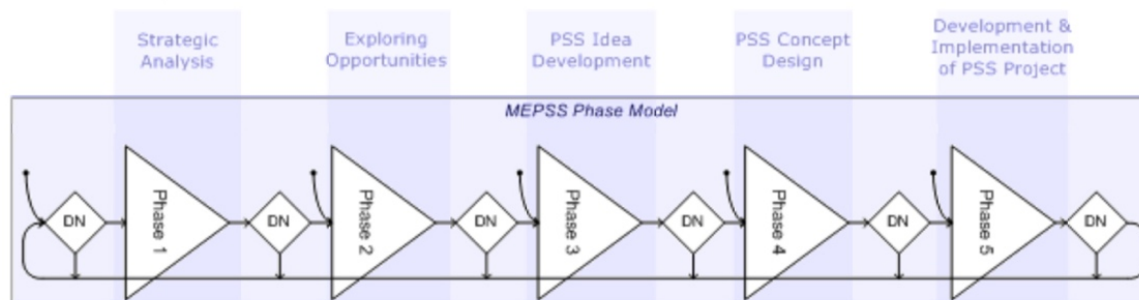
Figure 9. MEPSS method (van Halen et. al., 2005)

In many cases, strategies of PSS design process are becoming more effective for developing if the steps were developed with a more system cantered way. Furthermore, if the system is service oriented, phases should be different from use-oriented system for reaching a more sustainable result.

3. Methodology

In association with the well-known company in Turkey about their PSS design projects it can be served the solid example of Turkey's PSS design development.

R.Q. How does PSS design practice in Turkey reflect the approaches described in literature for the design of PSS?

For reaching that answer, there will be a series of interviews about existing project that how they have been developed. After seeing all the models in the literature, the most solid ones were DES, The Katahlys Method, and MEPSS. The key article that provide most of the steps and characteristics to this paper, has detailed compare with three key methods has chosen for this article, DES, MEPSS and the Kathalys [12]. The reason of choosing specifically those three methods is that those are the only ones created as detailed and it's proven that they are efficient in active cases [12]. All the findings will be analysed in a framework and be evaluated according to their appropriateness for this firm or projects.

Method of this article is single-case study. The reason of choosing that company is that Company offers specifically complex service design solutions with product and interior designs comparing to the other companies which has more value on product itself.

3.1. Participants

I-am associates, is firm that have multiple bases in Istanbul, London, Mumbai and Dubai. The interview is made with only Istanbul base. They have projects in many different fields; Branding, Interior Architecture and Architecture, Digital and UX (User Experience), System Design, and Architectural Practice. They have Graphic Designers, Interior Designers, 3D Designers, Visual Designers, Communication Designers, Interior Architects, Architects, Industrial Designers e.g.

Because this paper focused on PSS development in Turkey, interviewees have been chosen from the Istanbul office. Not without depending on project type, semi-structured interview focused on offering a model for specifically designed for the firm itself. Interviewees were Emre Demir and Ertuğrul Yurdakul who are founders of the company. Mr. Demir is an expert the topic of service design meanwhile Mr. Yurdakul is more into the how service design can apply and change the interior solutions.

3.2. Existing Data

Key article of this study already offers some compartment tables of those three chosen PSS design models; The Kathalysis Method, DES and MEPSS.

Phase	Input(s)	DES	MEPSS	Kathalys
Project initiation	None reported			
Analysis	Industry trends		■	■
	Clients' capabilities		■	
	Supplier capabilities		■	
	Clients' business environment			■
Idea generation and selection	An understanding of the benefits a client desires from a new offering			■
	A description of the system within which the innovation should take place	■	■	■
	Solution requirements	■	■	■
Detailed design	Service idea	■		■
Prototype the service	Service concept	■		■
	Client and supplier business cases			■
	Sales strategies			■
Implementation	Tested service concept	■	■	■
	Refined business cases			■
	Refined sales strategies			■
Evaluation	None reported			

Figure 10. Linking PSS design phase inputs to existing literature [12]

The listed seven steps from the figure are the ones that across in every existing models which briefly mentioned in literature.

3.3. Semi-structured Interview

Interview focused on finding process used on the way of best resulting projects. Not without depending on project type, semi-structured interview focused on offer a model for specifically designed for the firm itself. The approach of data collection focused on to find out:

- The interviewee's perspective of the PSS design process
- The inputs and outputs to each phase within process
- The tools, methods and techniques used within the design process
- Examples of unsuccessful projects and why the interviewee believed weaknesses in the design process made the project unsuccessful
- Examples of successful projects and why the interviewee believed strengths in the design process made the projects successful

For not the framing, answers that interviews giving, questions are created to reach more general and flexible answers. Detailed questions of semi-structured interview;

1) What is the first step for you to start working?
2) What are the main steps while you are creating a team?
3) How do you analyze customer and/or customer's needs? (Industry trends – Client capabilities – Supplier capabilities – Client's business environment)
4) What are the main steps you are taking in idea generation? How do you complete the selection?
5) What is the most important topic for you when you are designing the detailed service?
6) What is your prototyping methods? How do you analyze your own service design?
7) What do you pay attention to when you are pricing the service? How do you articulate the final price?
8) How do you test the final product before submitting? What is your criteria while you are evaluating your own work?

4. Results and discussions

For analysing the interview from the records, Table 2 has been created to see how I-am development process fits to other and the difference between them.

Table 2. PSS process phases comparison

PHASE	SUB-PHASE	DES	MEPSS	KATHA LYS	I-AM A.
Project Initiation	Creating a team	√			
	Project Plan	√			√
	Business Coalition	√			√
Analysis	Industry Trends		√	√	√
	Clients Capabilities		√		√
	Superior Capabilities		√		
	Clients Business Environment	√			√
Idea Generation and Selection	An understanding of the benefits a client desires from new offering			√	√
	A description of the system within which innovation take place		√		√
	Solution requirements		√		
	Service idea	√		√	√
Detailed Design	Service concept	√	√	√	√
	Sales strategies			√	
	Client and suppliers business cases			√	
Prototype the service	Tested service concept			√	√
	Refined business cases			√	
	Refined sales strategies			√	
Implementation	PSS which is sold on the market profit	√	√	√	√

Phases and sub-phases has been chosen from the existing data, in other words key article [12, 13]. From the chart, when we put the data in quantitate way, we found out that I-am development model is matching with DES %55, MEPSS %36 and Kathalysis %55. According to those findings, process model should be done independently from the existing process models. One more other reasons to making this table to see in which phases I-am associates is weak or strong.

So that one more final model has been made specifically for I-am associates process from the records and tables that mentioned before.

Table 3. Detailed process model of I-am Associates

PHASE	SUB-PHASE
Project Initiation	Fixed team
	Project Plan
	Business Coalition
Analysis	Industry Trends
	Clients Capabilities
	Superior Capabilities
	Clients Business Environment
	Consumer needs
	Opportunities
	Existing system analysis
Idea Generation and Selection	An understanding of the benefits a client desires from new offering
	A description of the system within which innovation take place
	Service idea
Detailed Design	Service concept
	Usability
	Scenarios
Prototype the service	Tested service concept
	Interactive workshops
Implementation	Design methods
	Work hours
	Quantity of designers

5. Conclusions

From the research that has been done, it is possible to say that existing process models cannot fit with every company more than 60 percent. So that every company, depending on the field they are making PSS design, should be evaluated by itself. Of course, existing literature will shape the concrete part of the models and help to create the model with some fundamental phases, which is accepted in every PSS design models.

For the case of I-am PSS design model which also represent the general model of in one context (Turkey), that research found out six important findings;

1) Creating theme phase not recognised by I-am because of the quantity of designers have been working there. Reason of that is developing the same designers in different field of studies.
2) Analysis phase are wide and detailed with different approaches.
3) Idea generation and selection phase is standard and similar with the existing models.
4) Prototyping phase recognises depending on how big the project is.
5) Implementation process depends on time and how many designers worked in the project, with that approach that phase quiet clear.
6) Evaluation (feedback) is not much recognised with every project; again it depends on the client and user.

In conclusion, it is evident that this study has shown PSS design development is quiet successful comparing the one from literature. That final model has shown that it has more complicated and developed even though PSS is a new field on the context of Turkey. The findings suggest that this work can be useful for detecting missing point in development for the companies and process can be developed according to the existing approaches in PSS.

As a designer, I believe that PSS design will have an important role in the industry. Because of the customer demands, more complex products with should be came with a service that attract customers. Turkey can be a good market for it. Strong relation between product and service recognised recently in

this context and there is a gap and demand in this field right now. If the companies specified on PSS or at least realize it and combine with their products, step by step this concept will be successful and wide.

Limitation of this study was that only one company was qualified enough to create a process model that can be generalized in Turkey. In the future, when those field will be developed in this context, other companies should have been analysed and compare in the same context to reach more suitable results.

One other limitation was time. For being able to understand whole process, while the company on a project, it should be analysed with a real project and it steps. This will make it more complex study that has the more generalized and successful.

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