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Visualization of Service Design Concepts

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A thesis submitted for the degree of

Master of Science (MSc) in Strategic Product Design

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Statement of originality

I hereby declare that the work submitted is mine and that where I have made use of another's work, I have attributed the source(s) according to the Regulations set in the Student's Handbook. Any contributions received in preparing this dissertation have been acknowledged.

SIGNED

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April 2016

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Abstract

Services and products have in common a number of tools and techniques in their development processes. Services though are of intangible nature and therefore present challenges in their visualization options in every step of their development. The necessity of a visual means of representation is unquestionable invaluable for the evaluation, comparison and debugging or refinement of a service concept. Along with the traditional methods of visualization like service theater, service blueprinting, scripting and customer journey the new tools that technology has to offer, are going to be evaluated. These include but are not restricted to, 3d modelling, virtual and augmented reality, highly configurable games as infrastructure for a service model and other contemporary technology. The desired goal is to develop criteria for application of the methods to certain types of services and to certain development stages. Another goal is to examine the details that might add value to these methods and propose combined methods and tools.

Keywords: Service Design, Visualization Methods, Service Concepts

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I would like to express my gratitude to my academic supervisor Dr. T. Meiren for the substantial and always readily available guidance. Also, I would like to thank the whole staff of IHU that made my studies one of the most memorable experiences of my life. Without the support of my family, Pavlos, Anastasia, Kelly, Spyros, Io, Giannis and my dearest wife Maria this endeavor would be impossible. Finally, I am thankful for all my teachers I had the privilege to be taught by.

Contents

1. Introduction

The world is a tangled web of products and services, with high awareness of the former as they occupy physical spaces, even though the “invisible” latter may well play a more important role in our lives.

On the successful implementation of new service design concepts relies both the imperative need to add value to products and also the fact that our consumer societies in the developed countries have reached a point of consumption saturation that can be overcome by the introduction of intangible offerings and time perishable services. Services also assist in the achievement of sustainability goals set in developed economies as they offer an alternative resource management scheme. Simultaneously, consumer behavior in products and services is shifting from traditional possession to a share and use mentality, to exploit offered value.

In this environment, the requirements for innovation and efficiency can only be met by systematic service development. The relatively new independent discipline of service design uses methods and tools that come from its interdisciplinary origin but also exclusive ones that were developed to deal with the specific challenges of the service world. Visual communication of information in these processes is as in all design disciplines the dominant channel of dialogue. The different methods, and their respective application potential and challenges, are to be researched in this dissertation. The goal is to relate methods to attributes and functions of the service development process and hence assist design organizations in the selection of the appropriate methods to their objectives and resources.

1.1 Research Objectives

As stated above, this dissertation aims to conduct a comparison of service design visualization methods. The primary goal is to assign methods to development stages and rationalize their use by the introduction of criteria. The criteria themselves will address both the organizational and functional needs of the design team and also the needs of the service concept. Achieving this combination is a step closer towards a study that holds application value besides academic interest.

A secondary goal is to compile a catalogue with service design methods based on visual representation. This goal will be a byproduct of the research on methods that are proposed in the academic literature and practitioners' manuals and portals.

1.2 Research Methodology

To accomplish the above stated goals, an iterative research procedure was followed. To some extent the theoretical background is consistent with the qualitative research approach as described in grounded theory. The study material was provided by searching for papers related to service design conceptualization, methods, tools and books, related to service design as theoretical and academic foundations, as well as practitioners' guides. In grounded theory the deducted outcome of the procedure is constantly verified to data to ensure hypothesis and data integrity. This constant interplay between data and hypothesis broadens and deepens the understanding of the study object and aids to the increase of variation of concepts elicited (Strauss & Corbin 1994). Borrowing flowchart symbols from the computer sciences discipline, the process is presented graphically in Fig. 1.

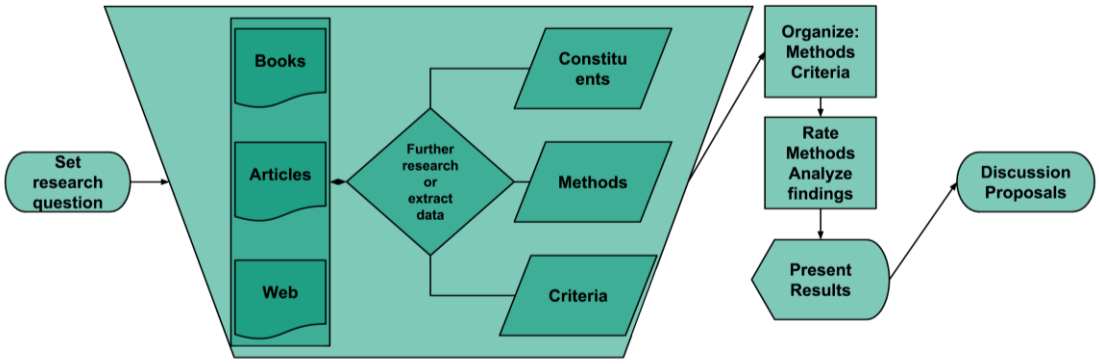


Figure 1 Research Methodology

2. Literature Review

2.1 Service Definition

To define the term “Service” is by itself an ambiguous task. The universally accepted definitions of G. Lynn Shostack and Zeithaml et al., define services by underlining the attributes that are fundamental differentiators from the goods – i.e. products.

“Services are intangible, heterogeneous, produced and consumed inseparably and perishable”, Zeithaml et al. (1985).

“Products are tangible objects that exist in both time and space; ser- vices consist solely of acts or process(es), and exist in time only. The basic distinction between "things" and "processes" is the starting point for a focused investigation of services. Services are rendered; products are possessed. Services cannot be possessed; they can only be experienced, created or participated in.”, G. Lynn Shostack (1982).

The inclusion of products in the definition and direct comparison to let the differences emerge, is the effect of reality, in which no pure 100% immaterial service exists. All services are rendered and delivered with a varying degree of material elements as seen in Fig 2.

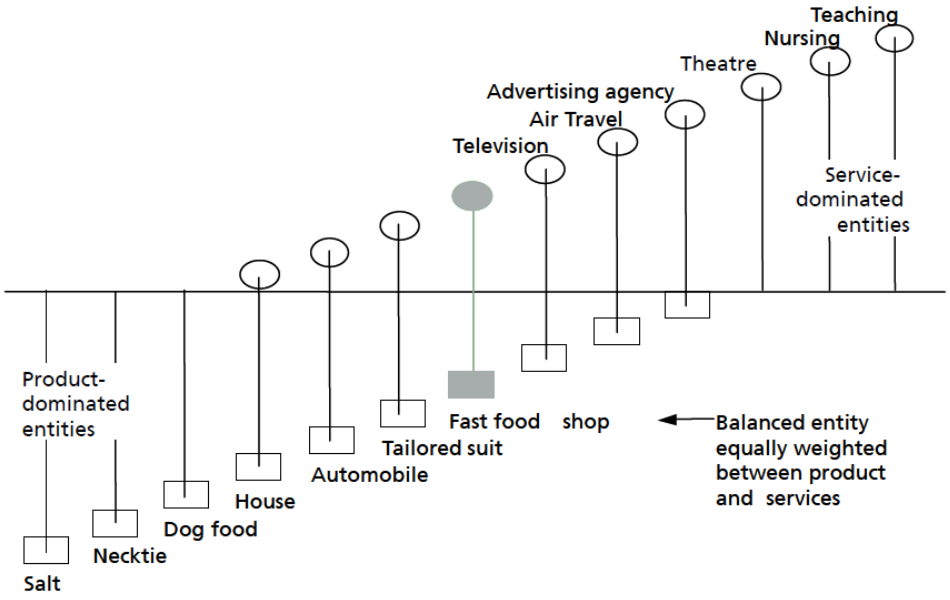


Figure 2 Material-Immateriality Balance[1]

[1] (Shostack 1982)

Services are experienced and therefore their value perception fluctuates strongly depending on factors that cannot remain constant (Zeithaml et al. 1985).

Services are rendered and participation is part of the delivery and consumption of them, leading to co-production reviews of the delivery system.

Services exist only when a user and a service system interact as definitions suggest.

A typology of services as proposed by Fähnrich (1999), sets the foundations for a systematic approach for the development of new concepts (Bullinger et al. 2003), as will be presented later in this chapter. The customization degree and the interaction level and nature are the differentiating factors as the empirical research conducted revealed. A summarizing description is shown in Fig. 3

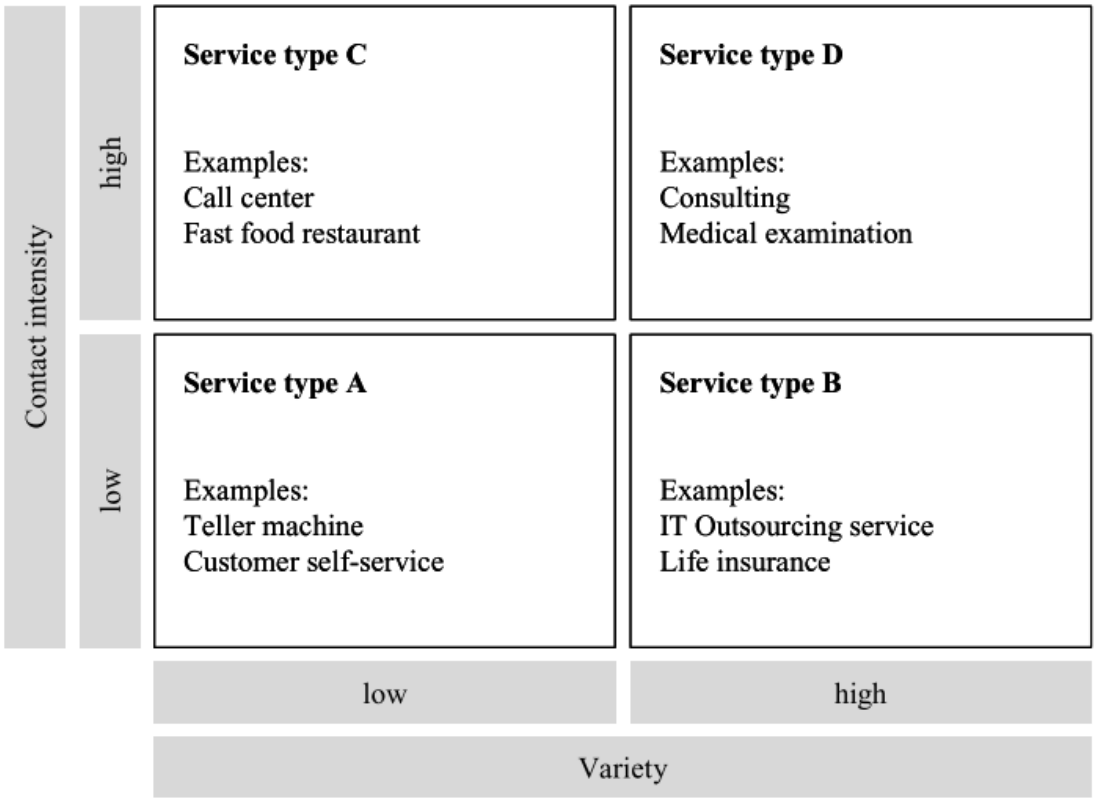


Figure 3 Service typology[2]

As the new discipline established its presence, a shift to a service dominant logic from goods and manufacturing, was captured by Vargo & Lusch (2004). Even though the paper originates from the marketing discipline, the service system is described on component and process level. The volume of services exchanged was recorded and their contribution to market activity recognized.

[2] (Bullinger et al. 2003)

The new roles of stakeholders as operands, co-producers and the new definitions of value and goods as seen from the service centered perspective, form a new ecosystem of operation. Fundamental premises are provided in Table 1

Table 1 Service Dominant Logic Premises

	Short summary
The Application of Specialized Skills and Knowledge Is the Fundamental Unit of Exchange	People tend to specialize in an area of abilities. The acquired skills are exchanged between them to ensure well-being and survival.
Indirect Exchange Masks the Fundamental Unit of Exchange	Direct exchange of desired services is rare and therefore a facilitating medium were introduced, e.g. monetary. Still the core idea is a barter economy.
Goods Are Distribution Mechanisms for Service Provision	Products are the enablers and enhancers of services.
Knowledge Is the Fundamental Source of Competitive Advantage	The service system and the desirability of offerings relies on knowledge. Therefore, knowledge is the incentive for the user to choose an offering.
All Economies Are Services Economies	Specialization and economic factors, drive even manufacturing activities to operate in some level through services.
The Customer Is Always a Coproducer	Due to the nature of service production and delivery, customers are constantly and actively involved in value creating processes.
The Enterprise Can Only Make Value Propositions	Since the customer is considered to be a co-producer, consequently the provider proposes essentially an intangible product, a process creating value.
A Service-Centered View Is Customer Oriented and Relational	The dynamic definition of the service system, strongly influenced by the user, is acknowledged by the last premise.

It is obvious that the nature of services is a complex system of interdependent and hard to isolate factors.

2.2 Value and Role of Services

Services are an integral part of our social and economic life. Ranging from government to entertainment, they cover all of our needs, from basic as safety or justice to value adding like modern communications or socialization and entertainment. In developed countries services account to more than 70% of the GDP and still growing (World Bank 2016) and offer employment to the majority of the workforce (Soubbotina 2004).

In developed countries, the post industrialization era shifts the direction of growth from the secondary and primary sector to the tertiary Fig 4. Increase of personal income in these economies, pushes a higher demand of services, as they offer added value to the lives of the recipients. The sustainable development of developed economies relies heavily on services as they enhance the finite resources management and rely more on human resources Fig. 4 (Soubbotina 2004).

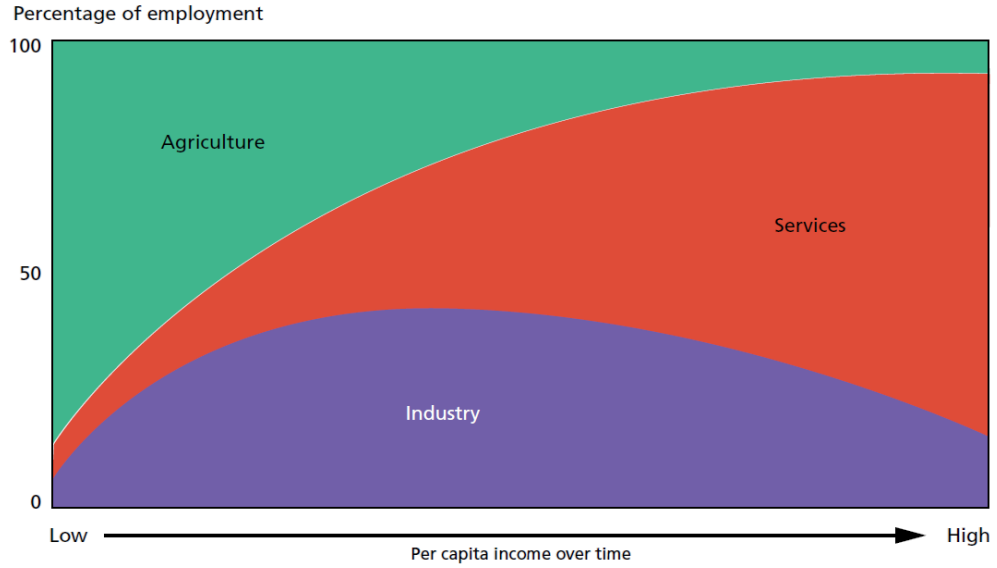


Figure 4 The changing structure of employment during economic development[3]

Saturated product consumption is being regenerated assisted by intangible and time perishable services. Even in developing economies the service sector is growing parallel to their industrialization (Soubbotina 2004), which itself is driven partly by service sectors of developed economies.

[3] (Soubbotina 2004)

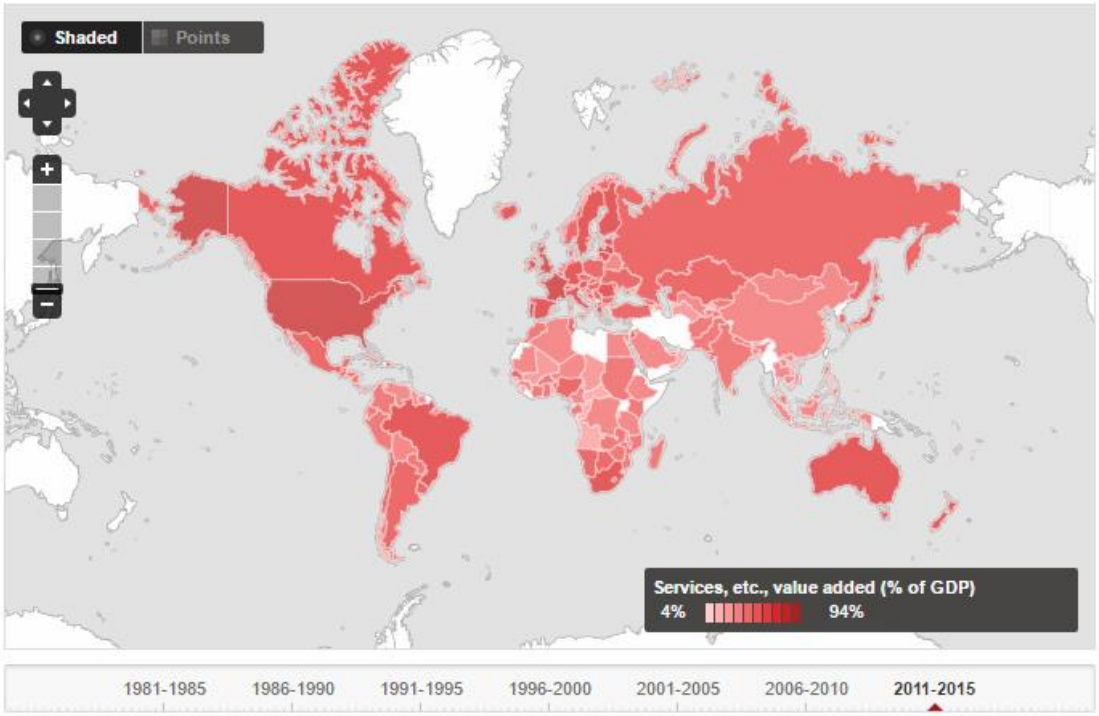


Figure 5 Percentage of Service induced GDP[4]

As World Bank data indicates, in the 1980s about half of the worlds GDP was generated by the service economy. In 2013 the percentage has risen to 70.5% and still growing, while in the Euro area amounts to 74.1% in 2014 Fig 6 (World Bank 2016).

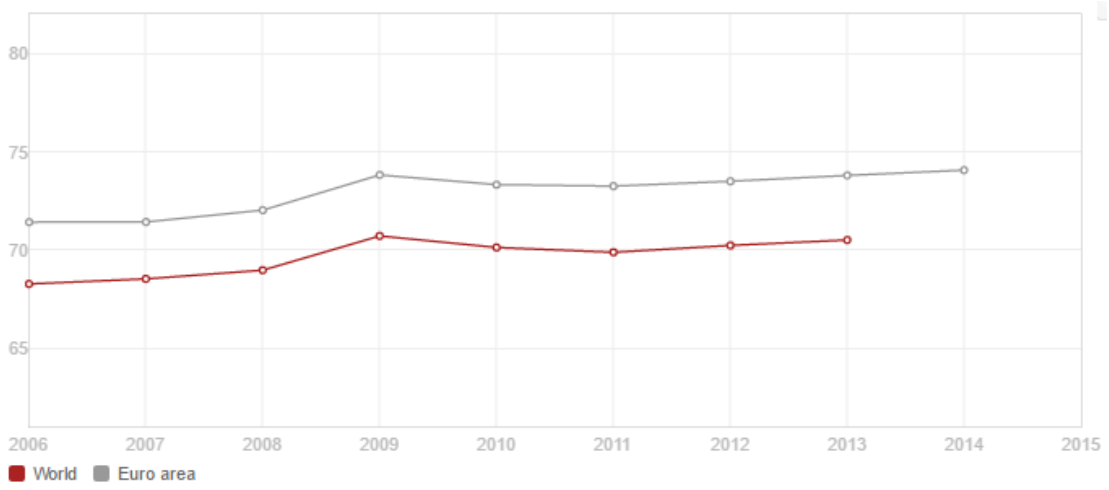


Figure 6 Euro Area - World Services percentage of GDP 2006-2013[5]

[4] http://data.worldbank.org/indicator/NV.SRV.TETC.ZS/countries?display=map
[5] http://data.worldbank.org/indicator/NV.SRV.TETC.ZS/countries?display=graph

2.3 New Service Design

For services to contribute sustainably and reliably to that extent in the economy and society, they need to be developed systematically. The development of new services is labor intensive and requires multidisciplinary teams of experts to map out the attributes and functions of each project while taking into account the challenges they pose as mentioned above.

In search for a central focal point and balance between the procedure and the people, various attempts to introduce a methodology took place. According to Holmlid (2007) and based on past work, *"service design is a human-centered and an outside-in perspective"*. The design process is focused on the users and providing systems are designed to existence in order to deliver the value sought by users.

Service development is in contrast a much more internal approach (Holmlid 2007). In service development resources of the provider, processing capacity and skills set define the developments process limits and a clear goal is predetermined (Nisula 2012). This results to definite, pragmatic and applicable solutions as the approach promises.

Beyond the theoretical and empirical definitions, a comparative study of service development frameworks complying with the above mentioned was executed by Bullinger & Scheer (2006). The researched workflows introduced by Ramaswamy, ISO and Edvardsson-Olsson cover the field from process-oriented to user-oriented and almost every other aspect, i.e. quality assurance and service specification. Schematic representations of the methods are shown in figures 7-9

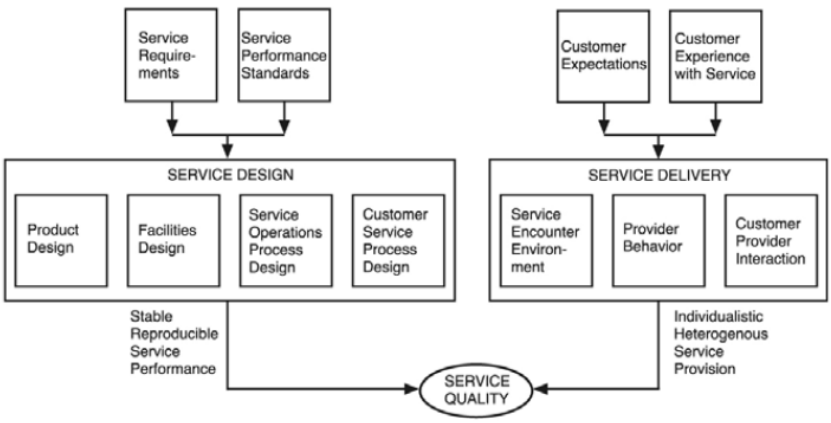


Figure 7 Ramaswamy model[6]

[6] (Bullinger & Scheer 2006)

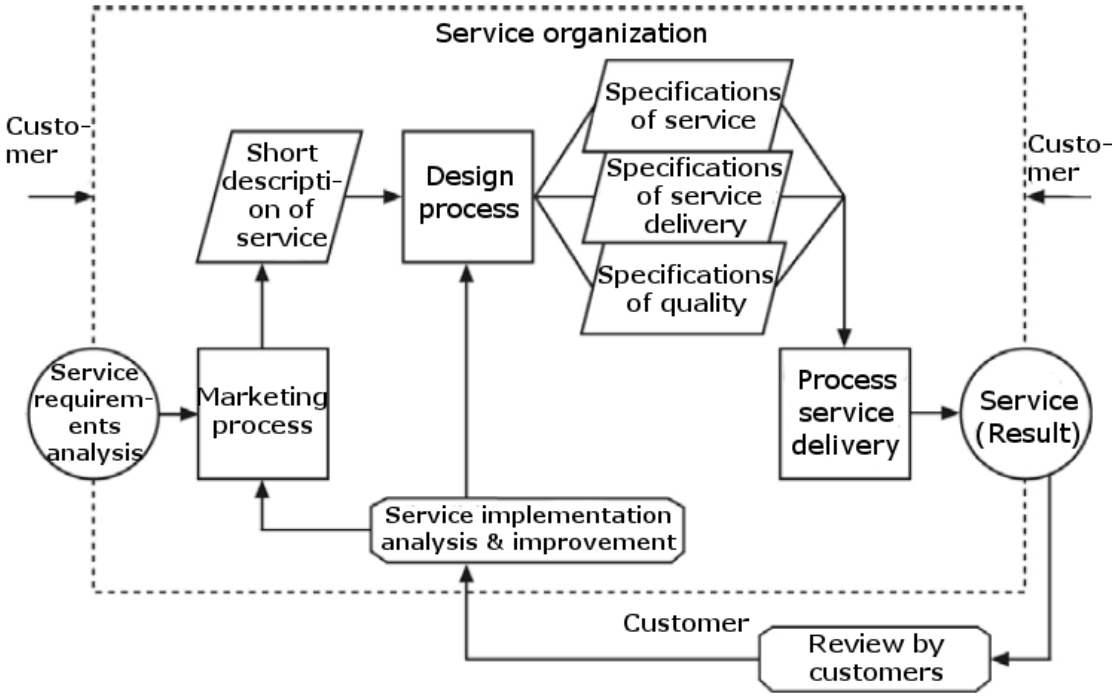
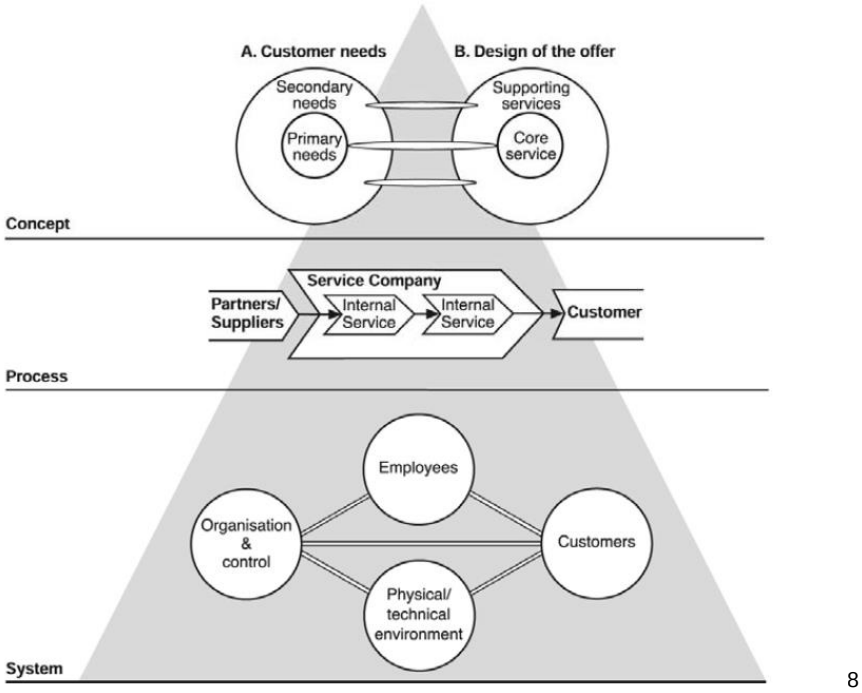


Figure 8 ISO model[7]



[8]

Figure 9 Edvardsson-Olsson model

[7] (Bullinger & Scheer 2006)
[8] (Bullinger & Scheer 2006)

Service engineering as described by Bullinger & Scheer (2006), is *"the development and design of service-products by means of appropriate procedure models, methods and tools"*. The idea behind it, is to conduct a systematic analysis of service development and the service itself in order to extract the defining dimensions of them. The result is a grid like Fig. 10 that can be used to structure service engineering in discrete and fully defined work steps.

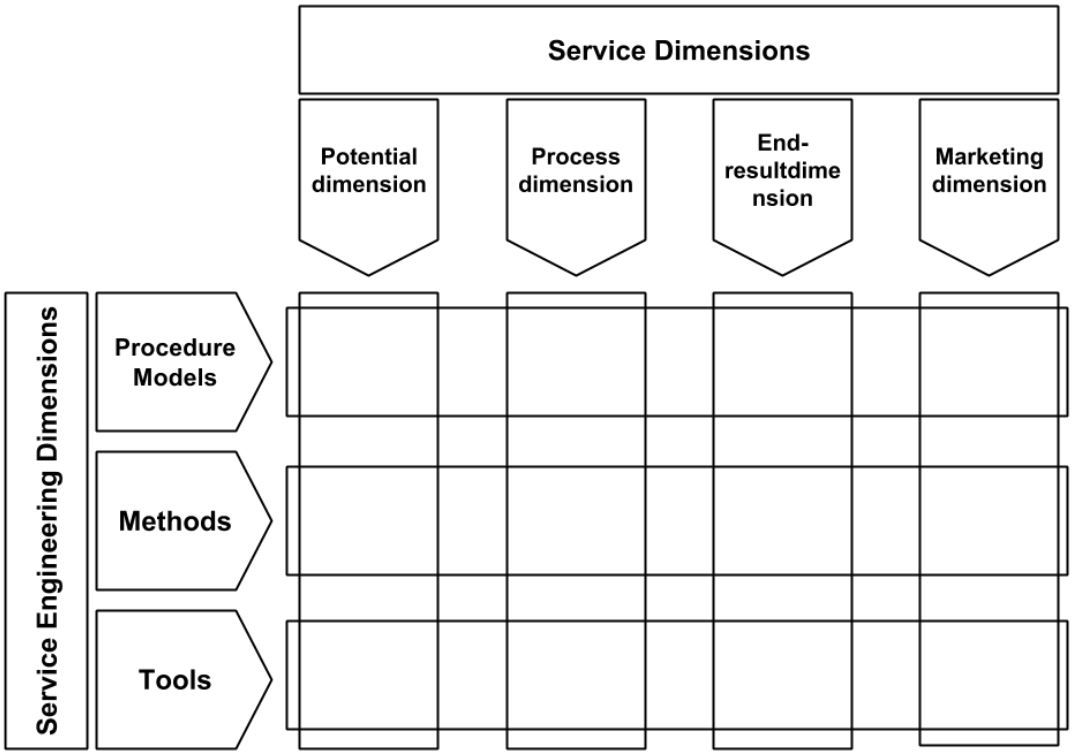


Figure 10 Service Engineering Framework Concept[9]

The service development procedure that will serve as a basis for the dissertation is the one used by Fraunhofer Gesellschaft Institut as presented on Chapter 4, and derives from the service engineering approach.

[9] (Bullinger & Scheer 2006)

3. Methods

Although there is a tendency to underestimate the abundance of methods for service design, research revealed a great number of. The definition of concept and conceptualization is wide and encompasses a great area of activities (Ostman 2007), taken into account that a concept consists of elements, some methods presented in this paper may not provide a holistic solution to the design problem but still hold value as components of a compilation. Because of the multifaceted nature of the service industry, there are methods that vary from being abstract and graphical to purely arithmetic or even algorithmic and from being totally fictional and/or virtual to being realistic or even true full blown implementations. A simple rule was used to decide whether to include a method or not, methods qualified had to provide visual clues besides textual or numerical. This rule helped to exclude diaries, business plans, pure descriptive and scripting methods. Graphs, drawings, sketches, photos and other graphical elements are required to play a major role in the proceedings of the method. Videos of real-life environments and people as well as conventional animations, and computer generated artifacts as well as technology enhanced environments (VR or AR) meet the requirements of this definition. Lastly, all human interactions and artifacts used in these process are also included, provided that the actual interaction between people has to include some sort of presentation of the ideas that are to be communicated. E.g. theatrical representations, use of artifacts, mock ups and toys. Following these guidelines, a list of methods was compiled.

3.1 Activity Map

(Curedale 2013)

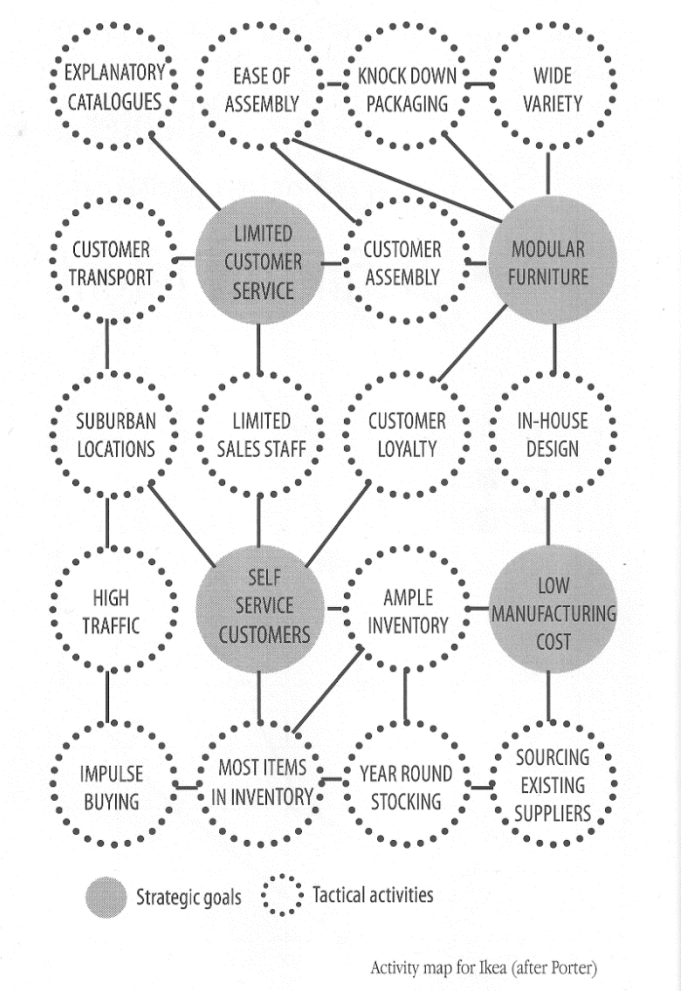


Figure 11 Activity Map[10]

Helps create rough specifications of a service. Resources can be identified as abundant and therefore under-utilized or lacking and thusly in need if a new service dependent on them is to be deployed. Assuming that the plotting of the map is accurate and is omitting none of the core or secondary activities of an organization, it is a useful tool for a lot of other business functions like documenting, resource planning etc. It can be a grounding stone upon which other processes can build on or extract information from.

[10] (Curedale 2013)

3.2 Actors Network Map

(Morelli & Tollestrup 2006; Curedale 2013)

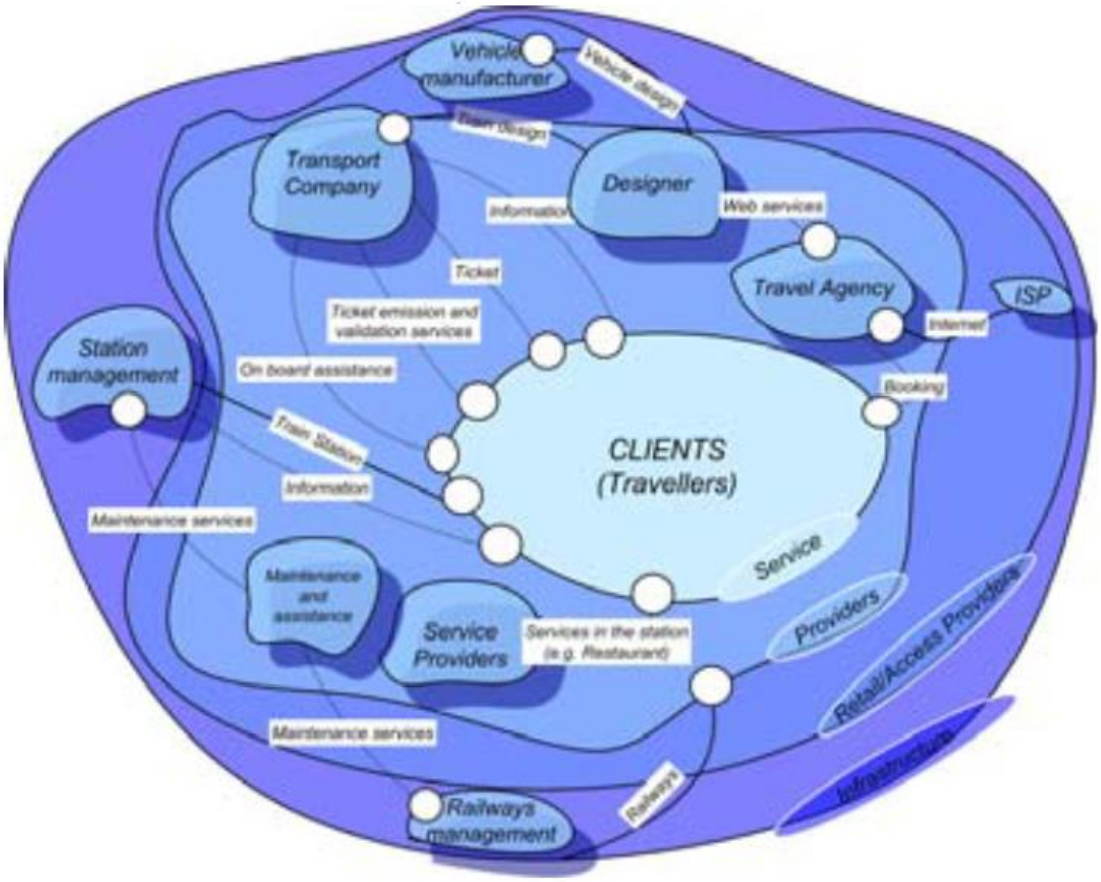


Figure 12 Actors Network Map[11]

In most applications of the service design world people and their needs lie in the center point. With the introduction of co-producing approaches, the number of stakeholders contributing to the delivery of service has risen and includes the recipients/users as well as their function in the service process. The graphical representation of this unison of human resources is the Actors Network Map (also known as Network or Actors Map (Curedale 2013)). It provides a list of stakeholders, their role, their interactions and implicates the environment and the channels through which it occurs. It can be expanded to include any module of the concept that plays a salient role. The actor networking theory unites the material components of the service to stakeholders in a way that their interactions and contribution to the service are made visible (Law 2007).

[11] (Morelli & Tollestrup 2006)

3.3 Affinity Diagrams

(Curedale 2013)

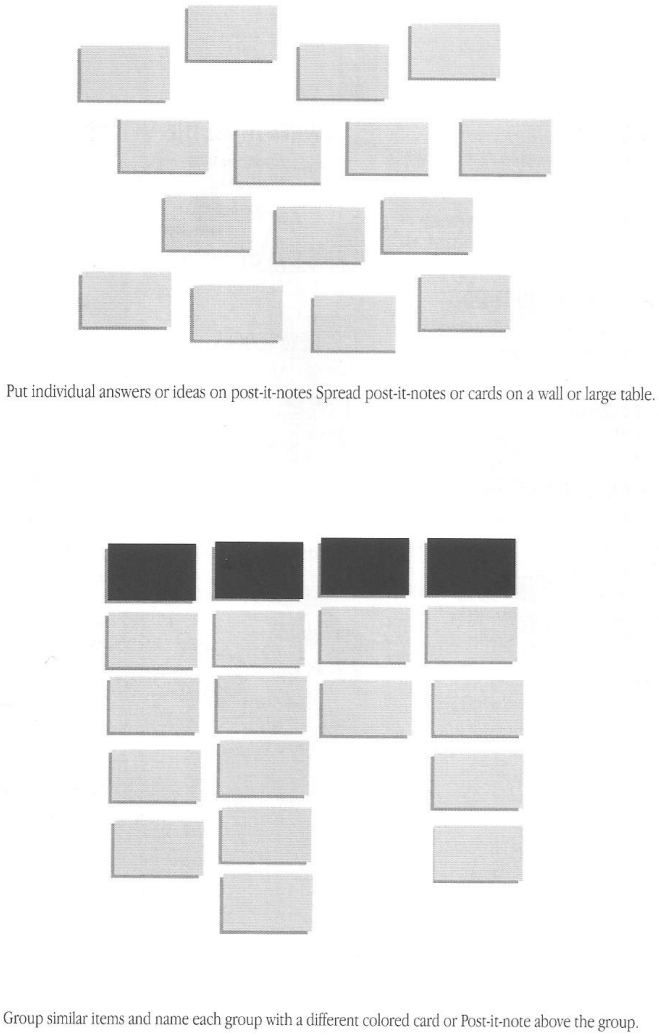


Figure 13 Affinity Diagram[12]

This is a great method to group and structure content that is generated or provided. The goal is not only to group the content but also to let the design team take a second look on the material and develop a more substantial comprehension of the potential that lies within them. Although it looks trivial to summarize ideas on a post-it, the analysis that is required to discover the links between them is a deep understanding of the core ideas. In the case of (Jamin Hegeman et al. 2007) the affinity diagram was used to explore the system elements of an existing service and to discover the critical categories to which the service system can be divided.

[12] (Curedale 2013)

3.4 Behavioral Map

(Curedale 2013)

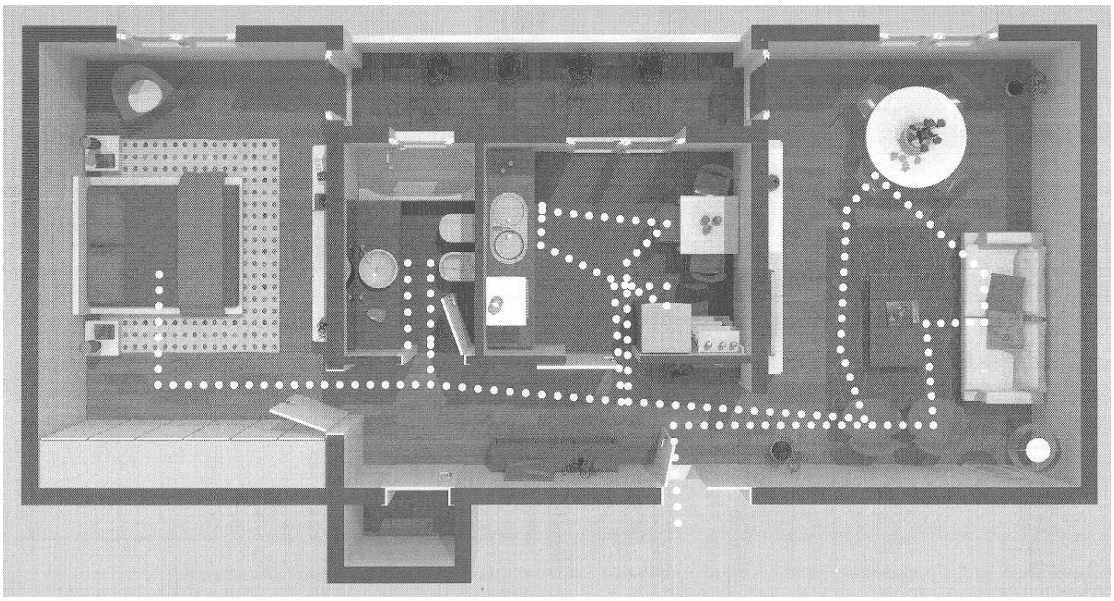


Figure 14 Behavioral Map[13]

This method is a specialized version of the journey map. It is mainly intended to point out and graphically present the patterns of movements that occur in the service environment. Based on the fact that at least an initial rough sketch of a layout has to be at hand, this is a method suited for testing and refining service concepts. It can also be used as a benchmark tool for existing services and their efficiency.

[13] (Curedale 2013)

3.5 Benefits Map

(Curedale 2013)

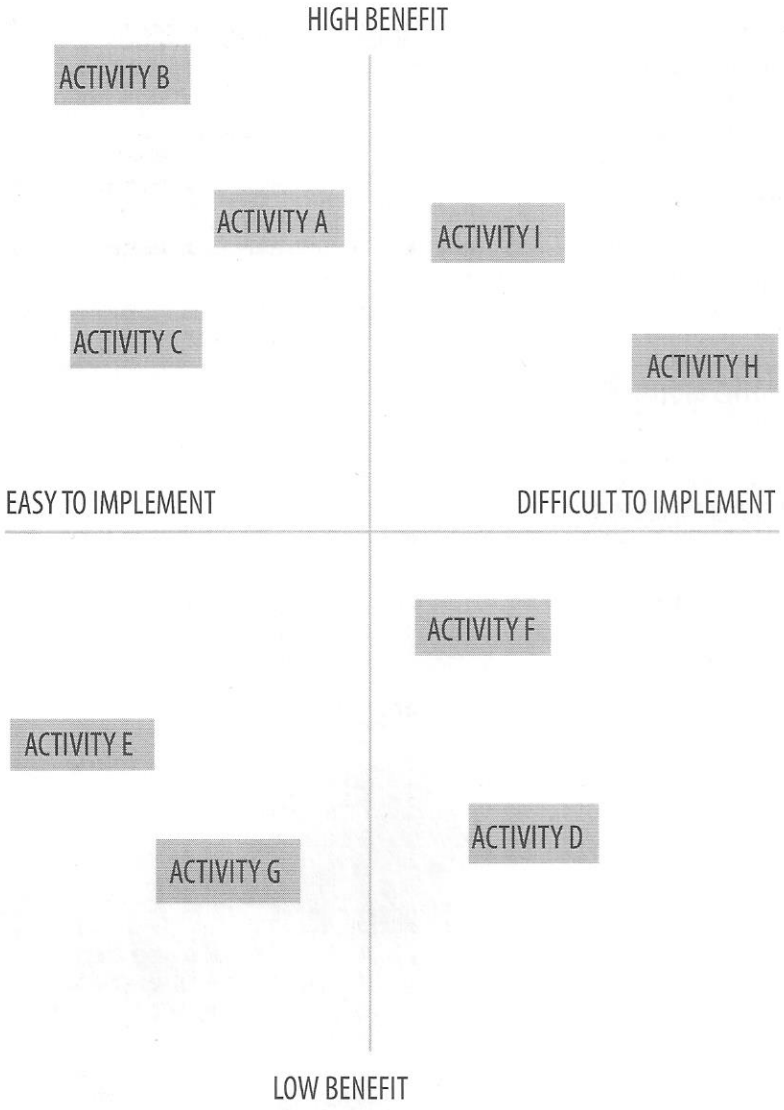


Figure 15 Benefits Map[14]

A benefits map can be a very helpful secondary process, assisting in the development of a service concept. The use of it can help the team to advance in leaps instead of little steps, helping the overall process and pointing out even if the concept developed is worthwhile at all, from an early point. It can also be described as a strategic tool, besides a visualization of the work packages lying ahead and their priority as it quantifies roughly the impact of the resource allocation both to the provider but also to the user/client/stakeholder.

[14] (Curedale 2013)

3.6 Bowman's Strategy Clock

(Curedale 2013)

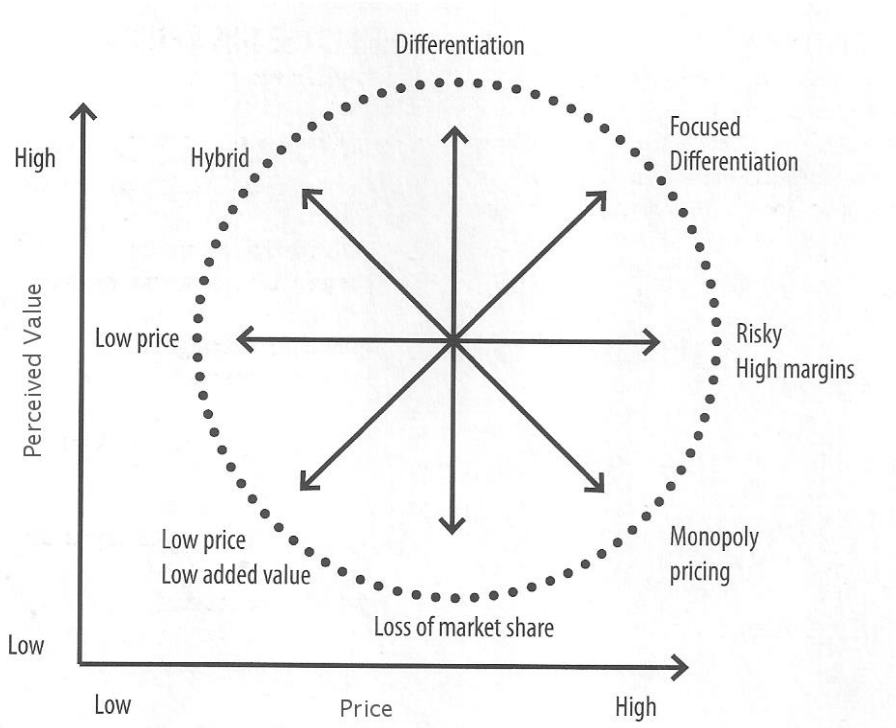


Figure 16 Bowman's Strategy Clock[15]

A secondary tool to the creative process, it has more value as an assessment tool and an orientation guide for the framework and the placement of the service to be developed.

[15] (Curedale 2013)

3.7 Business Process Analysis Software – BPA

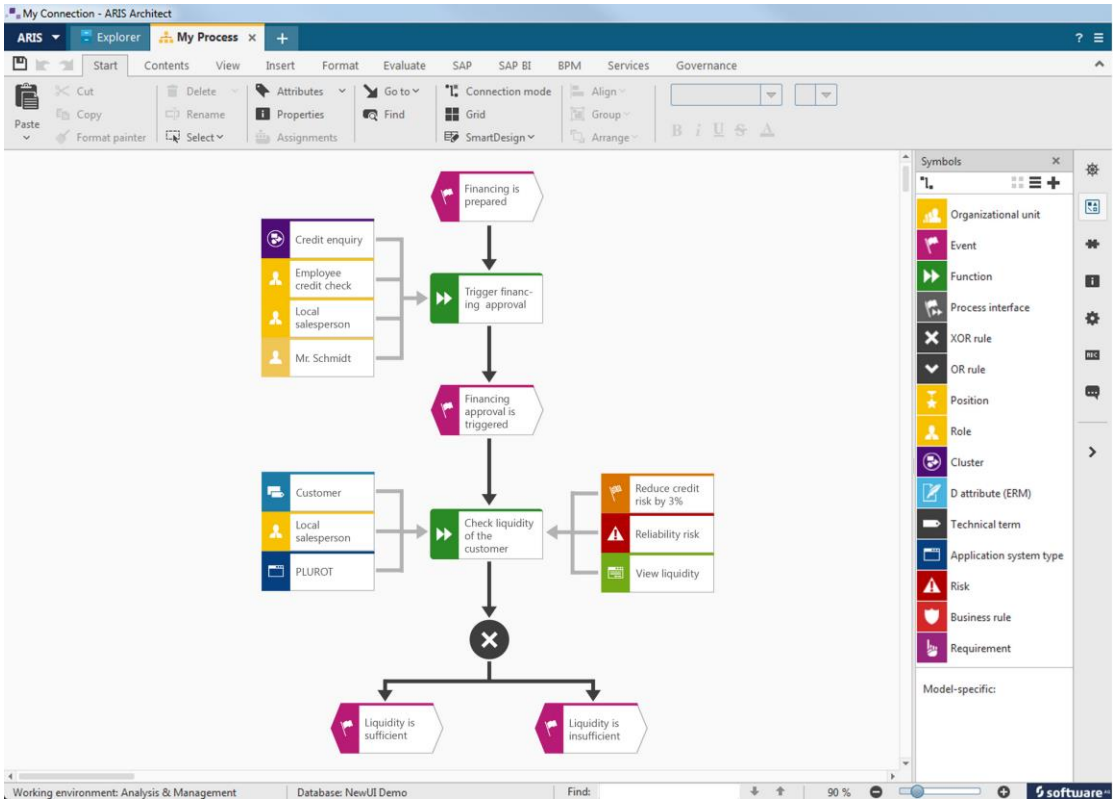


Figure 17 BPA ARIS Architect[16]

Service design discipline draws its origins in marketing as can be seen in ground laying work of Shostack (1977), trying to emerge as a new discipline. Early terminology and tools derive from product manufacturing, marketing and operations disciplines. This affinity enables service design to still be able to accept loans in tools from these fields. Such examples are managerial tools like BPA software ARIS® and process modeling software like Bizzagi® and virtually any business process engineering, modelling, analysis or simulation package, though with variable efficiency and applicability. Use of such programs is a significant aid to functional modelling of processes, opposed to the static graphic representation of Powerpoint®, and in cases of process studies often a complete prepared model to run, e.g. Markov chain analysis and overall operational efficiency and benchmarks.

[16] Source: https://nielsdoeleman.files.wordpress.com/2013/04/schermafbeelding-2013-04-16-om-12-23-551.png

3.8 Collage

(Curedale 2013)

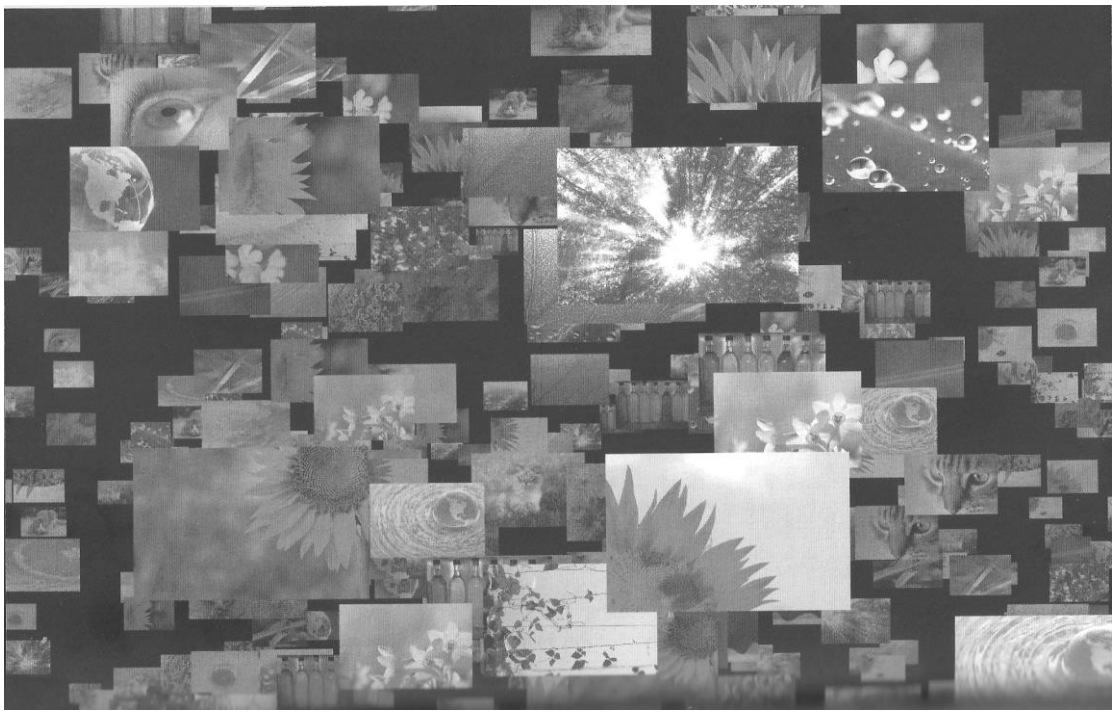


Figure 18 Collage[17]

Collages can be a form of narrative (Kostera 2006), or in this case the medium to unleash the creative powers of a team. The method allows a lot of space for personalization and abstract expression. They are not to be misinterpreted as unfocused work but rather as an out of the box view on the problem. It is obvious that they are close to mood boards and to some extent identical.

[17] (Curedale 2013)

3.9 Communications Map

(Curedale 2013)

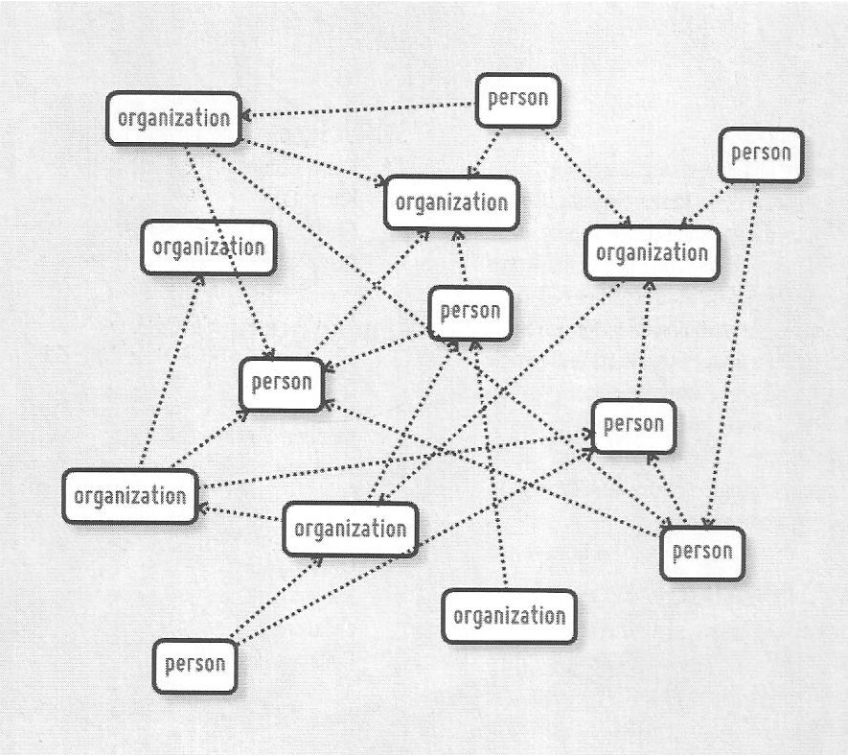


Figure 19 Communications Map[18]

When stakeholders and their roles in a project are identified, the way that they interact and information flows between them can make a significant difference in the efficiency of the endeavor. Since service design is a multidisciplinary task that is collaborative and often involving users too (Saco & Goncalves 2008), it is only natural that project management techniques are useful to tame and utilize the potential that lies in these diverse teams. Structure that is provided by the communications map, allows the participants to be involved in higher value tasks rather than trying to navigate through the hierarchy of communications. A variant of this method is the powergram (Brill & Worth 1997) invented by Alexander Greg. The variant enhances the map by adding weightings (proximity and intensity) to the relationships but also assigning negative or positive influence markers.

[18] (Curedale 2013)

3.10 Constructive Interaction

(Tassi et al. 2009a)

Figure 20 Constructive Interaction[19]

A method that can assist all roleplaying tools, including theatrical ones, especially in increasing empathy of the audience and understanding the internal procedures of the users. The guideline to talk out loud everything that is relevant to the interaction taking place helps the team of designers to better understand the settings required to achieve the desired goal. As with all methods involving people and observing them, various factors play a role that may influence the value of the observations negatively and render them subjective and non-reliable.

[19] Source: http://www.servicedesigntools.org/sites/default/files/res_images/XXX.jpg

3.11 Critical Success Factor

(Curedale 2013)

FACTOR	BRAND											
	A			B			C			D		
	-	+	++	-	+	++	-	+	++	-	+	++
Cost		x			x				x	x		
Brand			x			x	x					x
Technology		x		x				x		x		
Employees	x				x		x				x	
Customer service		x				x			x		x	
Distribution			x		x			x		x		
Speed to market			x			x		x				x
Design		x		x			x				x	
Reliability		x			x				x			x

Figure 21 Critical Success Factor[20]

This method can be used to map out and benchmark the current position of an organization. It can be considered as a graphical aid to help the organization realize what are the resources needed to succeed considering the competitors, as well as realize the potential of its own resources especially if they are relatively underutilized.

[20] (Curedale 2013)

3.12 Customer Experience Map

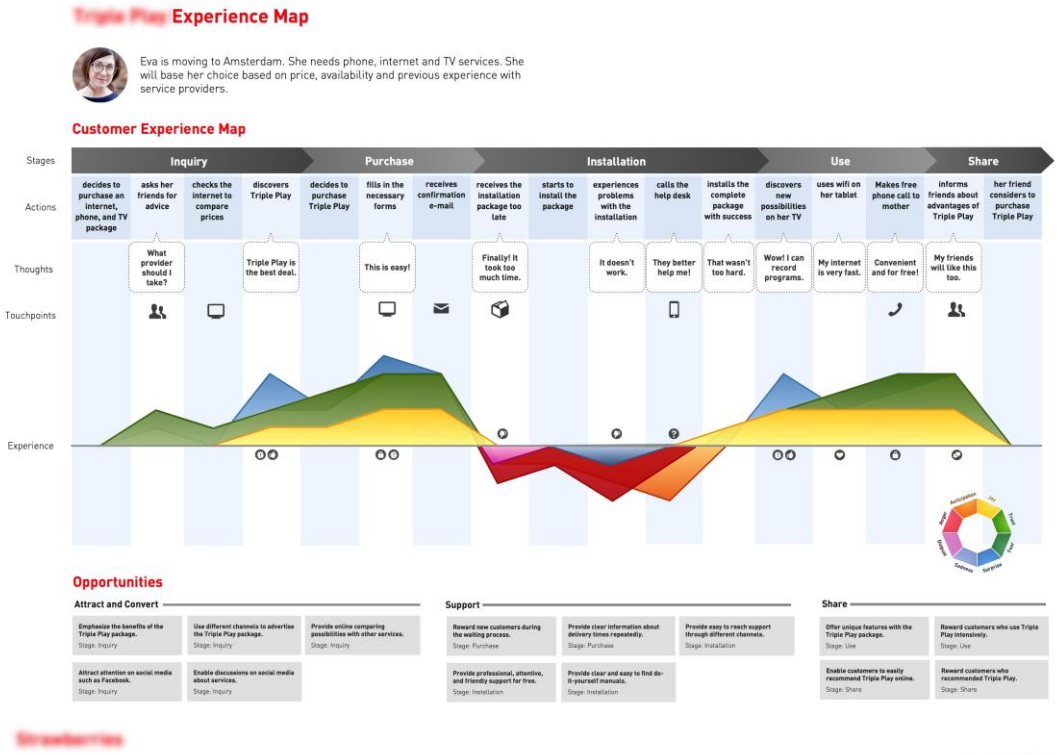


Figure 22 Customer Experience Map[21]

This method adds a graphical representation of the subjective user's fulfilment sense. A graph showing the critical touchpoints and their relative rating as positive or negative experience, enhances a blueprint, a customer journey map or other method based design. This allows the designer team to identify possible malfunctions or discrepancies that cause a negative fluctuation of the user's experience. Analysis of the data acquired from the user point of view (Johnston & Kong 2011) can lead to iteration of the service development stages or to incremental changes if the application is upon an existing service. Structured in a series of states and a scale of negative to positive experience, the map can be a standalone method to explore a concept (Curedale 2013).

[21]Source: https://s-media-cache-ak0.pinimg.com/originals/92/3c/9e/923c9e025a6ddeb771398ff04ca930e9.jpg

3.13 Customer Experience Modeling – CEM

(Teixeira et al. 2012)

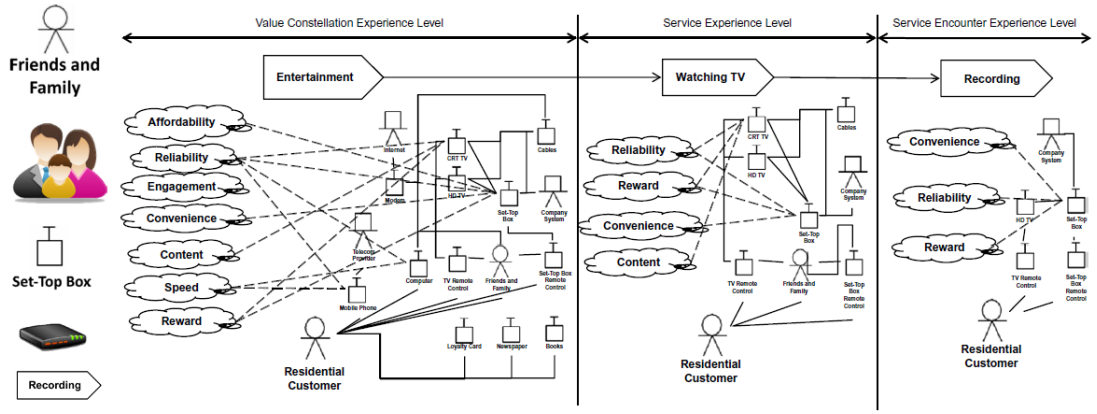


Figure 23 CEM Customer Experience Modeling[22]

Customer experience modelling is a method that was developed based on multidisciplinary tools and theories and is innately service design oriented. The goal is to unite value, tangibles, human and non-human actors in one framework and thus enable the interconnections, dependencies and relations to emerge. This is done in a technical visual language that is based on a combination of icons and labels and the relationship that actors have to artifacts, system actors (non-human) and consequently to the value offered is presented by connecting arrows. The value the users expects to receive is considered a prerequisite and therefore a requirement. Thus, the customer expectation requirements represent the values and the analysis of the service concept can occur. Inline to the MSD (Multilevel Service Design) theory, it offers a holistic approach to a service system and allows the collaboration of multidisciplinary teams on the project as well as other stakeholders (Teixeira et al. 2012). The service is analyzed on three different abstraction levels to elicit in-depth insights as well. Even though the method offers a solid tool for service designers to conceptualize and analyze, and among its aspirations is to allow access to the procedure to other stakeholders, the knowledge required to plot the models and to gather the data leads inevitably to specialists. Nonetheless, the representation of the service system is clear and comprehensible despite the multiple associations between users-tangibles-requirements as the model uses limited symbols.

[22] (Teixeira et al. 2012)

3.14 Customer Journey Map

(Seybold 2016)

Figure 24 Customer Journey Map[23]

User satisfaction is of utter importance to the service design world. The deep and critical understanding of users is important as it allows the designer team to address the needs of users in a non-obtrusive way. This can be achieved if the viewpoint of users is adopted and the service process is recorded as it unfolds over time. The customer journey map is user centered and therefore all touchpoints involved in the service are recorded as the user navigates through the system (Tassi et al. 2009b). The alternative visualization of the service, allows more detail to be specified in the interactions of the user with the system. However this means also that valuable information about background procedures is not included (Tassi et al. 2009b). The method could alternatively be described as a front stage only blueprint.

23 http://www.servicedesigntools.org/sites/default/files/res_images/Workshopslides_jeu-8_0.jpg

3.15 Deming Circle – PDCA

(Curedale 2013; Rother 2010)

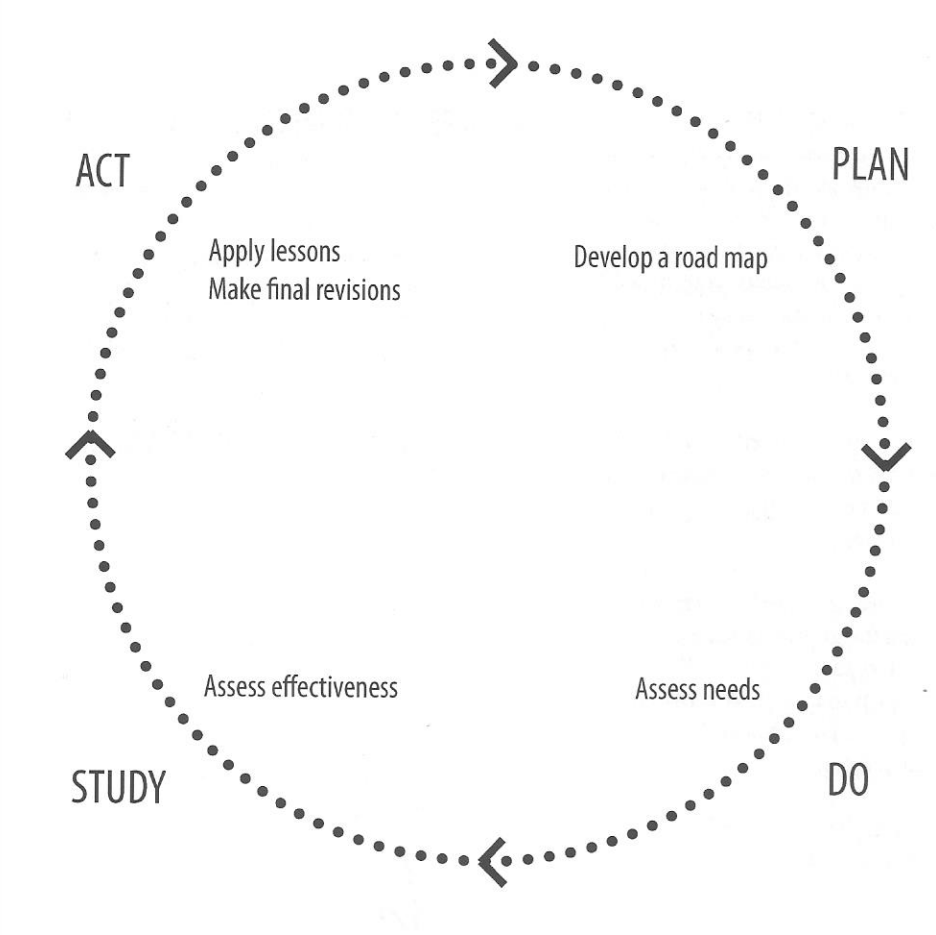


Figure 25 Deming Circle – PDCA[24]

This is a rough outline of a development plan. The circle serves as a roadmap to the completion of the service development process. It is a manifestation of the common mission that the team has undertaken and a fixed reference for all members to align to.

[24] (Curedale 2013)

3.16 Dramaturgy

(Benford & Hunt 1992)

Figure 26 Dramaturgy[25]

Dramaturgical affinity of social movements was the starting point that led to analogies that decipher human interaction. This was followed by assignment of structure to them and also standardization and designing of them. The techniques used in dramaturgy are used to simulate service process involving people and the factor of reality is only limited by the available resources. Dramaturgy can be used to simulate concepts at any stage of development from small abstracts of interactions to full blown and well defined concepts. It can also be used in the revision or troubleshooting of an existing service. This could be accomplished by regarding the dramaturgy as an observational case study (Johnson & Stake 1996). Besides the obvious analogies like scripting, staging and performing the audience plays a significant role too. The interpretation and the close observation of the stage reveals valuable clues in almost all aspects of the concept. This method depends highly on the ability of the actors to embrace their roles but also on the empathic abilities of the audience (Miyashiro 2011). The use of professional actors is a conflicting case between the ability of the professional actors to perform realistically and the first-hand experience of the audience to the experience. This can lead to biased deductions elicited, due to the actor-observer perception gap (Jones & Nisbett 1972). The staging can be of importance and adds value too. The value added by a realistic staging can make the difference justifying the expensive and complicated method.

25 http://www.slideshare.net/Intelligent_Furniture/tp2-how-to-use-drama-methods-in-service-concept-design

3.17 Drawing Experiences

(Curedale 2013)

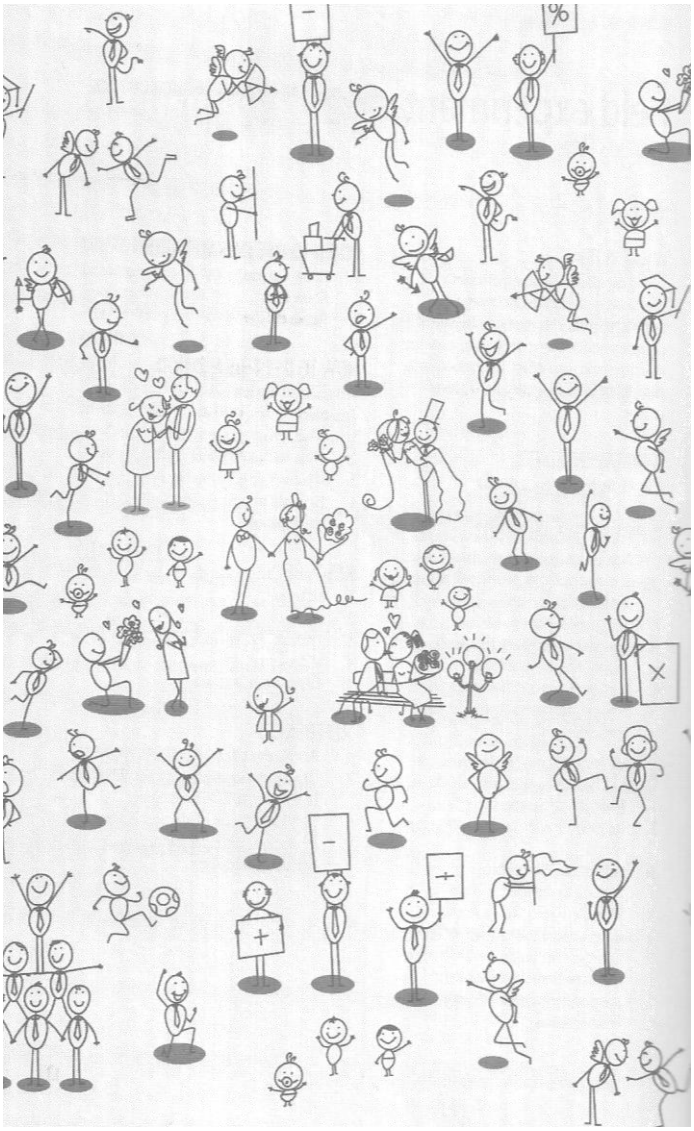


Figure 27 Drawing Experiences[26]

Using this method enriches the material that is used to deduce the impact of service experiences. It is a graphics based method that relies on the ability of the participants to draw a sketch that describes their encounter with the service environment under study/design. The method can help teams identify caveats of service concepts, but the fact that users are restricted to express themselves through drawings does not help the designers to get a more comprehensive review of the concept.

[26] (Curedale 2013)

3.18 Empathy Map

(Gray et al. 2010)

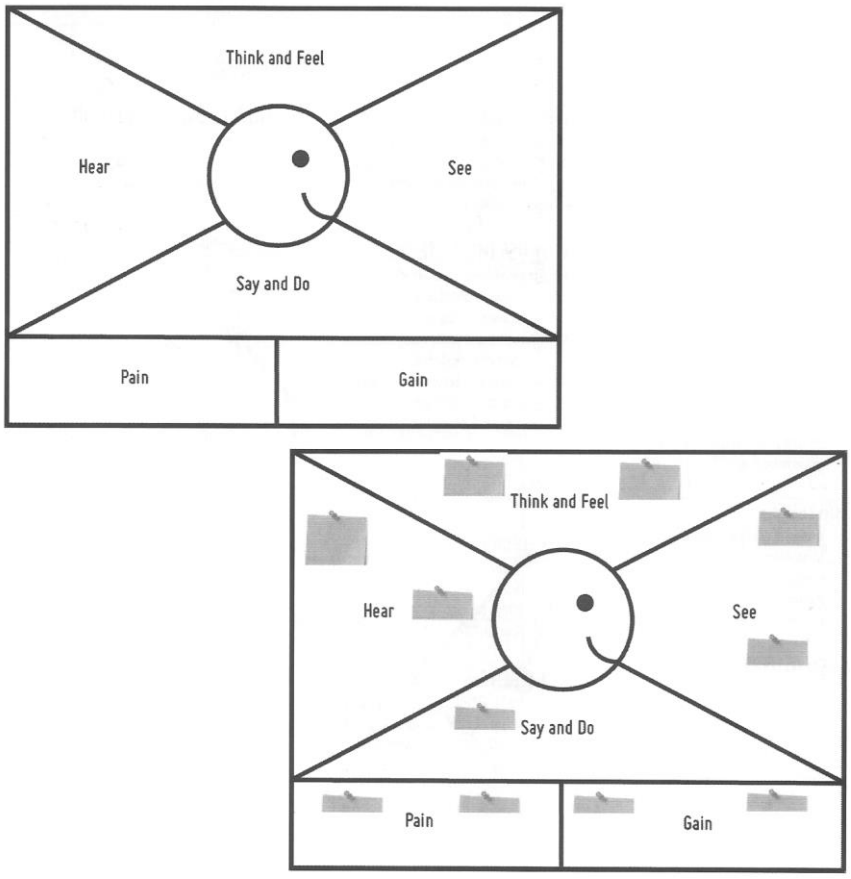


Figure 28 Empathy Map[27]

The value of empathy is evident in the analysis of dramaturgy or in videotaping. It is an important cognitive component for almost all attempts of people that try to put themselves in the viewpoint of another human being. This method attempts to organize and use a template on defining the conditions under which the empathic approach should be attempted. Using four dimensions that orbit around the person in question it deals with the perception of stimuli and the reactions to them both internally and externally. On the bottom of the "map" areas that describe the needs and problems of this person can be found. Personas that were developed as exemplary users can be used as input for this mapping activity. When an empathy map is drafted, the service concept is distilled to the essential experience of the users' interaction with it. This may be only one of the two parties involved in the system, still as the services are user-centered, positive findings of this process should be reviewed as prerequisites and negative as mandatory improvement points.

[27] (Curedale 2013)

3.19 Fishbone Diagram

(Ishikawa 1976)

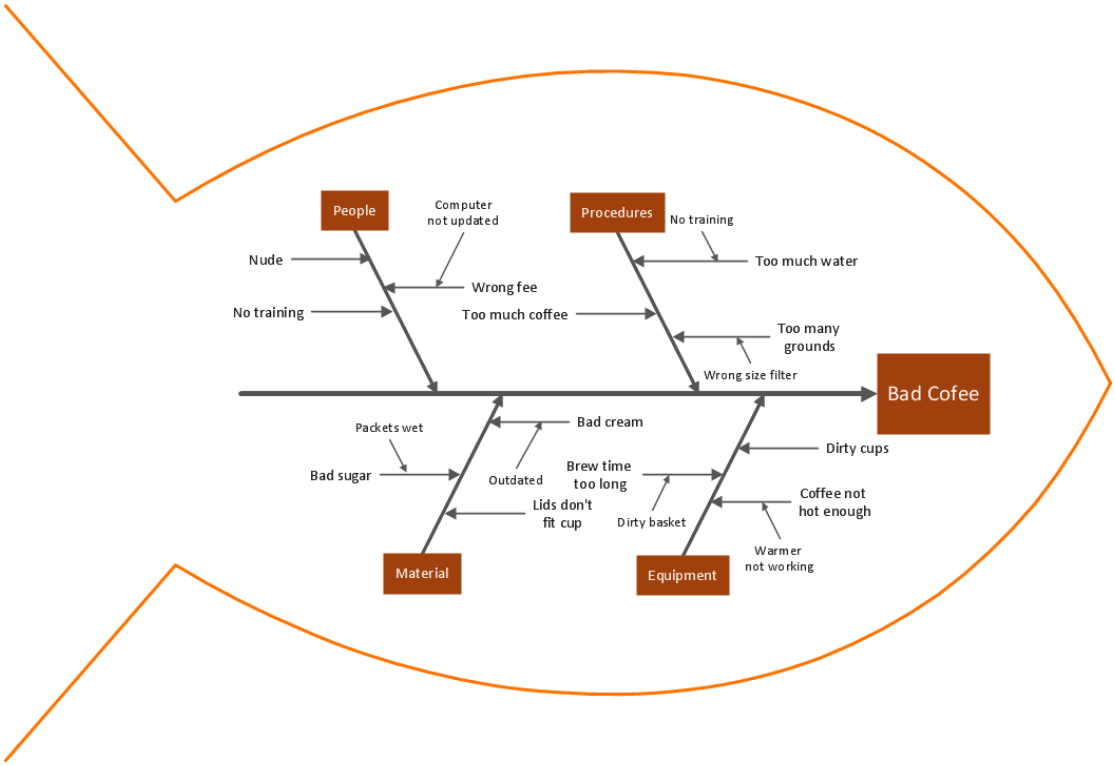


Figure 29 Fishbone Diagram[28]

The method was developed to let the factors contributing to a problem emerge from analyzing a system divided in discrete partitions. Serving its original intend, it is a valuable tool used in the service design discipline too. Still, it can be used as a service concept descriptor if the question posed at the origin of the diagram is the core service delivered to the user. It can also be the value added or the desired outcome rather than a service category label. The analysis to materials, methods, man, machine, nature and maintenance can be used to identify and complete the list of requirements to accomplish the goal stated in the origin of the diagram. It can be considered as an analogy to reverse engineering in the service design world.

28 http://www.conceptdraw.com/How-To-Guide/picture/Fishbone-diagram-example-Bad-coffee.png

3.20 Force Field Analysis

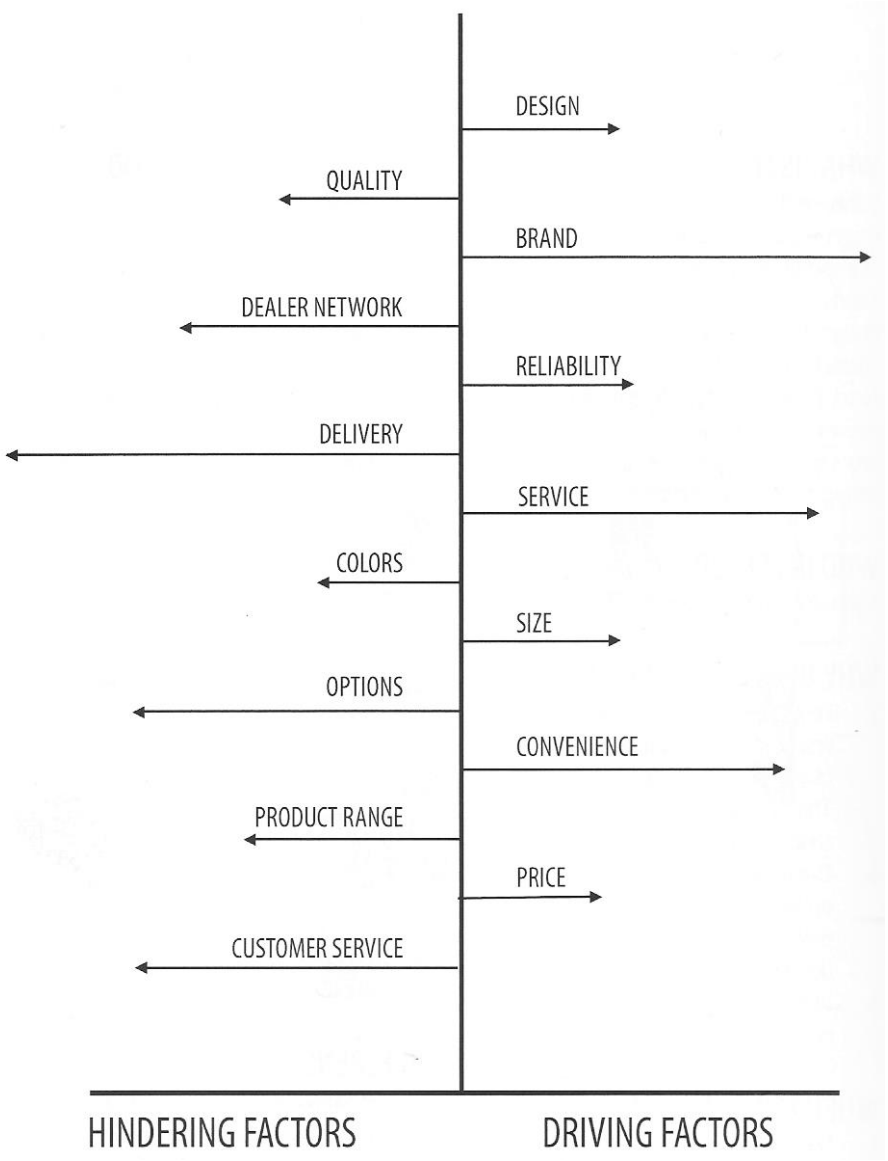


Figure 30 Force Field Analysis[29]

In this tool the objective is to analyze the factors that play a significant role in advancing or hindering the development of a project (Curedale 2013). It is a framework-setting tool and offers a binary compass to estimate the influence of parameters on the concept. Although qualitative and not precise quantifiable, it offers some sort of weighting of the factors as the arrows that represent them have different lengths. As a result of its qualitative nature it is inherently subjective but compensates by using real factors as they are identified in the team process.

[29] (Curedale 2013)curec

3.21 Group Sketching

(Tassi et al. 2009c)

Figure 31 Group Sketching[30]

Mood boards and collages provide an outlet for artistic content generation or framework setting. In the same mindset the instinctive creative urge to describe a situation or an idea with a sketch is satisfied through this activity. The group can co-create on a shared drawing surface and interact on the task at hand, whether they are geographically on the same place or connected via software (Greenberg & Bohnet 1990). The result can be a storyboard, a touchpoint map or any other graphical tool, depending on the research question posed.

30 http://www.servicedesigntools.org/sites/default/files/res_images/GROUP_SKETCHING.jpg

3.22 Integration Definition for Function – IDEF0-3

(Morelli & Tollestrup 2006; Wikipedia 2015; Kim et al. 2001)

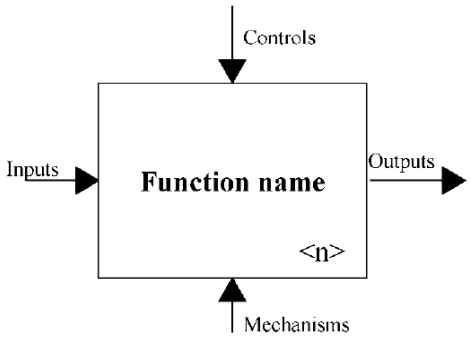


Figure 32 Basic IDEF0 modelling construct[31]

Integration Definition for Function is a flowchart derived, technical graphical language that is used to describe systemically the functions of organizations. It can depict a service in terms of function blocks that have inputs and outputs as well as from different perspectives. The creation of such a graph can help coding the service in a metalanguage (Tackenberg et al. 2010), which aids the further investigation of the service on virtual platforms, or can be used to strictly and precise define the functions and resources of a concept.

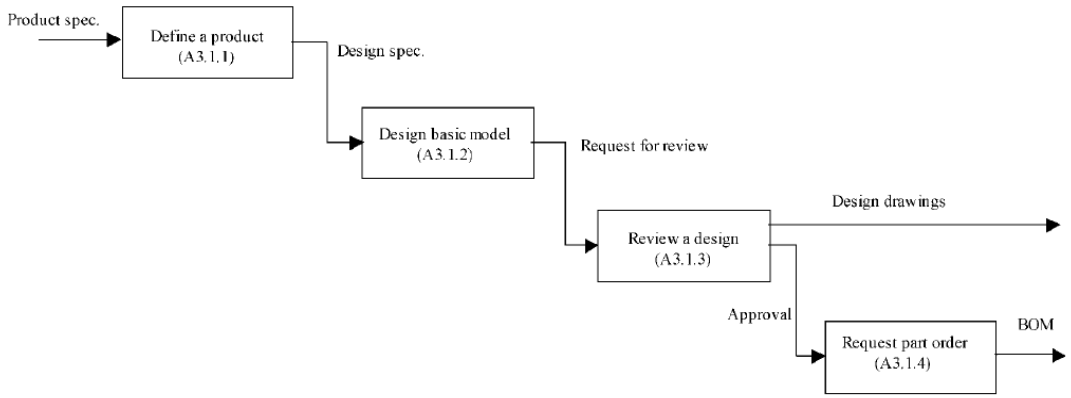


Figure 33 Reduced IDEF0[32]

[31] (Kim et al. 2001)
[32] (Kim et al. 2001)

3.23 Knowledge Management Software

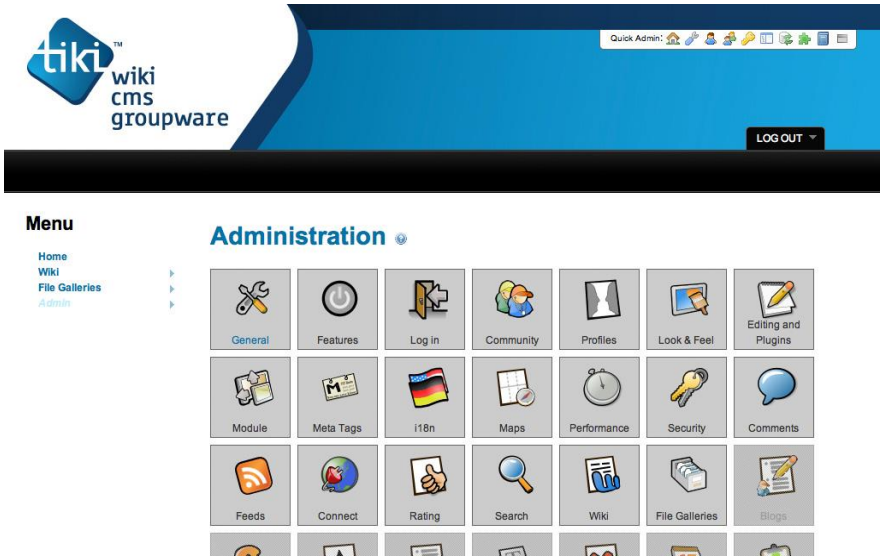


Figure 34 TikiWiki®[33]

Software tools for Service Design can't be found in abundance, even though the new discipline was developed contemporary to major informational revolutions. However, as a design discipline, it's practitioners creatively adapt and use tools that weren't developed for it explicitly but can facilitate its design activities. In today's designing world, getting hold of information doesn't pose that great of a challenge in comparison to organizing and making it available in an effective framework. This task can be carried out efficiently with the help of wiki style content managers like TikiWiki® and Mediawiki®, who can handle documents, graphics, videos and any kind of content and most important of all allow users to interact between them and comment on it. Several attempts made (Wodehouse et al. 2004; Hadley & Debelak 2009) showed that expected advantages were confirmed and the compatibility with younger generations way of perceiving collaboration. Of course as mentioned in one of the studies (Hadley & Debelak 2009), multiple channels of communication can dilute the value of this tool. It is problematic to add or impose another software tool to facilitate design when there are established and mature tools like email. With Web 2.0 being the standard mindset, cloud providers like Google® and Microsoft® can offer ample space and tools to allow teams to collaborate in service development processes. Generic office software like Powerpoint® and Excel® is already used in various methods like Blueprinting or Flowcharts and even Wizard of Oz, making the cloud and collaborative versions of office software suites the up-to-date tools to use.

[33] http://installatron.com/images/remote/ss2_tikiwiki.jpg

3.24 Laboratories

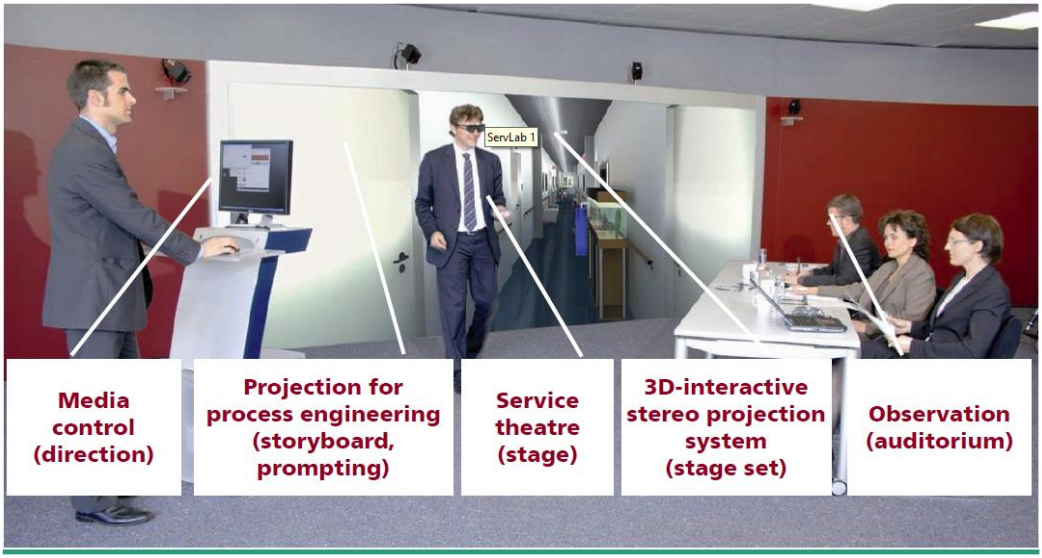


Figure 35 ServLab FhG IAO[34]

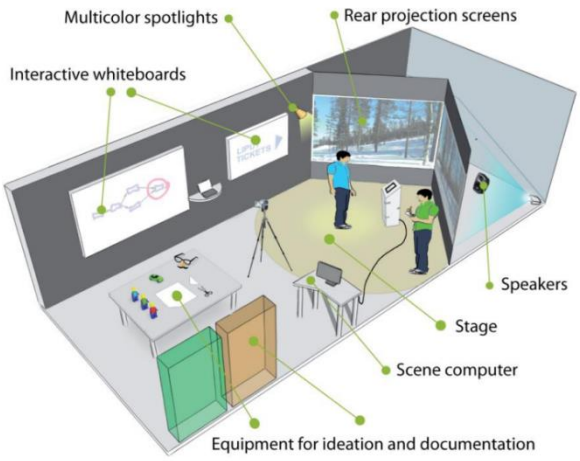
Laboratory installations dedicated to service design are a unique category by themselves. If not all, the vast majority of them use some or all of the methods examined. Still there are some exceptions like the S-Scape and it's SPD and SPDL tools (Lee et al. 2011), that were developed to assist the efficient and structured operation of the laboratory. The focus of these organizations also vary and spread across the whole spectrum of service applications. From PSS oriented to pure services, B2B and B2C along with strictly public policy or social innovators and researchers. The people and the resources also vary, from pure private to academic and mixed schemes. Noteworthy is that they use digital technologies in different intensities. ServLab and S-Scape have developed immersive VR systems whilst SINCO uses an orthogonal projection setup to emulate different surroundings.

What is common in every lab is that the analysis is a main deliverable of the process. Besides the analysis, visual deliverables include videos, real life enactment, VR enactment and facilities to deploy designing and development activities. Laboratories are a vast subject in depth and width, that cannot be analyzed in a few pages, a table with links to websites and/or papers can be found in the Appendix A. To summarize, their main contribution to service

Figure 36 Overview of SINCO

[34] (Meiren 2015)

design visualizations can be considered that they are a testing bed with an array of tools at arm's reach.



[35]

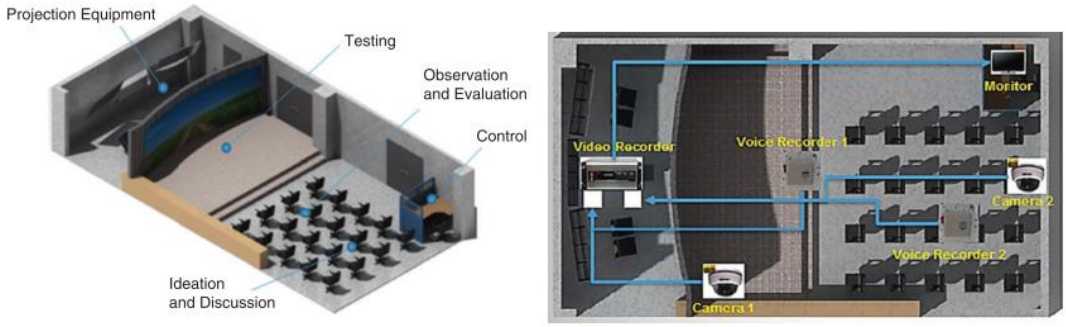


Figure 37 The space structure and recording system of s-Scape[36]

[35] (Miettinen et al. 2012)
[36] (Bae & Leem 2014)

3.25 Lego Serious Play®

(Tassi et al. 2009d)

Figure 38 Lego Serious Play IHU

Service design teams use this technique for a variety of reasons. Besides the obvious use of creating a servicescape with the help of the famous LEGO blocks, it is a way to initiate a deeper dialogue on the problem laying ahead (Moritz 2005). Despite the association to child's play, learning theories supporting this tool are widely accepted such as constructionism (LEGO Serious Play 2002). A byproduct of using this tool is the strengthening of the team's bond through the ritual of playing (LEGO Serious Play 2002). As the concept or the servicescape materializes, even in this symbolic form, details and possible caveats can be spotted. The result can vary from being a rough representation of the environment in which the service will be placed or to a detailed blueprint or storyboard and therefore the method can be used from idea generation stages to low fidelity simulation.

3.26 Low Fidelity Prototyping – Rough Prototyping – Mock Up

(Curedale 2013; Tassi et al. 2009h)

Figure 39 Smart Street Project Rough Prototyping[37]

Designers and design teams tend to have an exceptional ability to mentally visualize, materialize and explore concepts that are even roughly outlined. Still, in a team like this the differences between the mental implementations amongst them may vary a lot. This discrepancy can be dealt with prototypes, even rough ones, because the physical existence of objects leaves less free variables for misaligned expectations between the designers. Since costs can escalate easily in this method and the result is fundamentally different, low and high fidelity prototypes are considered different approaches to the problem. Besides fidelity level, real prototypes tend to serve other functions of service development procedures. Another benefit of having a prototype is that the materialization in the real world highlights unaddressed or misjudged parameters that have to be dealt with. The degree of fidelity may vary from simple illustrations on a sketch board providing background to semi-functional environments.

37

http://www.servicedesigntools.org/sites/default/files/res_images/ROUGH_PROTOTYPING_0.jpg

3.27 [38]Mind Map

Mind maps are an extremely versatile tool that can be used in different scenarios of the steps in a creative process. The activity is team-oriented but leaves room to each participant to contribute both independently and collectively. Participants may build upon others' ideas and expand further but have a choice to start a new branch of thoughts that weren't covered yet. This type of enrichment to the team's pool of elements and ideas to be used, is vital as it can provide solutions to process problems as well as define requirements and/or an agenda for the service. The structure of them is rather relaxed but not lacking of prioritization at the same time, still there needs to be some sort of rule to prevent this method from perpetual aggregation of branches. They can be used from the initial steps of idea generation to

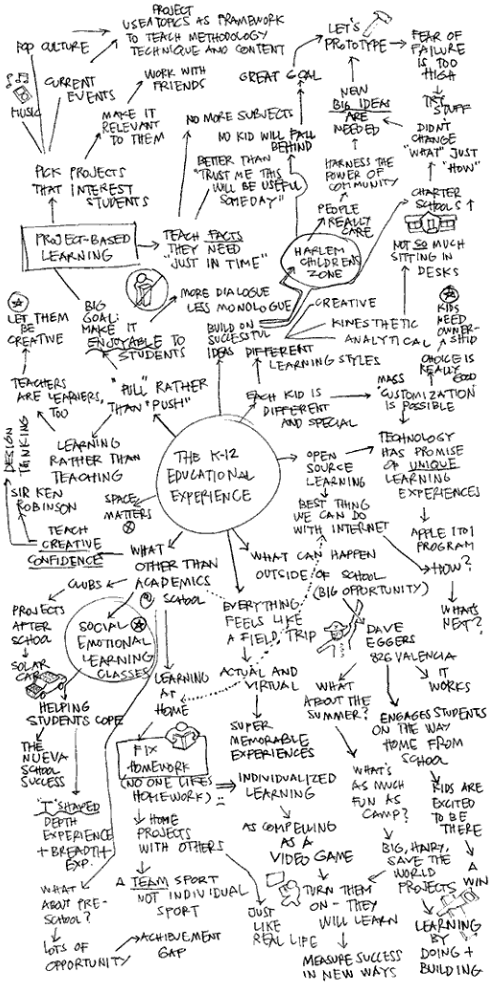


Figure 40 Mindmap

the service development steps as a core tool and can be valuable documentation and referral lists for the further down the path steps like prototyping and launching. The adaptability of the method makes it ideal to be implemented to a piece of paper up to specialized software. The latter is of course preferred as an indexed and easily shareable form of documentation. These documents are rather better suited to smaller groups as the addition of a great number of nodes to them may lead to an unfocused or hard to follow map. This also makes them unsuitable for general use in the lifecycle of the service after its launching as they are predominantly creative tools. An approach for cooperative mind mapping is the pin card method developed by W. Schnelle (Curedale 2013). In this variation the nodes are created by participants and reviewed by their peers. Then the nodes are grouped and presented to formulate the solutions generated to the central questions.

[38] (Curedale 2013)

3.28 Mood board

Figure 41 Moodboard

Mood boards are important breeding beds to grow new ideas on and synthesize in the product development world. This applies to the service design world as well. The abstract and yet in context nature of mood boards allow them to be adaptable to all sorts of requirements and situations. Mood boards can be created to summon up the facts and elements that will constitute the service or portray the outline of an environment or a scenario of usage to allow a team to deepen it's understanding of, and empathize with, the case. It is a valuable tool that is highly creative and the research needed for the creation of the mood board itself is an enrichment to the content of the building elements and clues that will be brought together to a comprehensive service.

3.29 Offering Map

(Tassi et al. 2009e; Pacenti & Sangiorgi 2010)

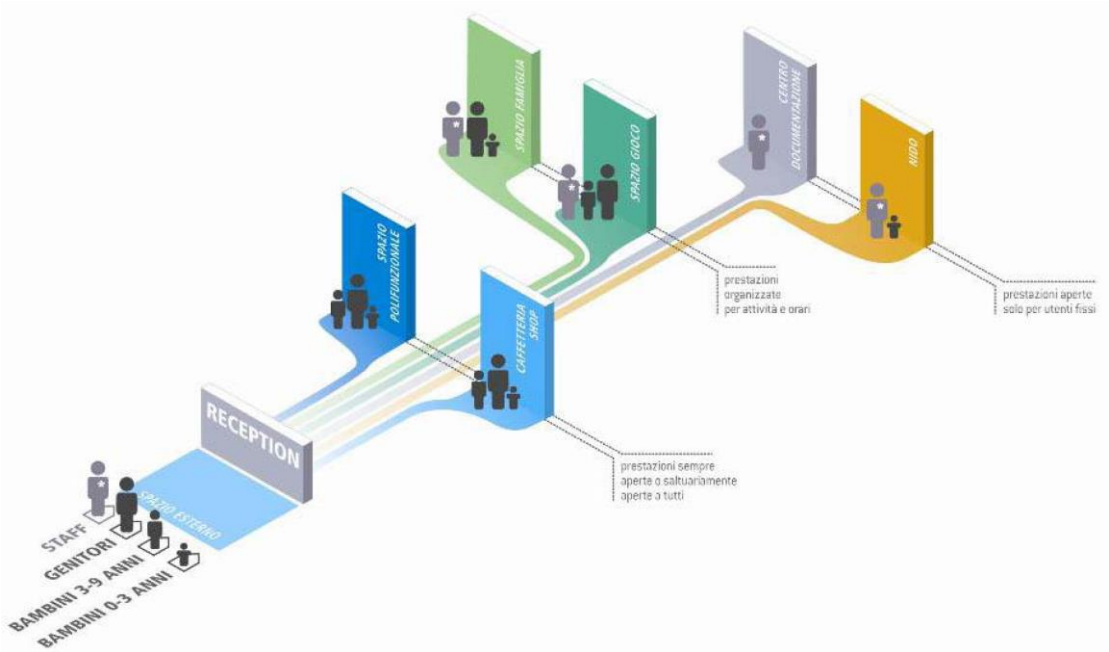


Figure 42 Offering Map[39]

The Activity-centred Design as a guideline (Maffei & Sangiorgi 2006) offers tools that map a service based on the nodes that are created by the different activities that constitute the service. This tool has a native advantage as a specification list of modules required for the service to function as planned. It clearly defines all required steps that are needed to navigate through the procedures and displays their interrelationships and dependencies. For a complicated and diverse in procedures service, this tool breaks down the workflow into discrete and manageable steps. Actors that are to play a role in each activity can be listed too (Tassi et al. 2009e), thus including the human factor as a variable too.

39 http://www.servicedesigntools.org/sites/default/files/res_images/L-15_schema%20persone.jpg

3.30 Open/Closed Cards Sort

(Nielsen 1995; Spencer 2009)

Figure 43 Open/Closed Cards Sort in action[40]

Very often cards are used in creative processes to organize material or to fuel the creativity of the team. In the case of open or closed cards sorting, the goal is to organize cards with various messages in categories (predefined or not). This leads to an interpretation phase of the findings that draws helpful conclusions. Although the method does not provide a concept of service to work on, if used on potential users, it reveals the way that the users perceive some notions. In this context it is a valuable instrument of requirements definitions, provided that the interpretation is successful. Another use of the card sort is to display aspects of concepts, like touchpoints (Jamin Hegeman et al. 2007) on a single card. Again the arrangement that will be used to organize the cards will form a more comprehensive picture than each card separately.

[40] https://www.flickr.com/photos/rosenfeldmedia/3343498557

3.31 Personas

(Cooper 1999)

Figure 44 Personas in Templates[41]

The invention of personas is credited to Alan Cooper and has been used in a wide array of design disciplines. In this method attributes that constitute a unique person are ascribed to a fictional character. Once the description of the character is complete, a concept can be evaluated through the subjective lens of this character, or it can be used as a seed to develop a new service concept. The intention of use determines where the data of these characters will come from and the degree to which they will reflect the segmentation that marketing i.e. proposed (Tassi et al. 2009f). It is important to mention that personas and their credibility play a vital role to all dramaturgy methods, virtual or augmented reality simulations and in general in any process that a plausible character has to interact with a service system.

[41] http://www.servicedesigntools.org/sites/default/files/res_images/persona.jpg

3.32 Pictive

(Curedale 2013; Muller 1991)

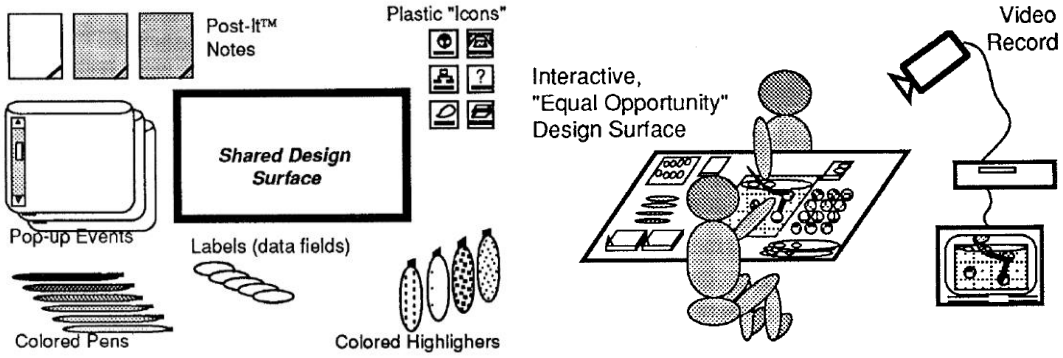


Figure 45 Pictive Elements and setup[42]

This technique combines the creative elements of collage and moodboards with templates and predefined elements to simulate interfaces. The original method was used to encourage members of teams to participate in the design process (Muller 1991). The sessions are meant to be recorded and the footage is to serve as additional input to the development as it captures nonverbal feedback to the interfaces proposed. In the case of computer programs interfaces the method is clearly a low fidelity prototyping one, papers and cut-outs are used to emulate the actual elements of the interface. Still, the detail level of the design is not restricted as the freedom that the method provides allows for a versatile customization at insignificant time and effort cost. The method resembles the storyboards of human interactions and is to a point a storyboard of an interaction between machine and human.

[42] (Muller 1991)

3.33 Picture Cards – Ideo Method Cards – Greeting Cards

Figure 46 Issue Cards[43]

Using card games to initiate the design process is a proven way to approach the problem at hand. In the case of Ideo cards specifically, an added advantage is that the cards are not just probes to stimulate imagination and inspiration but also provide a rough outline as they are divided in four categories: Ask-Watch-Learn-Try. With the framework set, the Ideo cards can be a starting point for discussion but also when compiled in alignment to a service proposition, a full description of the concept. One could consider them predefined elements of collages or mood boards. As Ideo themselves point out, the collection is open to additions as needed by the application or the team specifics (IDEO n.d.). A variant of cards is also the pattern language as described by the original work and the generalization of it (Alexander et al. 1977; Curedale 2013).

43

http://www.servicedesigntools.org/sites/default/files/res_images/1441632482_fa9109407d_o.jpg

3.34 Problem Tree - Objectives Tree

(Curedale 2013)

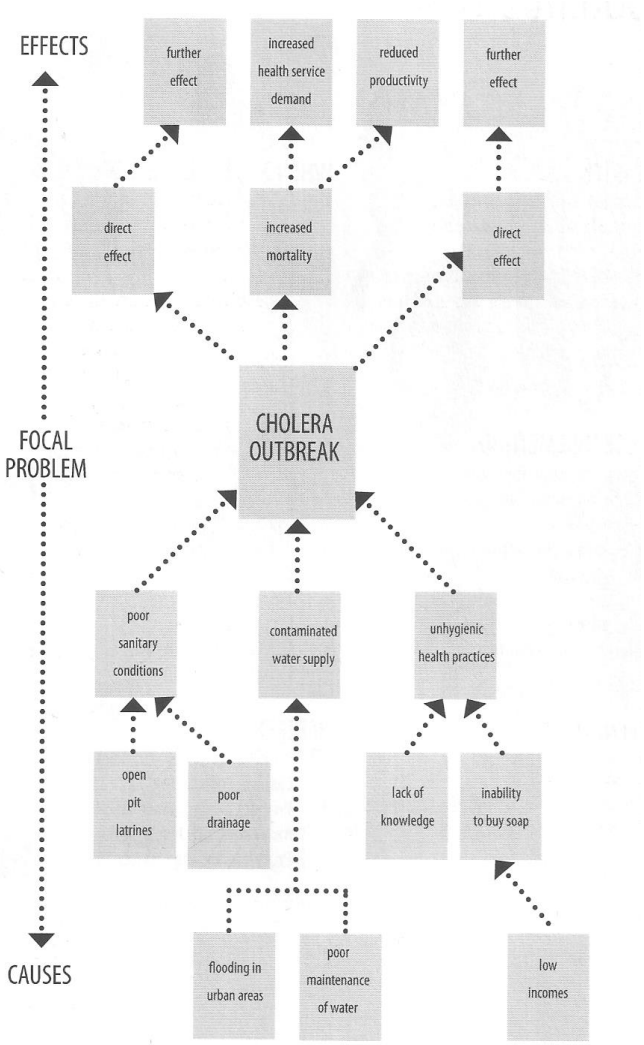


Figure 47 Problem Tree[44]

A mind-mapping variant, closely related to the futures wheel as well. A cause and effect diagram, enabling the creators of these graphs to assign effects to causes or vice-versa. The main idea behind this method is to organize and systematically record incremental analysis of the actions needed to take or the actions that lead to an event. It is helpful in strategic planning of initial ideas exploration but also in the iterations or prototype analysis during the later steps of development.

[44] (Curedale 2013)

3.35 Process Chain Network Diagrams – PCN

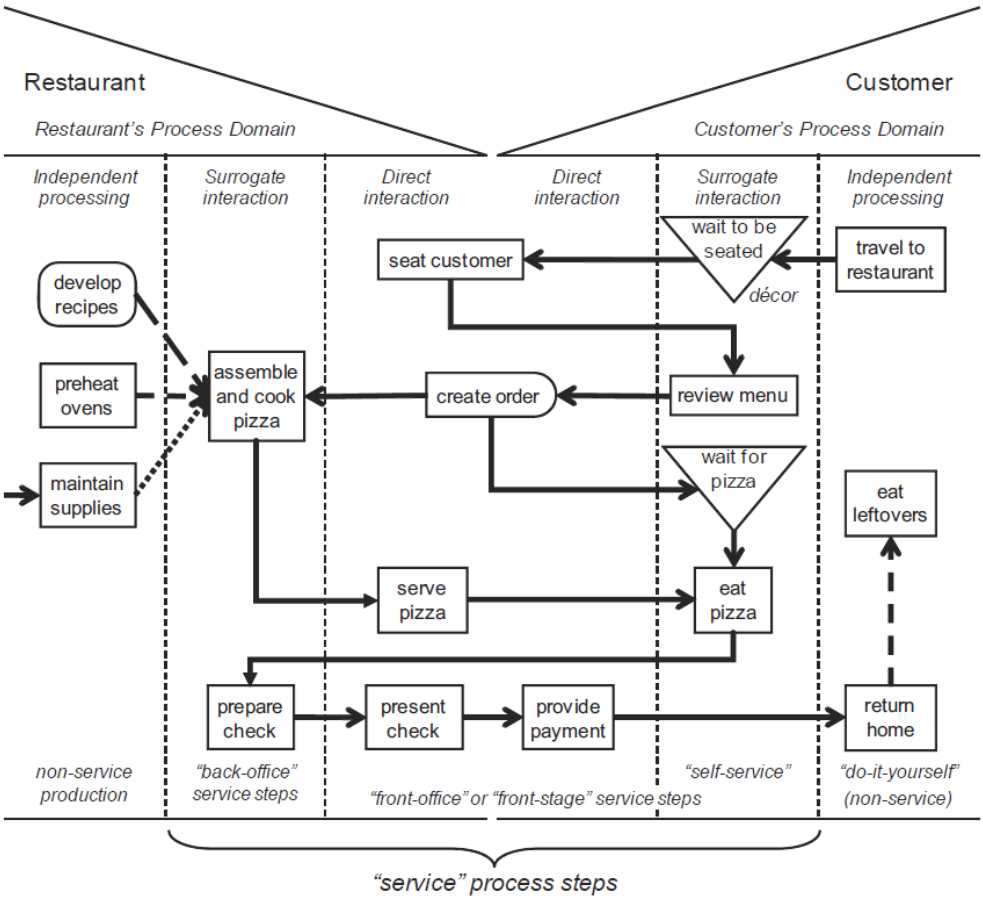


Figure 48 Process Chain Network Diagrams – PCN[45]

Process Chain Network Diagrams are based on Blueprinting and Flowcharts; this method successfully combines the merits of both methods. Not only does it put on paper the entities involved and the processes that take place but it also addresses the problem of playing down the processes of the users involved in the service system (Sampson 2012). Inherently from blueprints and flowcharts, PCN diagrams list tangibles and flow of information but the conventional swim-lanes approach of blueprinting is replaced by a vertical arrangement classified by interaction degree. Although it is an analytical tool that can present the full extent of the service, it can be applied to model process steps of the service too. It also includes information from other business units, such as marketing and operations management. The most significant diversifying factor of this method is that it includes a more detailed picture of the proceedings on the users' side and allows the service design team to handle the user in co-producing scenarios in a more detailed way and with the same terminology and analytical depth as the providers' side.

[45] (Sampson 2012)

3.36 Product Service System Board – PSS Board

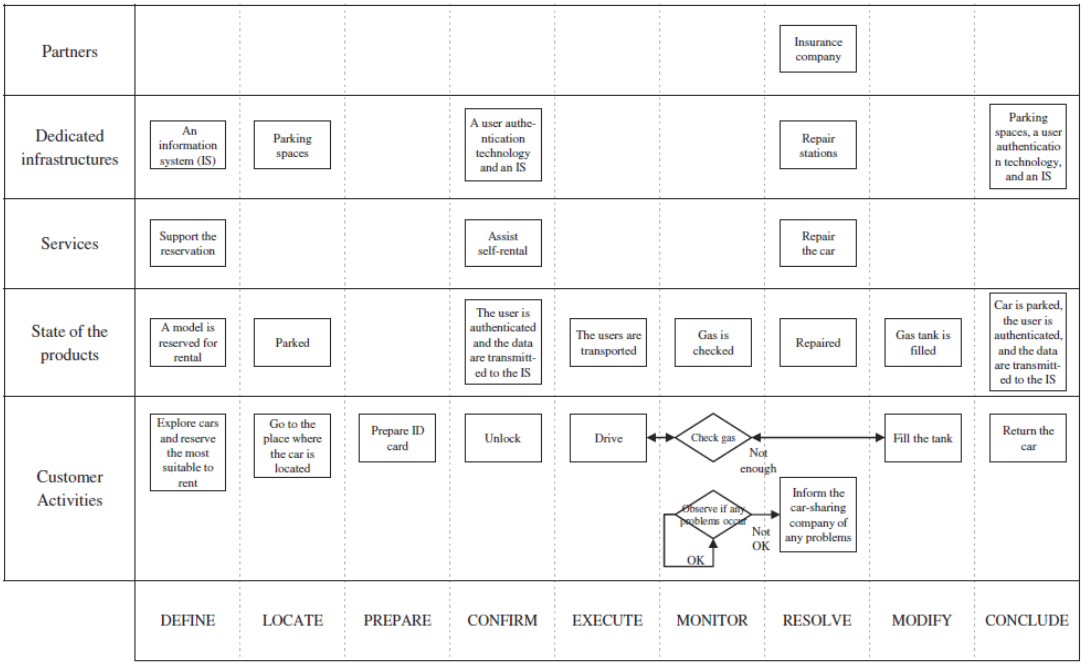


Figure 49 Product Service System Board — PSS Board[46]

When studying the service world, it is clear that most services although immaterial in nature (Zeithaml et al. 1985), contain a certain mix of tangible factors that may be either produced in the procedure or enable the service process to be deployed (Holmlid 2007). The broader assessment of a service may require to design the material elements and include them in the development process not only as a touchpoint but also as a frontline actor. The Networking Actor Theory lays theoretical ground for such an approach and practically it can be dealt with tools like PCN, mentioned above. A Product Service System Board (PSS Board), is the adaptation and modification of conventional service blueprints to an environment of mixed tangible and intangible actors (Lim et al. 2012). Retaining the familiar shape and structure of blueprints, the PSS alters the diagram by adding a stepped process dimension that indicates the process step the asset-actor is in and extends the actors to stakeholders like outsourcing partners and dedicated infrastructures besides the product. Flow chart elements for decision and state changing events are used to document the interactivity between elements of the board. It is a structured method as the developers intended it to be and successfully integrates the product actor with the service process in a single framework.

[46] (Lim et al. 2012)

3.37 Real Prototyping

Figure 50 Real Prototyping[47]

Depending on the resources available, a prototype of a service may be a part of the visualization of a service. The procedure of creating a prototype calls for a preconceived plan of some form. Following this path of development means that the prototype isn't the first representation of the whole service but still the importance and usability of a prototype is of highest value to projects that are going to be implemented. Specifically, the only definitive way of evaluating process efficiency or validity is by actually deploying the service (Tassi et al. 2009j). The use of this tool is more often used in the testing phase, still if the resources are available it is one of the most accurate visualizations of a service concept. Given that the design process is iterative, the testing through experience prototyping (Buchenau & Suri 2000). The adjective "real" is used to differentiate the method from newer versions that evolved through technology like virtual reality and lately augmented reality prototypes that don't include real users and providers.

47 http://www.servicedesigntools.org/sites/default/files/res_images/SERVICE_PROTOTYPE.jpg

3.38 Repertory Grid Analysis

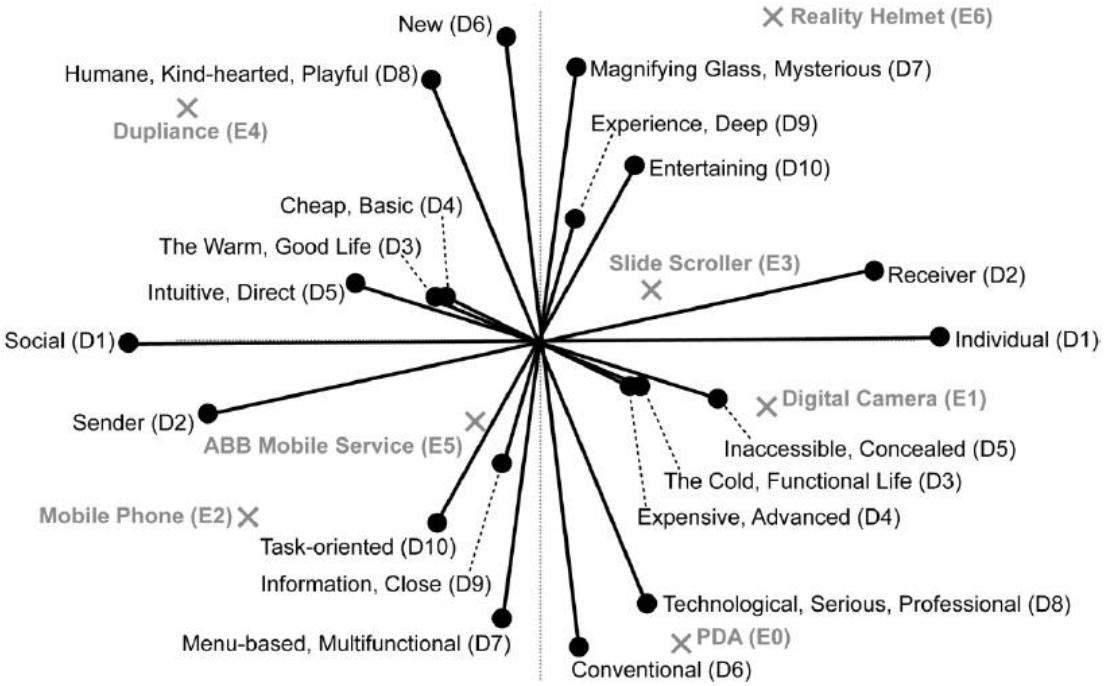


Figure 51 Repertory Grid[48]

A great and unbiased tool to explore the personal constructs of users is repertory grid analysis. With the help of data from the statistical analysis and the correlations mapped, comparing the inputs from a great number of subjects can enable a research team to understand and identify the most important aspects of a service proposition and also to delve deep into the common constructs of a group of people and identify patterns and similarities between elements (Kelly 1955). Each person perceives and interprets stimuli based on predefined experiences, thus associating the unknown to known facts. The predefined frameworks of our perception are called personal constructs. The freedom that the method bestows upon the interviewee puts him in a position to possibly externalize the deepest and most unbiased personal constructs regarding the subjects in question. It is a valuable and unique method that allows the quantification and illustration of the divergent subjective perception of common subjects.

48 http://markheckmann.github.io/OpenRepGrid/visualization_biplot_files/figure-html/biplot2d-transforms-2.png

3.39 Role Playing Methods and Frameworks

Figure 52 Various Roleplaying instances[49]

Six hats (Curedale 2013) is a method that tries to make the most of the distinct viewpoints that the team members have to offer. This is accomplished by assigning to each of the members to shed light on a certain constituent and the results are presented to the rest of them. It is a dramaturgical method since the representative of a hat has to assume a role and act within its definition. A simplified alternative is the “Idea Advocate” (Curedale 2013), instead of approaching the concept from various angles, a single and positive promotional stand is made from a team member. An alternative technique used, is the “If I were you” (Curedale 2013). In this a scenario is introduced and the actors are called to express themselves by describing their viewpoint positively.

A more structured and detailed approach to Role playing is “Role Storming” (Van Vliet 2012). It is a combination of brainstorming and exploratory role playing. Room for exploration of actors and their role is provided while in the same time fragments of the service is being enacted. The goal of this tool is to explore concepts and ideas and report of points of interest using the team at hand, while setting up a creativity fostering environment.

[49] (Simsarian 2003)

3.40 Service Blueprint

(Shostack 1984)

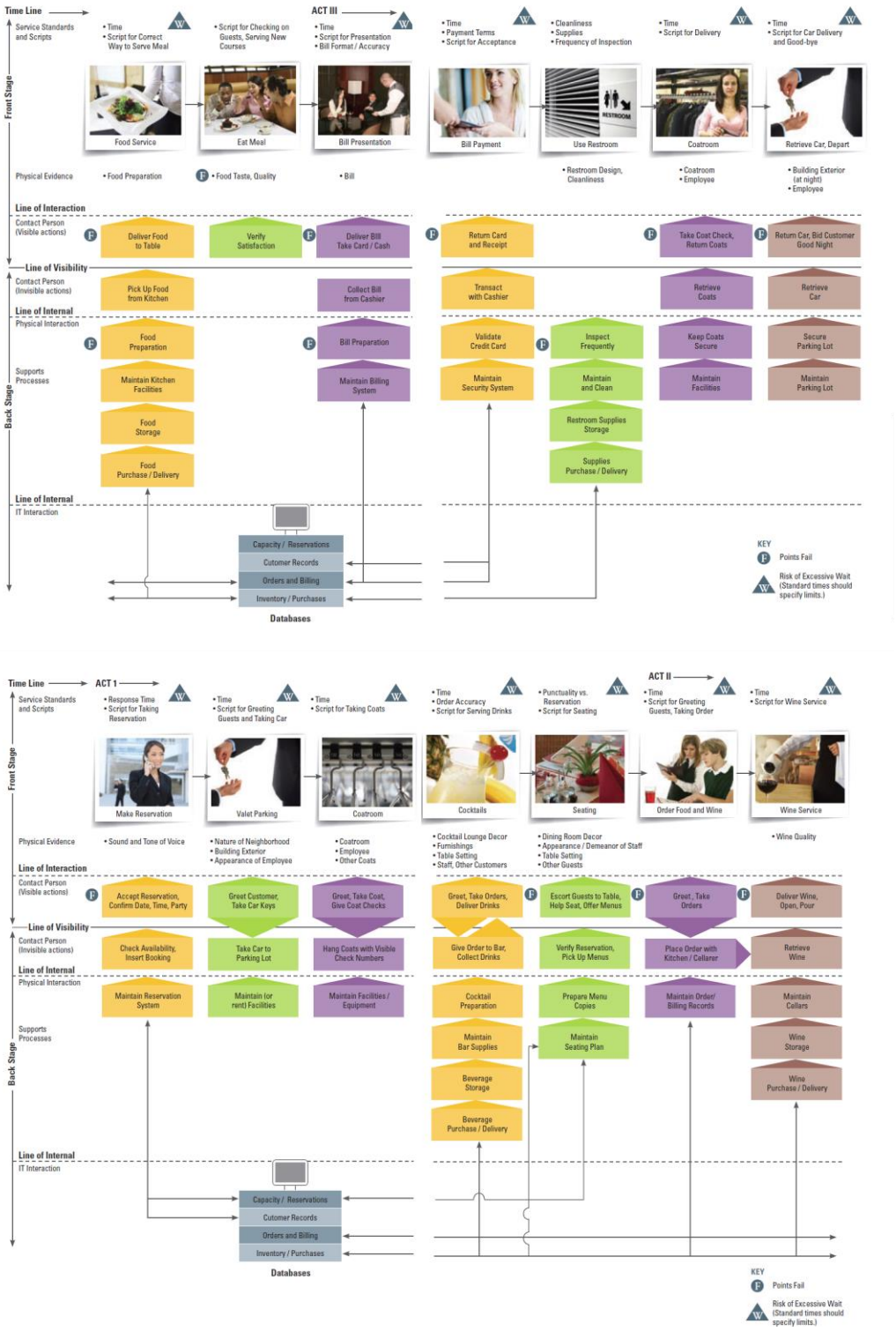


Figure 53 Service Blueprint[50]

[50] (Lovelock et al. 2009)

Perhaps the most famous method and certainly one of the few tools that were developed to serve the new discipline of service design. The method is great for providing a detailed plan of the service to be delivered. It can be enriched as needed, bearing in mind that like any other of the graphical methods too much information can distort the perception of the viewer. Blueprints inform the reader of all interactions that take place and the actors involved in them. The blueprint is a scenario with directions to all participants, the ones that are “on stage”, the ones that will come “on stage” at a later point and even persons that aren’t going to stay “off stage” during the whole course of the service. It also lists material resources needed or outsourced services if the scenario deems them necessary. The service is broken down in activities and in “swim lanes”. Swim lanes by themselves are an important tool, as they describe the milestone activities focused to specific roles. An important addition to the blueprint is the emotional map/experience swim lane that indicates the satisfaction factor of the user during the interaction with the service system. One major advantage of the tool is that it is flexible and open to modifications, yet focused and detailed when drafted correctly. This open structure enables it to incorporate elements of FMEA (Failure Mode and Effects Analysis) or flowchart annotations and to broaden its application range from concept development to implementation and prototyping with ease (Lovelock et al. 2009; Shostack 1982).

3.41 Service Image – Poster – Tomorrow Headlines

(Tassi et al. 2009i; Tassi et al. 2009g; Tassi et al. 2009l)

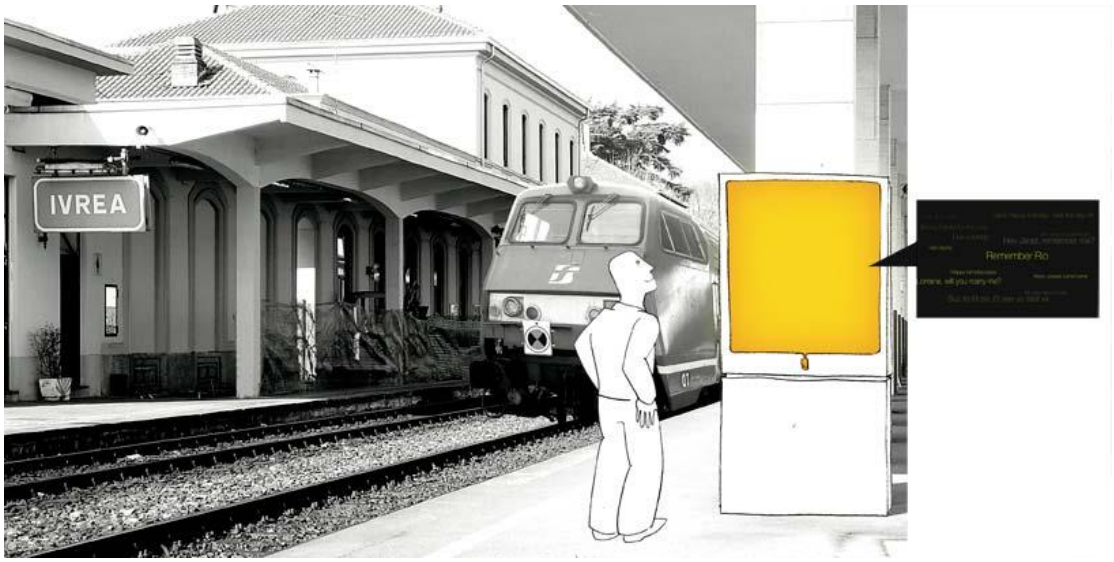


Figure 54 Service Image[51]

These three methods can be grouped together as they all project a snapshot of the service in a fictional world. There exist time-related differences but the common method of creating a single visual cue about the service allows the common investigation of them. These methods intend to both give a description of the service and to stimulate the dialogue between the stakeholders and the team. They also serve as a commonly accepted starting point for all developing parties involved (Tassi et al. 2009i). A more practical use is that the Poster and Tomorrow headlines can provide information from an early stage as to how the new service will be positioned in the existing market (Tassi et al. 2009l; Tassi et al. 2009g).

[51] http://www.servicedesigntools.org/sites/default/files/res_images/SERVICE_IDEA_05.jpg

3.42 Shadowing

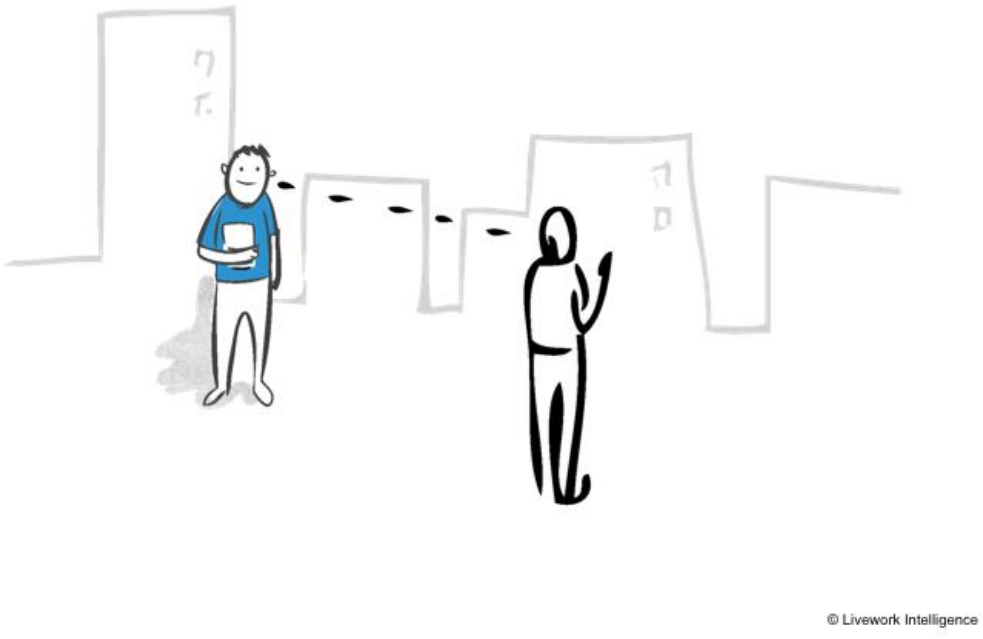


Figure 55 Shadowing[52]

In the spirit of acquiring accurate and reliable data, the obvious step is to collect data at source with as little as possible contamination and alteration by reformatting and putting them into context. This can be achieved by shadowing (McDonald 2005). A visual presentation of data can be found in the method described as “a day in the life” or “fly-on-the-wall” (Curedale 2013). The timeline based method is a detailed log of a person’s day, but the entries are logged by an observer. This is of course a source of criticism as ethical issues may arise (McDonald et al. 2014) or a Hawthorne effect may come into play (McDonald 2005).

[52] http://liveworkstudio.com/tools/shadowing/

3.43 Stakeholder Map

(Mitchell et al. 1997)

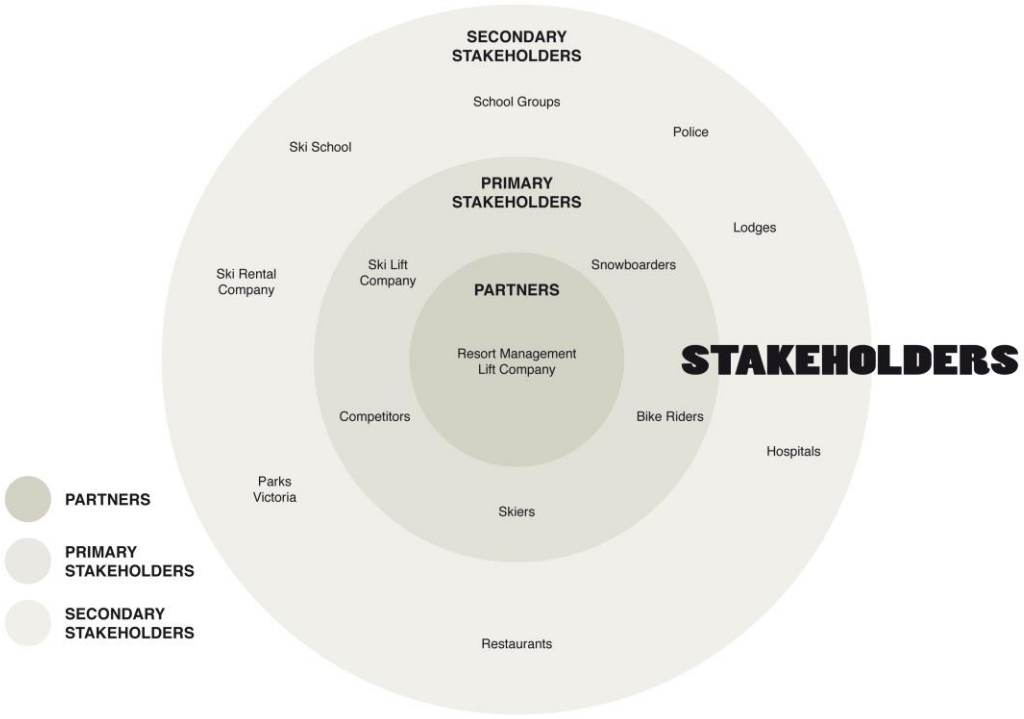


Figure 56 Stakeholder Map[53]

The stakeholder map is a tool to organize the stakeholders of a project in categories and therefore easily define their role in it. It is part of the analysis required in the creation of a service concept as the groups can be the first step in defining the prerequisites of a service concept. Data from this process can be fed in later steps of development i.e. communications map – powergram. Apart from the identification of actors, the map can include information about salience or usage scenarios, refining information conveyed.

[53] https://skibindings.files.wordpress.com/2012/04/stakeholder-map.jpg

3.44 Storyboard

(Hart 2008; Curedale 2013)

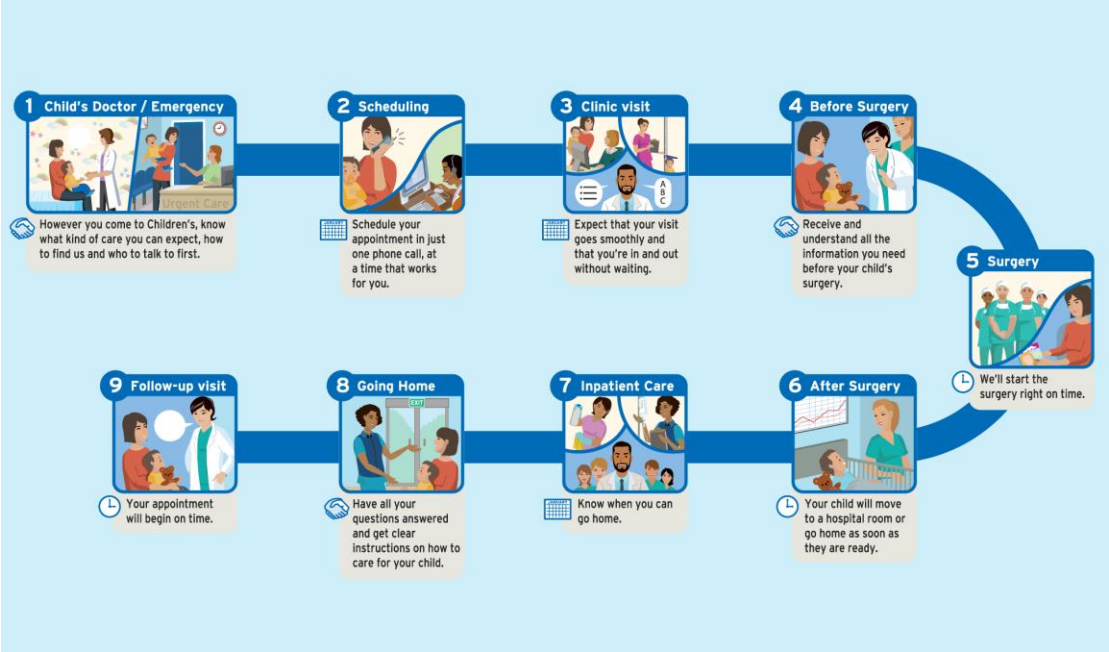


Figure 57 Storyboard[54]

Story boards as we know them in modern filmography are credited to Walt Disney Studios (Curedale 2013), though the technique of visual representations in a sequence to tell a story can be found as early as prehistoric caves or pyramids (Hart 2008; Curtis & Vertelney 1990). The method is timeline based and the service proposition is broken down to major scenes, arranged in a sequence that summarize the interaction. As its origin is from the film industry, it is a scripting method that plans the interaction of the users with a service system but also defines every other touchpoint considered as important in the scenario. Storyboarding is quite similar to the front stage part of a blueprint and a visually enriched version of scripting. The perspective can be adapted as needed, being the users (James Jeff 2012), providers or that of a third observer.

[54] http://www.servicedesigntools.org/sites/default/files/res_images/STORYBOARD_03_0.jpg

3.45 Sustainability Map

(Curedale 2013)

Figure 58 Sustainability Map[55]

Much like benefits map, this is a secondary tool used to evaluate various propositions on two factors, business potential and environmental sustainability. Potentially misaligned concepts are easy to spot and be improved or canceled. A subjective method nonetheless as it relies on the assessments of the team members and not on data.

[55] (Curedale 2013)

3.46 System Map – Platform

(Tassi et al. 2009k; Morelli & Tollestrup 2006)

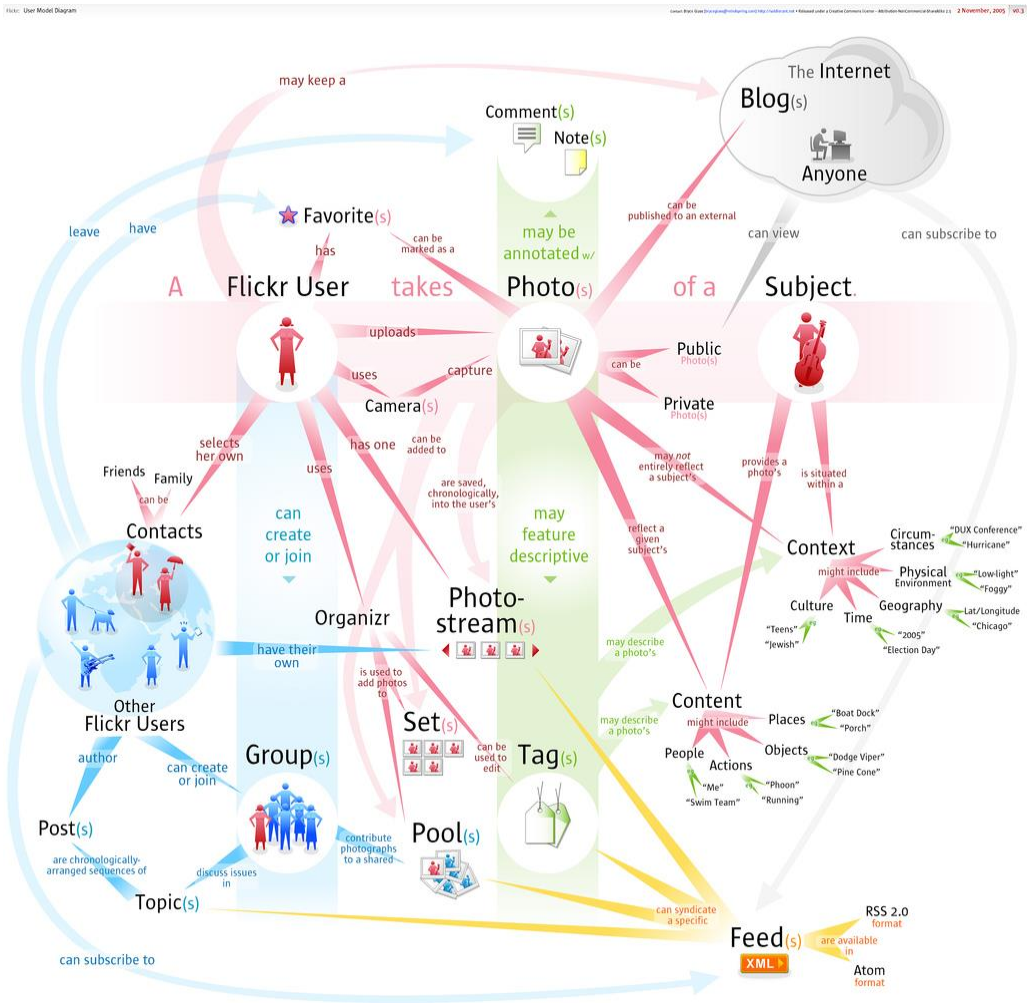


Figure 59 System Map[56]

As services become more complex and are often coupled with products, the need to design them focusing on the whole platform has risen. Tis need is being met by the system map, in which all actors, materials, information and every other participant is placed. The overview of complicated systems becomes easier as the flow between actors and materials becomes visible in such a representation. Although the method offers clear advantages in detail, it requires a meticulous recording of all participants and their interdependencies in the system to be used.

56 http://www.servicedesigntools.org/sites/default/files/res_images/58299511_2bcff18db2_b.jpg

3.47 The Futures Wheel

(Gordon & Glenn 2003; Curedale 2013)

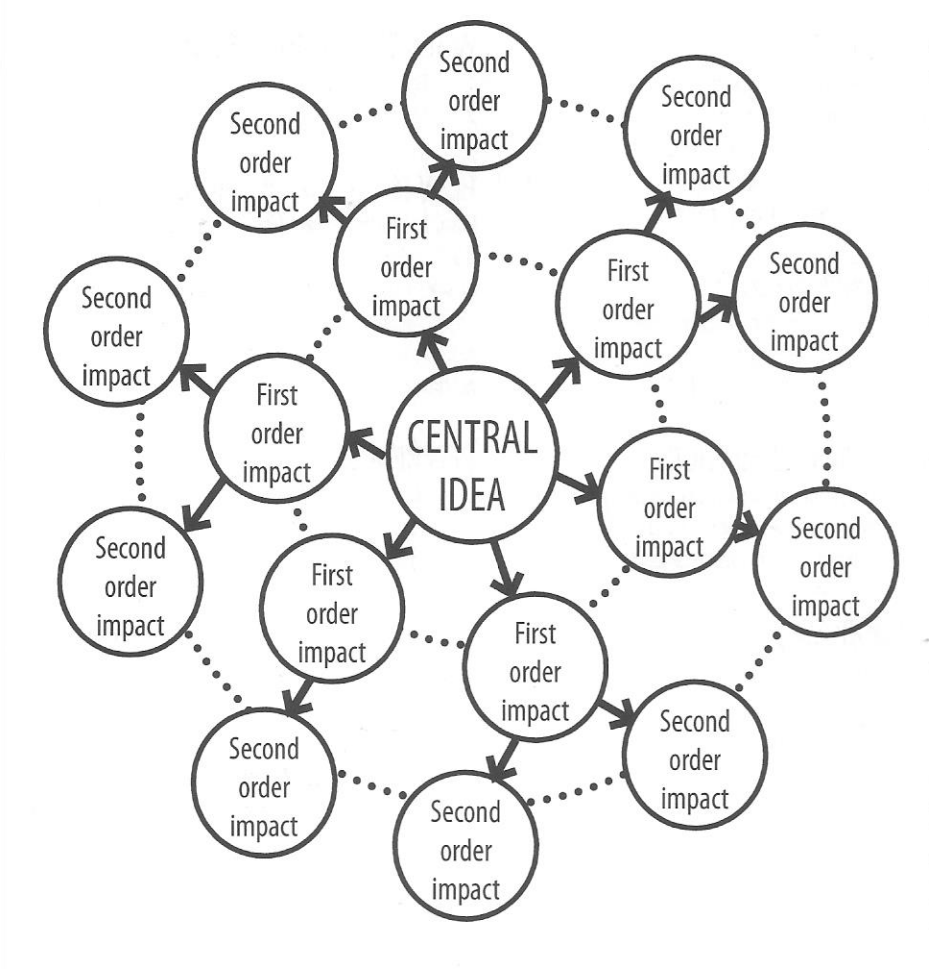


Figure 60 The Futures Wheel[57]

A method that is used to assess and explore the endless possibilities that lie ahead in the future, taking for granted one starting point. It can be used for choosing the basic structural components of a service or to evaluate the impact of scenarios. This is could be freely applied from general assumptions about the impact of the service to distinct service encounter scenarios. A tool to be used in order to enrich and make more realistic the service concept being designed.

[57] (Curedale 2013)

3.48 Touchpoints Matrix

(Brugnoli 2011)

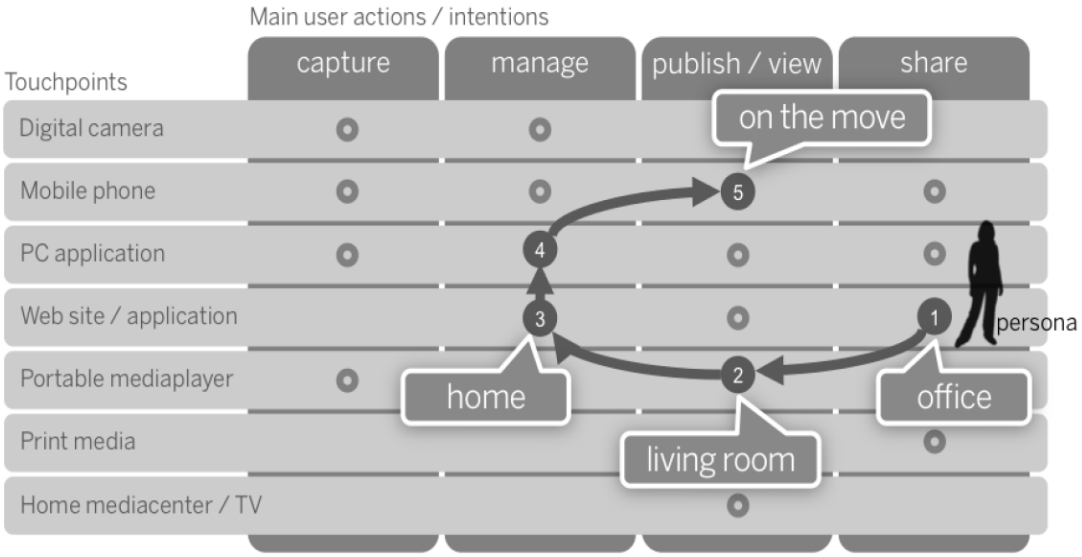


Figure 61 Touchpoints Matrix[58]

In contemporary service world and especially in the digital services, the touchpoints of interaction can be difficult even to enumerate (Brugnoli 2011). The touchpoint matrix is the organized display of touchpoints and their interconnections as the service is delivered. As mentioned above, the systems are becoming more complex and a certain goal may be reachable through different paths. To be able to design the interaction and deliver a homogenous service feeling, the different touchpoints involved have to be identified and therefore included in the design agenda.

[58] (Brugnoli 2011)

3.49 Video Recording of Users

Figure 62 Video Recording Users[59]

This method creates multimedia material that can be evaluated at a later point of time. Evaluating teams differ as the target of the process demands. Teams consisting of designers or a mix of stakeholders are the usual receptors of the material that can be used for almost all phases of the service design development process. From idea generation to the last refinements before full blown roll out and even post launching of the service, this method can fuel any process needed. The success of this method relies both on the analytical skills of the people that are exposed to the material but also on the context that the material was created. The need for affinity with the desired outcome is of high priority as material out of context might provide out of the box insights but is much harder to be linked to a structured method of service design. In any case it is one the most important ethnographic methods, complementing the traditional diaries with sound and picture, lacking only smell and touch to fully stimulate all senses and enable the empathic link between the design team, or stakeholders, and the users. (Curedale 2013)

59 http://www.healthbizdecoded.com/2013/04/qa-meet-ellen-isaacs-corporate-ethnographer-at-parc/

3.50 Virtual and Augmented Reality

Figure 63 Augmented Reality[60]

VR and the evolving AR are being studied and applied in multiple disciplines as their benefit of artificial reality is unique to critical applications. From medicine to manufacturing VR and AR are used to enhance with contextual information and unlimited trials processes and products, whilst minimum impact on sensitive and irreplaceable assets is risked. A framework for non-destructive usage and test of services. In the case of service design, the brand-organization and of course the actors themselves involved are at stake. Given the unique nature of services and the complexity of servicescapes and interactions, VR and AR present unique advantages to test and visualize touchpoints to whole worlds. Besides the dedicated and focused software tools to create these artificial worlds, the online platform Second Life (Kohler et al. 2011) can be used to model a service system and in a co-creative environment. Technological advancements allow immersive experiences to such an extent, that details of service systems can be reliably represented in function too. Still limitations do exist as full interactive environments are costly and hard to model digitally (de Sá & Churchill 2012). Another factor that plays a significant role is the perception of living actors in a VR-AR setting. Human to human interaction is hard to imitate to such an extent that artificiality is not a constituent anymore. It can serve as testing platform but cannot be relied upon to induce the full range of emotions that a human to human interaction would.

60 https://www.google.gr/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwivqejdtrbMAhWIbxQKHaHEBssQjRwIBw&url=http%3A%2F%2Fvrworld.com%2F2015%2F04%2F13%2Fprivacy-matters-the-looming-threat-over-ar%2F&psig=AFQjCNFtAjLhQNVAjwn3kh0r1FZhYAc1Ew&ust=1462107956245467

3.51 Wizard of Oz

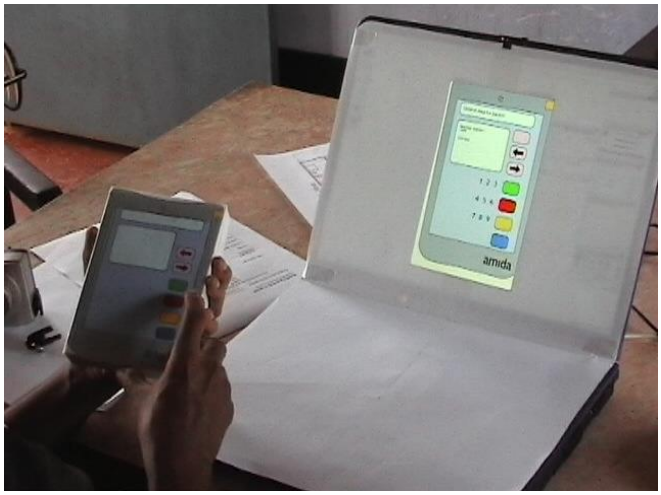


Figure 64 Wizard of Oz Emulation of interface[61]

A method that allows to operate responsive mock ups of user interfaces for computer programs using remote human operators to simulate the response of the program to the interaction. The goal is not only to test “live” systems but also to record the impact of them on the users. It is an inexpensive method to form and test an interface but the consistency of a programmed system is hard to simulate with real humans producing the responses (Curedale 2013). However with the help of specialized software, breakthroughs and stronger commitment from stakeholders to projects are achievable (Molin 2004).

61 http://www.servicedesigntools.org/sites/default/files/res_images/WIZARD%20OF%20OZ.jpg

4. Classification and Evaluation Methodology

4.1 Dominant Constituents Extraction

In order to process the information of Chapter 3 into a categorization and elicit the main constituents that dominate the service development process, a systematic questioning approach whilst delving into details of the process was used. Each questions responses were used as inputs for the next, resulting to hopefully a deeper understanding of the fundamental notions lying underneath the surface. Two structured and similar models were of new service development (NSD) were examined, the first is a model introduced in (Bullinger et al. 2003), and the second is the more elaborated version of Fraunhofer IAO reference model as shown in Fig. 65 (Meiren 2015). As this classification approach is meant to be oriented more towards application, the elaborated version of FhG establishes a link to applied practices.

Figure 65 FhG Reference Model for NSD[62]

The first question to be answered is “What is the development stage that this method refers too?”. As stated above, the answers are provided by NSD structured approach of Bullinger et al. (2003) .

The second question is “What purpose does it serve? What elements does it define?”. This is partly answered by the elaborated version of FhG (Meiren 2015). Some rephrasing and organizing in different groups has been done. This is justified by the indent to steer focus to methods used in the process. Stages that were deemed out of scope, regarding the research question and conditions set in Chapter 2, were omitted. The resulting answers are shown on Table 2

[62] (Meiren 2015)

Table 2 First and Second level of constituents extraction

What is the development stage that this method refers too?	***What purpose does it serve? What elements does it define?***
Idea management	Idea generation
	Organizational Integration
Requirements analysis	Users
	Providers RA
	Stakeholders
Service design	Concept
	Process
	Tangibles SD
	3rd Party Integration
	Concept modeling
Service test	Conceptual test
	Simulation of servicescape
	Simulation of interaction
Service implementation	Process SI
	Providers SI
	Tangibles SI
Market launch	Rollout
	Feedback

The third question that needs to be answered is “What are the dominant constituents?” of the answers to question 2. A careful and iterative examination of case studies and papers resulted to the answers presented on Fig. 66. The reduction of responses is in line with the indent to reveal elements that are core tenets of NSD.

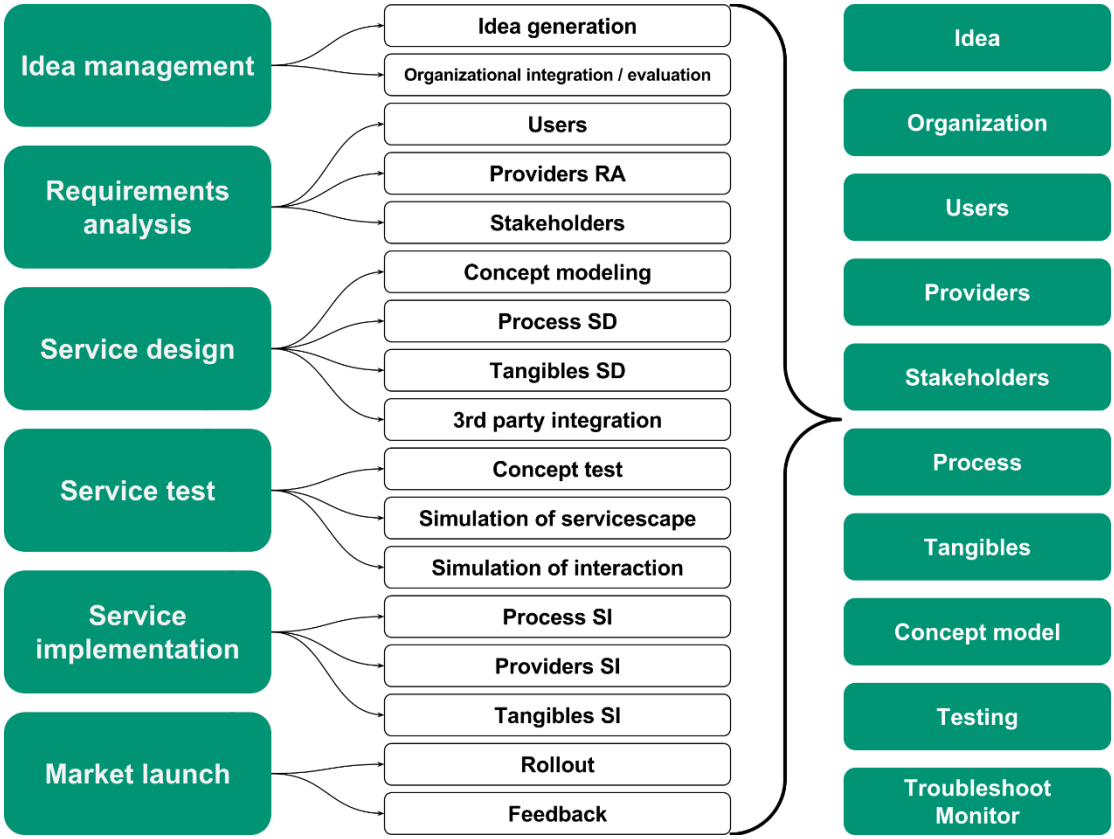


Figure 66 Third level of constituent's extraction

- Idea

This element represents the first exploratory steps to present a possible project to the team. It includes all efforts made to initiate the ideation, be it fact based, abstract or innovative.

- Organization

Within this term every aspect of the organization that host the design and providing processes is included. Strategy, weakness, strengths, structure etc.

- Users

The definition of users in this context is the actor or group of, that is the recipient and/or the co-producer of the service and subsequently the main beneficiary of the offered value. Their needs, perception and values are part of the constituent user.

- Providers

The actor or group of, that is given the duty to provide the service to the actor defined as user.

- Stakeholders

The rest of the actors that are involved in the service concept, from beginning to the end of lifecycle. This includes among others management and facilitators, design team, third party providers, social groups etc.

- Process

It is clear that process refers to the part of the service that formalizes, pre-calculates and to some extend standardizes the actions of the providers to deliver the service.

- Tangibles

The notion of tangibles includes all material aspects of the service. From artifacts to spaces and machinery among others.

- Concept Model

The rendering attempt of the service concept in order to describe it from start to end in any level of abstraction and using a subset or all of the components participating.

- Testing

The realization of the service concept in a controlled environment, inducing nevertheless valuable insights and allowing observation of factors that may have been left out. The test may vary from a functional real setup to a computer simulation or another even conventional method. Besides whole concept test, partial tests may be conducted to observe subsystems of the service offering designed, e.g. interaction, tangibles and process among others.

- Troubleshoot / Monitor

Throughout the whole procedure, troubleshooting problems is part of the iterative process and even after the tests and rollout, the service remains a dynamic system that needs to be measured for performance and conformance.

4.2 Criteria Introduction

The criteria presented are the output of the methodology process presented in Chapter 1.2. During the progress of the research, it became obvious that although common criteria exist between all methods they don’t cover all important aspects of their added value. The solution is to use the common criteria in every constituent discovered and enrich the rating with category

specific criteria. A short description of the criteria will be given and their groupings according to the category of methods can be found on Table 3.

Two groups use more than one set of rating criteria, Concept Model and Test, because of the depth of their content. These two groups are milestones in the design process, producing a complete service entity in vitro. Therefore, an additional rating on the integration factor of service elements is done: Users, Process, Tangibles, Stakeholders.

- Time

  This is one of the unambiguous measures used. A higher rating means that longer times are needed to implement the method.

- Experts

  The need to have experts in order to operate within the methods instructions. This criterion also indicates the potential of the method to be used in co-designing scenarios and the suitability to non-dedicated service design teams. A higher rating is a probable indicator of higher costs but also of lower times and more detail.

- Equipment

  The tangible side to the need for experts is the need to have equipment in order to function within a method description. This includes also software besides conventional products.

- Collaborative

  As almost all service design activities are intended to be used by teams, this criterion doesn’t examine the ability to use methods in a group, but rather the efficiency and to some extent the desired side effect of building team bonds. The lower rating in this category isn’t purely negative, as it reflects also the option to use methods with smaller teams.

- Abstraction

  In examining the degree of abstraction, the inputs and subsequently the outputs of the process are indicated. The more abstract methods rely less on real data, whilst factual methods do. Consequently, produced outputs are influenced and differ in the proposed solutions.

- Structure

  Methods that have a high degree of standardization and are operated with strict rules in form and function, in contrast to methods that are initiated with few ground rules and let the final form evolve through the

process. Both have clear advantages and as always, the decision depends on the application.

- Interactivity

  By interactivity, the dynamic ability of the method to respond to stimuli is assessed. This also is an indicator of realistic simulation capabilities.

- Virtualization

  In today's world we still rely on "analogue" tools like paper and pencils, often with good reason to. Still the potential of a method to be transferred in the digital world is an attribute that plays a significant role, e.g. in geographically dispersed teams.

The additional set of integration criteria are the following:

- Users

  This measure shows the degree of user integration that the method at hand offers.

- Process

  Some methods are structured in a way that the process is the center of development. As is to be expected, detailed processes are the major outcome of such approaches.

- Tangibles

  Methods assessed by tangibles, are reviewed on their focus on this aspect of services.

- Stakeholders

  With the help of this benchmark, methods are judged on the inclusion of stakeholders in their components.

Cost as a criterion was intentionally left out as it would be a highly dependent variable since Time – Experts – Equipment are used.

The assigning of criteria to the major constituents is presented on Table 3.

Table 3 Constituents — Criteria Matrix

Idea	**Organization**	**Users**	**Providers**	**Stakeholders**	**Process**	**Tangibles**	**Concept model**	**Test**	**Troubleshoot-Monitor**
Cost	Cost	Cost	Cost	Cost	Cost	Cost	Cost	Cost	Cost
Time	Time	Time	Time	Time	Time	Time	Time	Time	Time
Experts	Experts	Experts	Experts	Experts	Experts	Experts	Experts	Experts	Experts
Collaborative	Collaborative	Equipment	Equipment	Equipment	Equipment	Equipment	Equipment	Equipment	Equipment
Abstraction	Abstraction	Abstraction	Abstraction	Abstraction	Structure	Collaborative	Collaborative	Collaborative	Structure
Structure	Structure	Structure	Structure	Structure	Interactivity	Structure	Abstraction	Abstraction	Interactivity
Virtualization	Virtualization	Virtualization	Virtualization	Virtualization	Virtualization	Interactivity	Structure	Structure	Virtualization
						Virtualization	Interactivity	Interactivity	
							Virtualization	Virtualization	
							Users	*Users*	
							Process	*Process*	
							Tangibles	*Tangibles*	
							Stakeholders	*Stakeholders*	

4.3 Scaling

The scale used was introduced by Edeholt & Løwgren (2003) and later used in the amending work of Holmlid (2007). These two papers investigated the characteristics of current service disciplines of Industrial (as in “Product”), Interaction and lastly, appended by Holmlid (2007), Service design. They were rated in various attributes by a qualitative scale. The three discrete ratings are “highly oriented”, “somewhat oriented” and “not to any significant degree”. It could be argued that “oriented” can be replaced by “suited” since this is an applicability investigation, however the vast majority of methods can be adapted to special use scenarios and the high potential of transformation in, by definition, creatively potent teams can safely allow only an indication of orientation and not a restrictive definition. It is important to stress that using this rating, the comparison doesn’t result in a ranking, but in a characterization, e.g. *“not to any significant degree”* abstract means also that a method is *“highly oriented”* to a factual approach.

5. Categorization and Results

Methods have been sorted to the main constituents and are going to be evaluated in their respective groups. Even though a number of methods tend to have a broader field of application, they have been assigned to only one category in order to provide a somewhat clearer picture in crowded categories like Concept Model or Test.

The results are presented in radar charts in order to show the area of attributes covered. Radar charts of each individual method and the ratings tables can be found in the Appendix B. The underlying principal is that methods cannot be quantitatively compared in a qualitative research setting like this. Apart from the nature of the research, in practice methods are chosen by fulfilling binary requirements, like digital or collaborative, and not on average performance ratings. The latter is proposed in the Chapter 6.2 as a survey and benchmarking study.

Methods are plotted on graphs in their primary group, and against the respective set of criteria.

5.1 Constituents and Methods

As shown on Table 4 the methods were assigned to dominant constituents as follows.

A discrepancy can be observed in the column of Providers. The lack of methods assigned to this constituent is not an uncovered field. On the contrary, the reason for this absence is that due to the assignment of each method to only one constituent and in combination to the fact that Providers as an element is part of Stakeholders, actor of Process and resource of Organization, the methods that address them are already grouped in this constituents.

Table 4 Constituents — Methods Matrix

Idea	Organization	Users	Providers	Stakeholders	Process	Tangibles	Concept model	Test	Troubleshoot-Monitor
3. Affinity Diagrams	1. Activity Map	4. Behavioral Map		2. Actors Network Map	7. Business Process Analysis Software – BPA	14. Customer Journey Map	13. Customer Experience Modeling – CEM	16. Dramaturgy	19. Fishbone Diagram
8. Collage	5. Benefits Map	10. Constructive Interaction		43. Stakeholder Map	22. Integration Definition for Function – IDEF0-3	26. Low Fidelity Prototyping – Rough Prototyping – Mock Up	23. Knowledge Management Software	24. Laboratories	34. Problem Tree - Objectives Tree
21. Group Sketching	6. Bowman's Strategy Clock	12. Customer Experience Map				48. Touchpoints Matrix	29. Offering Map	32. Pictive	
25. Lego Serious Play®	9. Communications Map	17. Drawing Experiences					33. Picture Cards – Ideo Method Cards – Greeting Cards	37. Real Prototyping	
27. Mind Map	11. Critical Success Factor	18. Empathy Map					35. Process Chain Network Diagrams – PCN	50. Virtual and Augmented Reality	
28. Mood board	15. Deming Circle – PCDA	30. Open/Closed Cards Sort					36. Product Service System Board – PSS Board	51. Wizard of Oz	
39. Role Playing Methods And Frameworks	20. Force Field Analysis	31. Personas					40. Service Blueprint		
41. Service Image – Poster – Tomorrow Headlines	45. Sustainability Map	38. Repertory Grid Analysis					44. Storyboard		
	47. The Futures Wheel	42. Shadowing					46. System Map – Platform		
		49. Video Recording of Users							

5.2 Evaluation and Results Constituents to Criteria

5.2.1 Idea

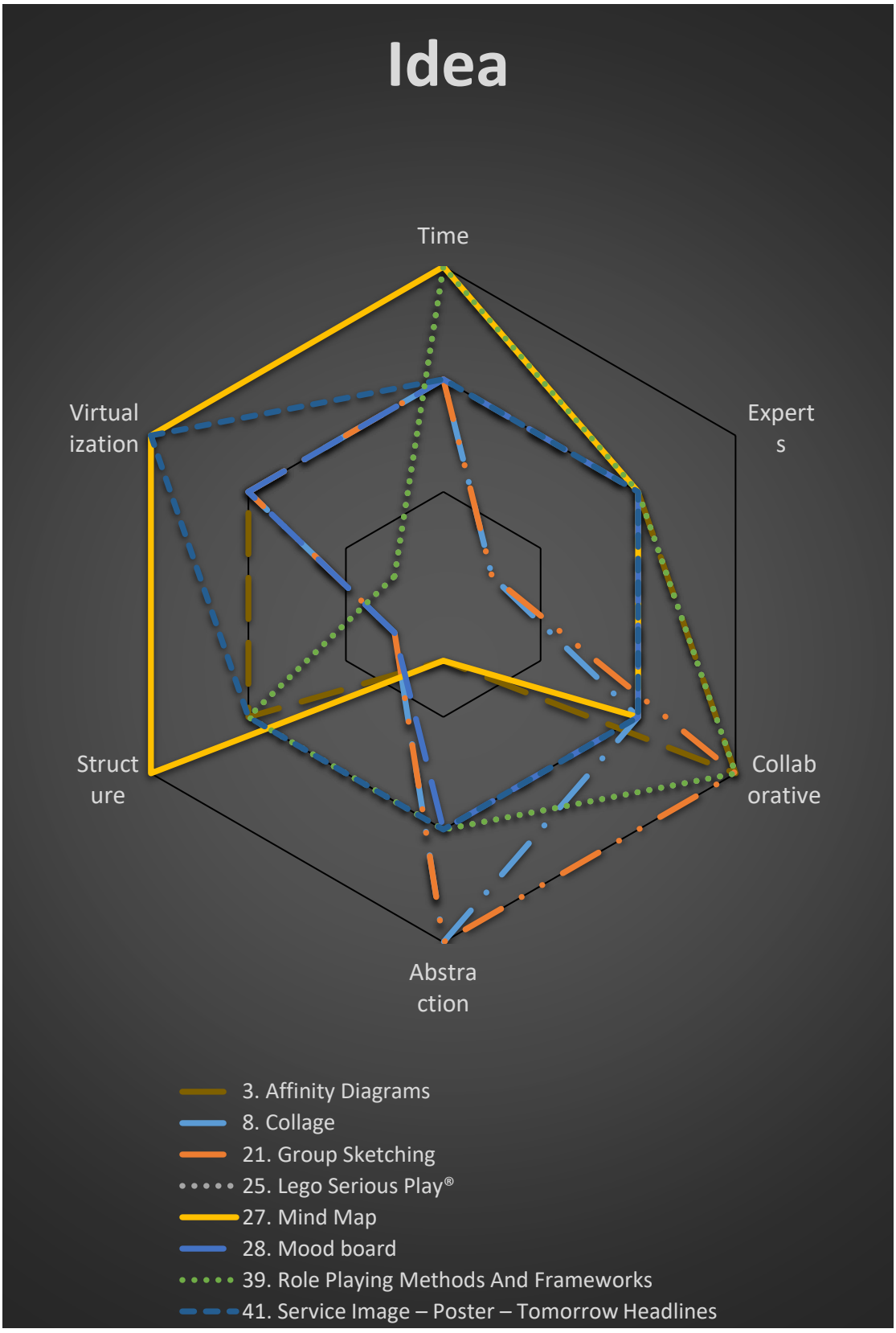


Figure 67 Idea — Methods Results

Initializing the service design process, an idea has to form in a rough form to be pitched to the service provider organization and the design team. Although inspiration is a moment, the minute amount of time, ideation procedure methods require some time to produce usable outcomes. A very short amount of time spent on this element would jeopardize the rest of the process. The wide coverage of the criteria area is consistent with the requirement to enable ideation of any form and the open structure participation in order to benefit from the potential of all stakeholders. The outcome may vary through the whole range of abstract-factual, reflecting methods that are solution- to problem-oriented. Structure follows the same pattern of facilitating ideation in any form and virtualization potential is highly variant, posing challenges in capturing the defining data of some methods, e.g. Lego Serious Play®.

5.2.2 Organization

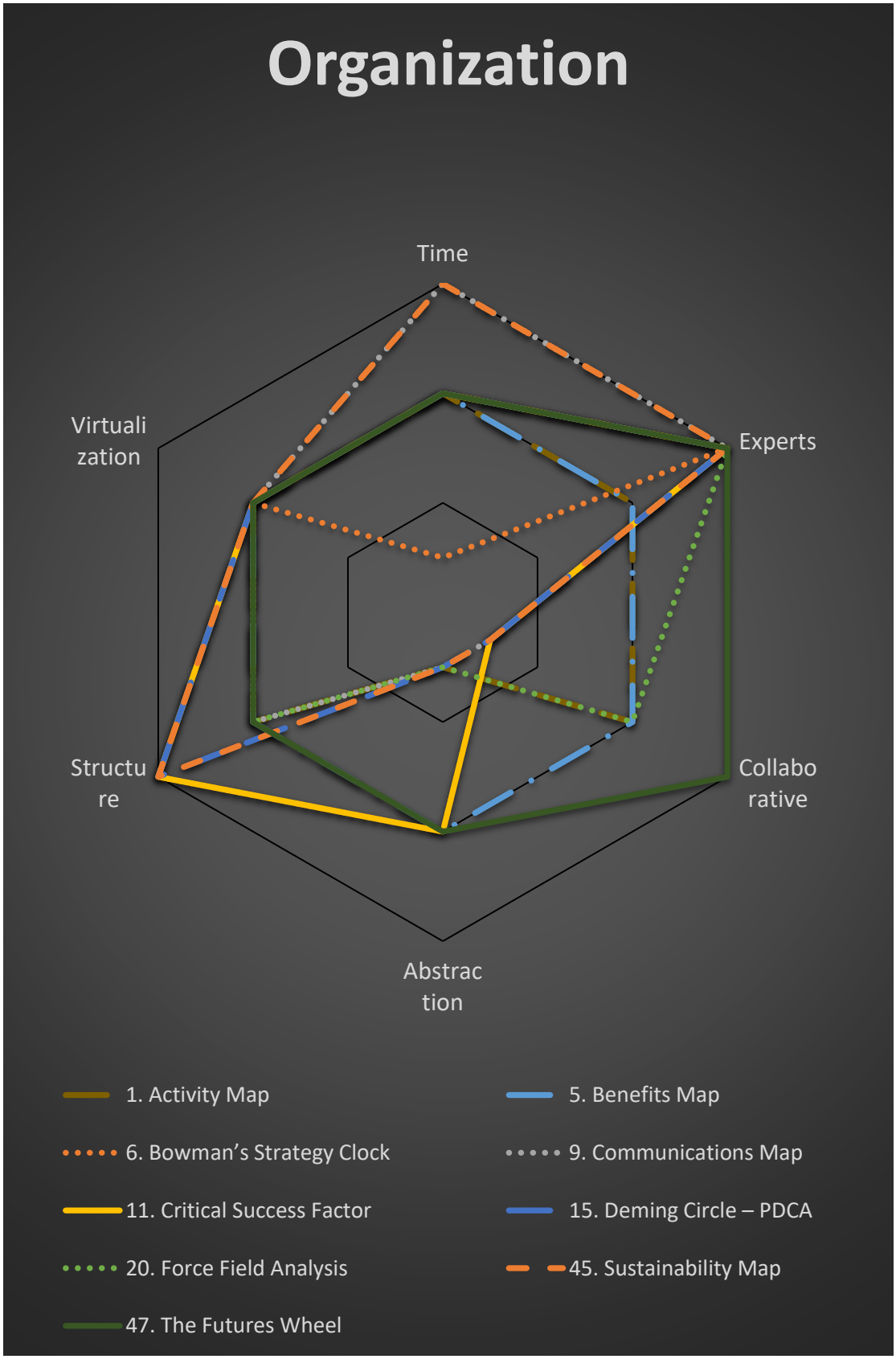


Figure 68 Organization — Methods Results

In this constituent, time plays a major role. Natively structured and factual methods, need time to be plotted with precision that is required. This leads to using experts, so as to validate the credibility of the information provided but also to asses and operate within the framework set by established methods. Virtualization is innate good, templates and structures easily digitized are used and text explains depictions in most cases. Collaboration is variant, some methods are not that friendly to group activity and need a more flexible team and an easier achieved consensus.

5.2.3 Users

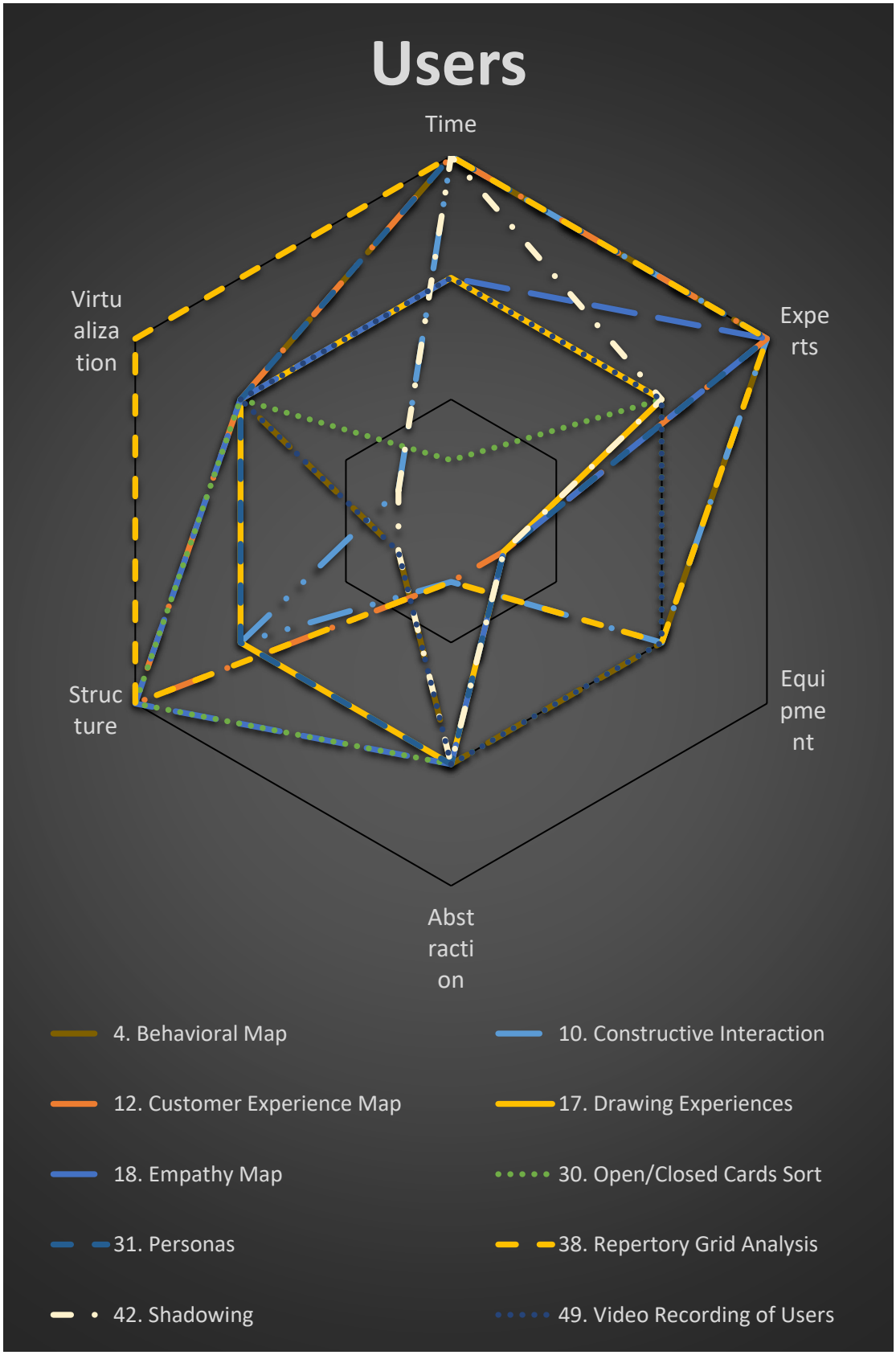


Figure 69 Users — Methods Results

The tendency to invest higher amounts of time is clearly depicted. It is justified by the importance of the task but also by the difficulty of deciphering user's intentions as inputs cannot be used directly but have to be carefully processed. As explained above, these methods need experts that possess both experience and knowledge in the field to function effectively and to feed downstream steps with valid assumptions. The use of specialized equipment is medium rated for the methods examined. The rise of IoT technology is probably going to change this in the following years. Abstract constructs cannot be entirely avoided in this category, still the methods strive to sort the subjective perceptions to objective data. Interpretation of data is a key function of these methods and this the activity that in most cases requires experts and time investment. Strong differences exist, as for example a quantitative method is highly structured, in contrast to an observational method that has to be flexible and allow events to unfold unobtrusively. Although the need for virtualization is imperative as information of these methods is to be communicated and referenced throughout the development process, some methods like Constructive Interaction have to be operated in a very strict manner to convey all information to a digital platform. Still the ratings are relatively set within this group, excluding thus none of the methods from digitalization.

5.2.4 Stakeholders

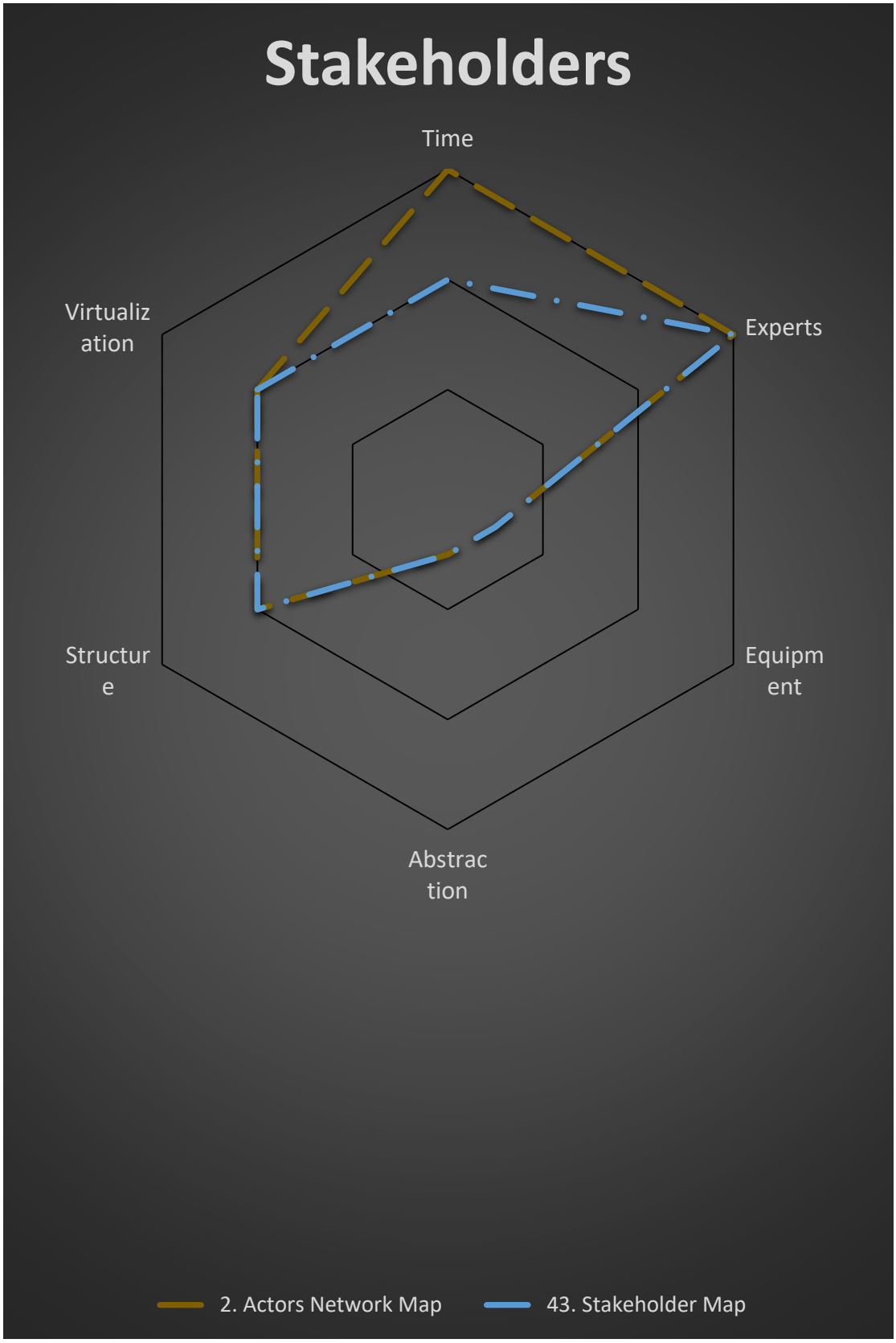


Figure 70 Stakeholders — Methods Results

The rating of these two methods reflects their similarities. The only difference that can be depicted using this set of criteria is the time involvement, which is significantly higher in the Actor's Network Map, due to the inclusion of information and tangibles aspects. It could be argued that in this form it resembles more of a concept description method. Besides the level of detail, the meticulous documenting of actors involved, justifies the time requirements. People plotting these maps need to have an overview of all factors, both internal and external and this characterizes them as experts. As the methods were presented on Chapter 3, the need for special equipment is nonexistent. Data depicted on these maps needs to be accurate and up-to-date to function within their role, thus abstraction is an unwanted quality. There are structural guidelines to draft such documents, but they are adaptable to the characteristics of each project. Last, the virtualization potential is medium as it can easily be digitized and the information can be retrievable and indexable with relative ease.

5.2.5 Process

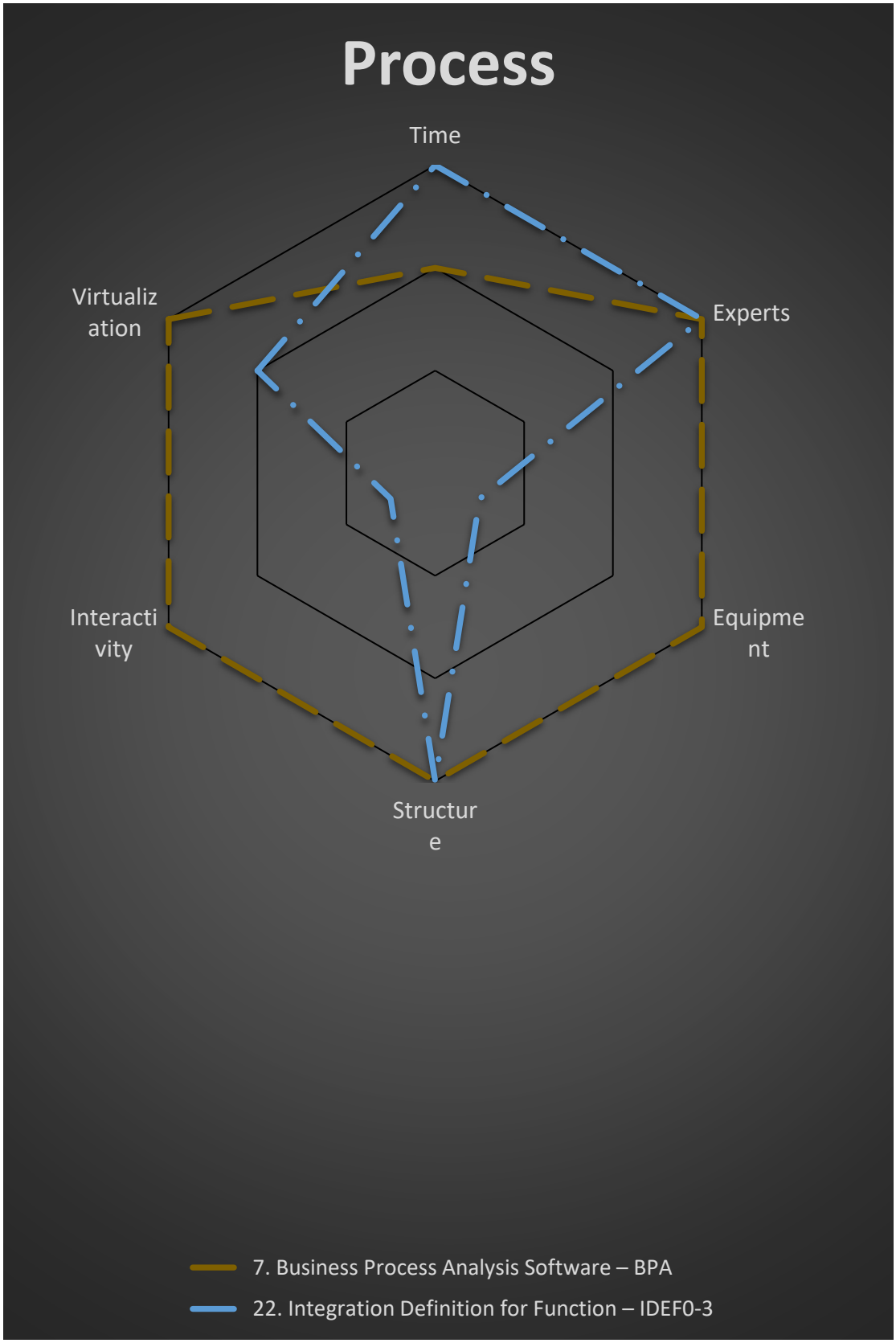


Figure 71 Process — Methods Results

Process modelling methods are by definition structured and factual. Since abstraction would be out of context, structure was evaluated only to underline the highly oriented nature of them. Both methods examined need people with specialized knowledge to use the “language” and symbols of process modeling and to function within the detailed ruleset. The contrast of BPA to IDEFx method on the equipment level is due to the fact that the former is by definition a software dependent function, whereas the latter could be operated with as little as pen and paper. However, it must be stressed that this is an unrealistic scenario if substantial value is to be drawn by the implementation of such methods. Virtualization is high by definition for BPA, but IDEFx is a method developed with programming elements incorporated and therefore easily digitized. Evaluated on their current form and not their potential, interactivity of BPA is significantly higher due to the dynamic modelling procedure, while IDEFx is rather static.

5.2.6 Tangibles

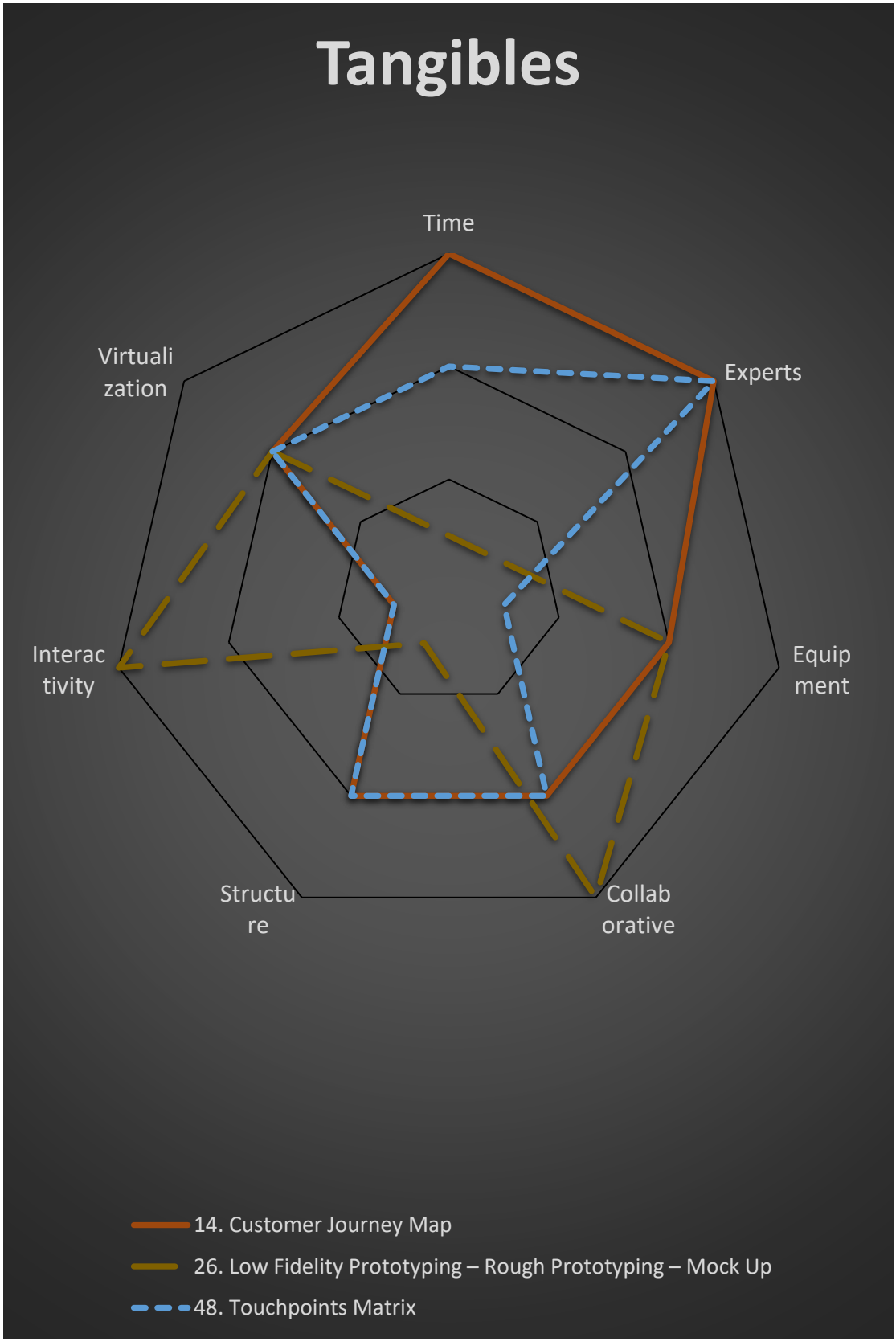


Figure 72 Tangibles — Methods Results

As figure 72 depicts, the methods examined cover the area to a satisfactory extend. The time investment is relative low as expected in the low fidelity and higher for the documenting and investigative design methods. Experts are needed for the structured methods and as the name suggests, more open to participant is the low fidelity method again. The possibility of using eye-tracking equipment, other sensors or cameras to record touchpoint interaction was taken into account. Interactivity of the low fidelity prototypes is high as it is an artifact at hand and can be handled as need arises. Virtualization potential is medium for all, depending on available resources and skills.

5.2.7 Concept Model

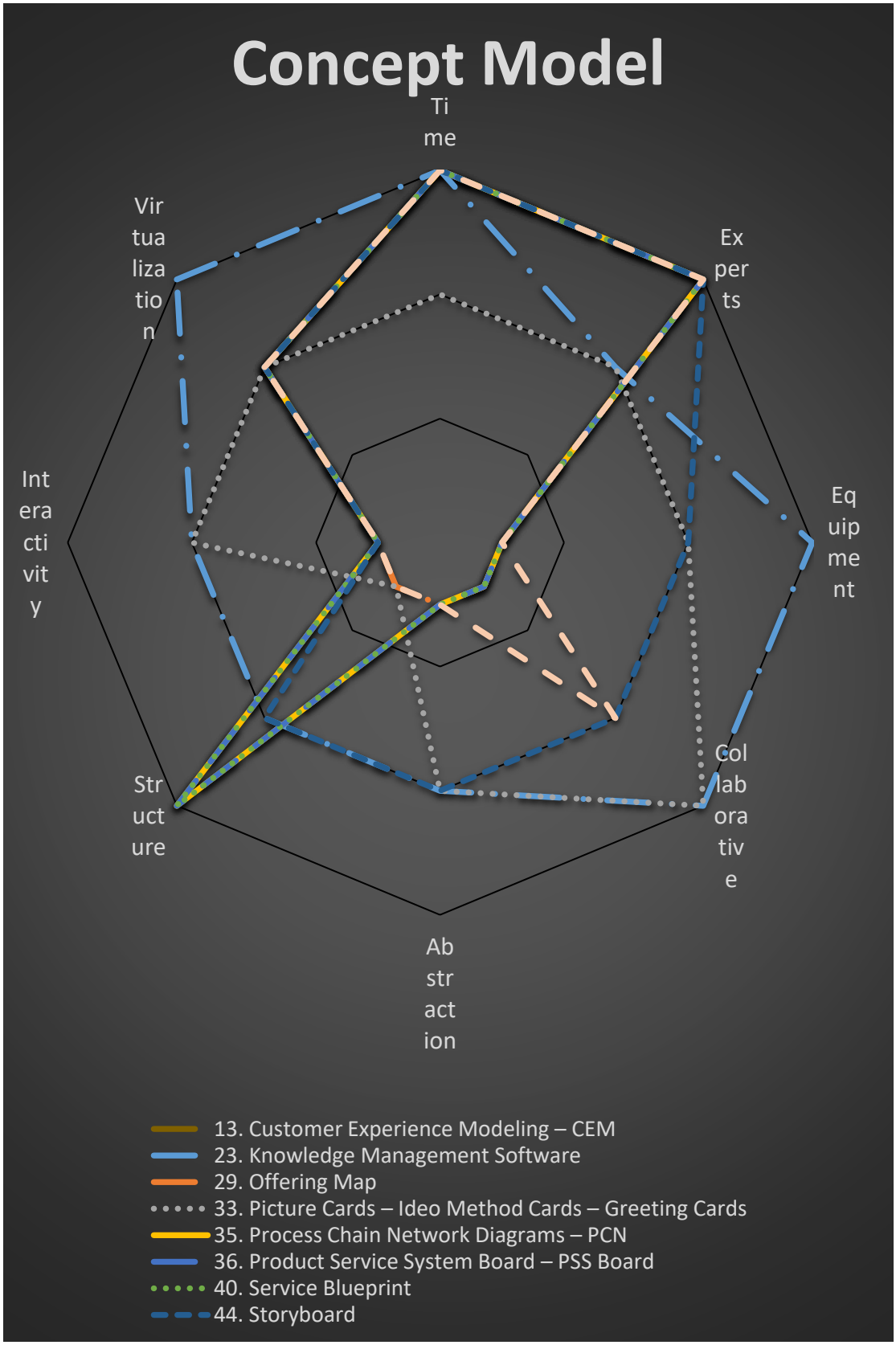


Figure 73 Concept Model — Methods Results

In this group of methods, the requirements of comprehensive and thorough description of concepts are extremely high. Methods within this group have to be able to synthesize and compile a functional service proposition from all other elements. These techniques have to produce a clear picture of the service too, and in most cases are used to engage stakeholders in implementation and market launch phases. Justifiably, all methods are time consuming with differences striking out only in a comparative analysis. Expert operators and coordinators are required, as the structure tends to be defined or in the case of more adaptable methods, high synthesizing skills are required. To conceptualize in a holistic approach requires extensive knowledge of all service involved functions. This makes the process uninviting to co-design attempts, but among peers, collaboration is fostered by most methods. By definition, Knowledge management requires equipment as in software and possibly IT infrastructure. The rest of the methods require little or non-significant equipment and rely fully on the labor of design team members. In some this team may be limited in numbers, e.g. as blueprinting and derivatives, with overview of information and in possession of special skills, enabling them to execute core activities like this. There would be more variability and potential in this criterion if the methods were fully digitized and therefore capable of dynamic responses. With conventional applications interactivity is rather limited. Some potential for digitizing is observed, though this cannot be a major qualifier to choose a method except for Knowledge Management.

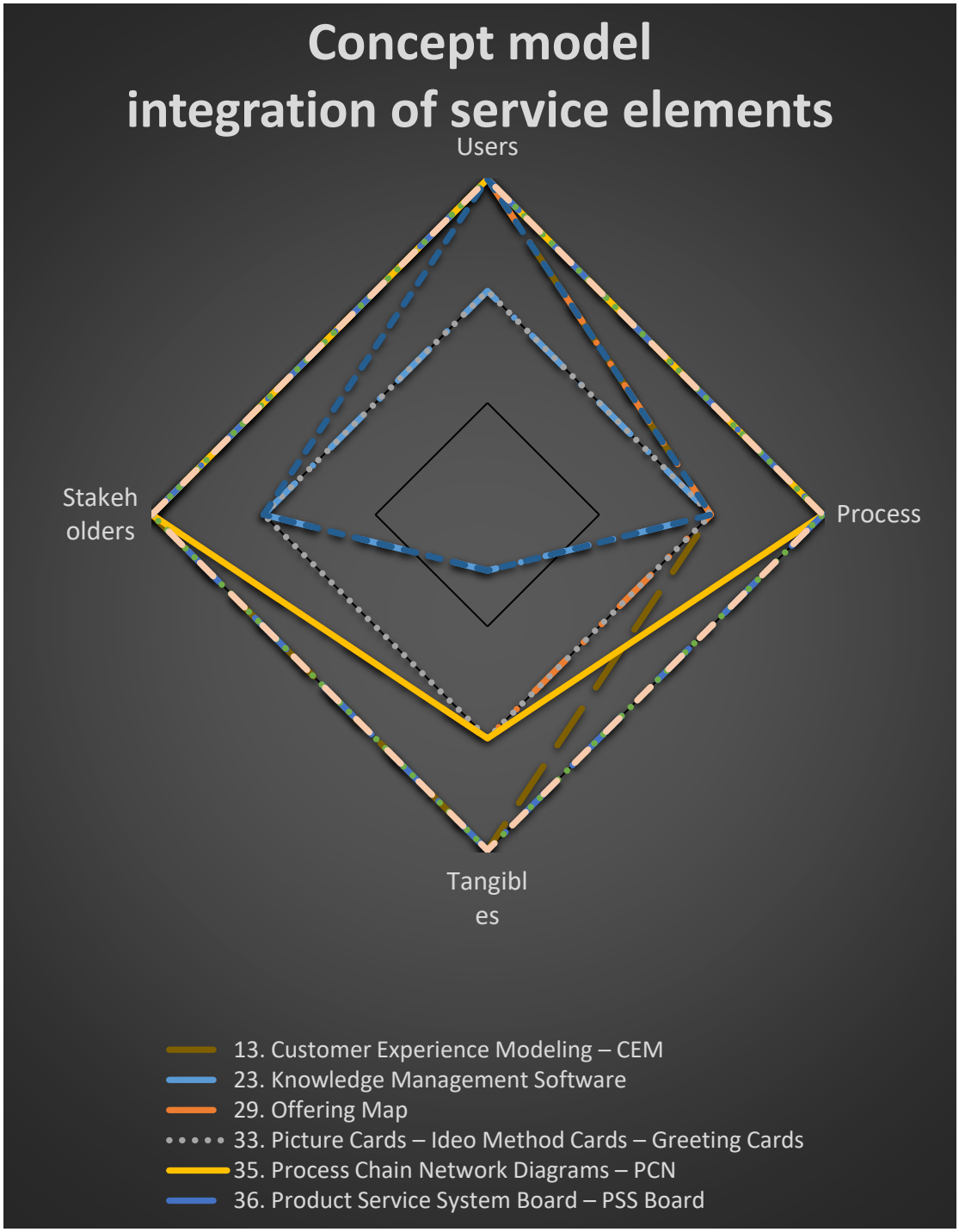


Figure 74 Concept Model — Methods Integration of service elements Results

Users lie on the focus point of all methods with a slight variation of integration. As above, process is an essential component of these methods. Tangibles are first priority in some methods whilst others are shifted to other factors. Stakeholders are included in all concept modeling methods, consequently as process and users would suggest.

5.2.8 Test

Figure 75 Test — Methods Results

As mentioned above, testing is one of the most demanding and multifaceted constituents. It usually includes all elements that compile a service to a fully defined level. Even when part testing is conducted, the modules that are tested are fully described. The explorative mode is paused during these procedures and if needed the design process iterates on new found data in testing, it is therefore expected that time investment is high. Wizard of Oz and Pictive are rated relatively lower, but only in comparison to the alternatives. Experts and equipment are essential to all process and differentiation exists only in direct comparison within the constituent. In fact, these are the most people and equipment intensive methods. Dramaturgy is the only exception in equipment, but only as a stripped down to the essentials version, Wizard of Oz requires as little as a ubiquitous spreadsheet software with basic scripting functionality. Collaboration varies significantly as some methods are designed to be operated in smaller groups, or participation even hinders the core functions of them, e.g. Dramaturgy. Abstract elements exist only as symbols to facilitate the methods deployment. In every other aspect, these methods real on facts, even if internally generated. Testing, even though not as strict as scientific experimentation, needs structure to induce and collect systematically data. This is preferably done in an interactive environment, true to services dynamic nature. Compared within the group, the potential or innate virtualization factors vary. Though, the group is characterized in general from medium to high potential.

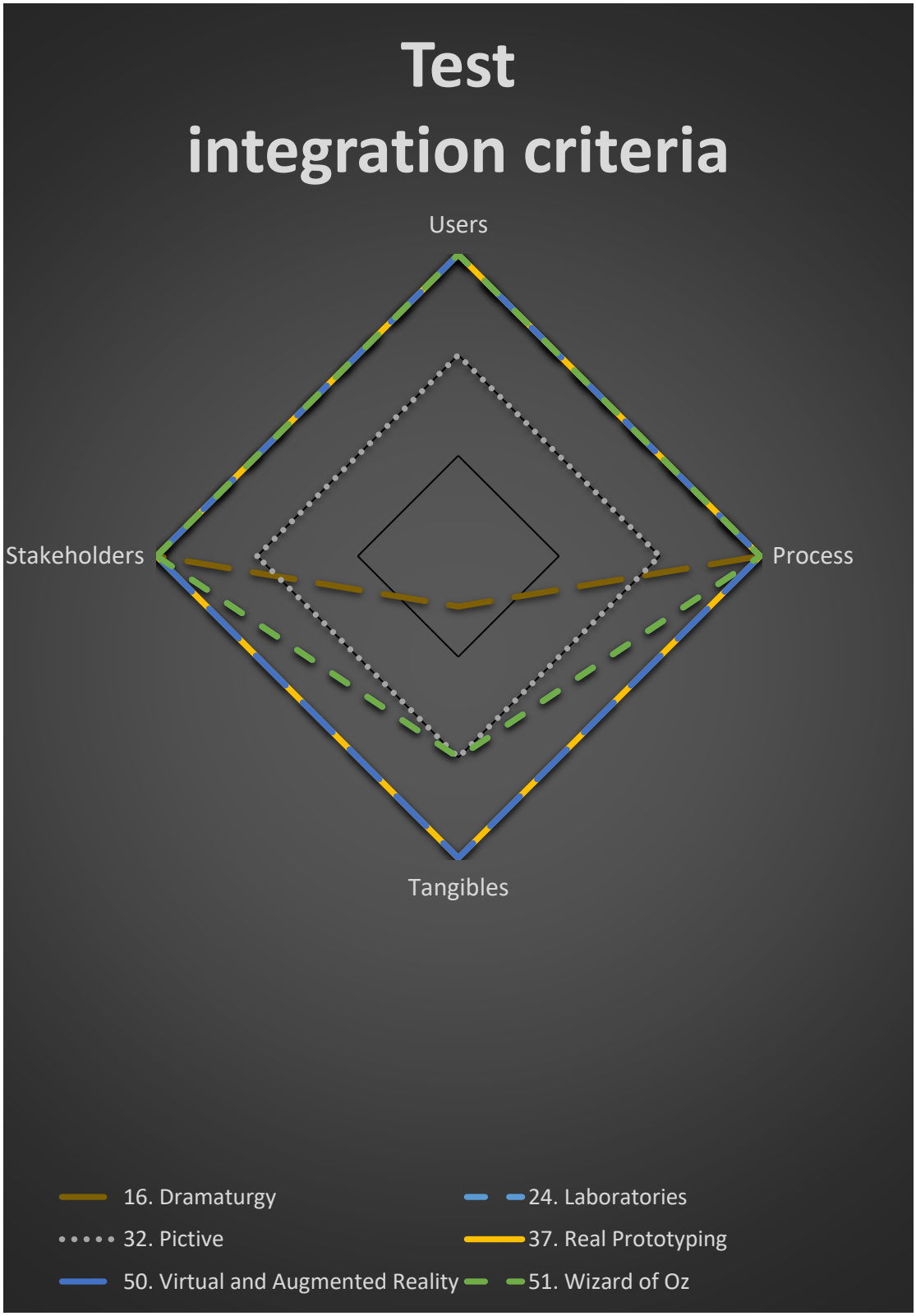


Figure 76 Test — Methods Integration of service elements Results

A rather even and balanced degree of integration with the exception of Dramaturgy that may use tangibles but is not required to.

5.2.9 Troubleshoot Monitor

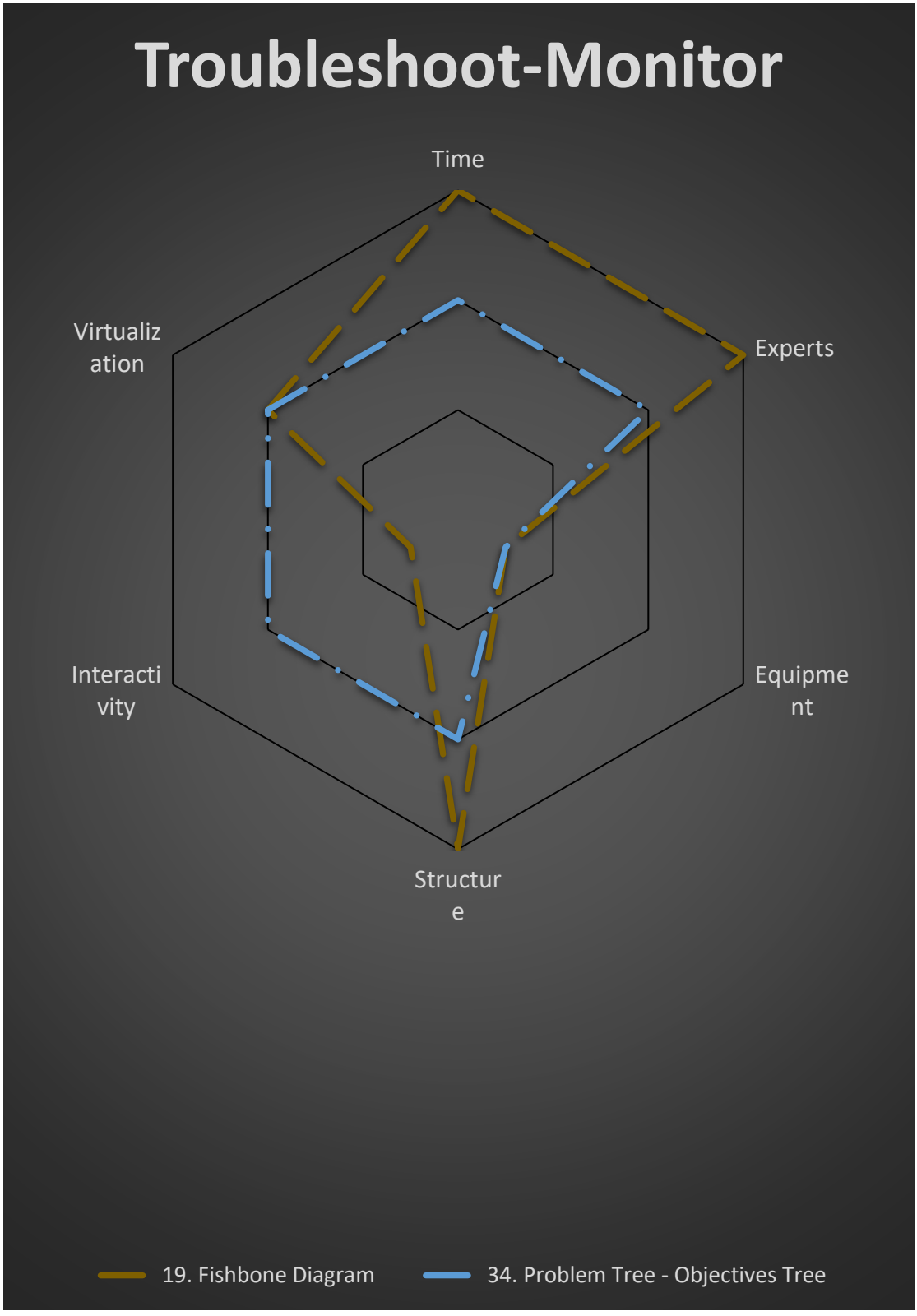


Figure 77 Troubleshoot / Monitor — Methods Results

The task ahead for troubleshooting and monitoring services requires expert knowledge and time resources allocation. As with other critical factors, the work required is of high quality and detail and this leads to methods with structure and rules that guide reliably the users to solutions and to causes of dysfunctional elements. Problem — Objectives tree bare some resemblance to mind-mapping and therefore have a more flexible structure, making them more responsive to quick examination of scenarios. However, content and context is fixed for both of them. Both of them are independent from equipment and present a fair virtualization potential, having a balance of textual (easier retrievable) and graphical elements.

5.3 Methods to Service Development Stages

The last deliverable of this research attempt is the organization and assignment of methods to service development stages, as they were defined on Chapter 4.1. The resulting matrix is presented in Fig. 78.

The cluttered look of the diagram reveals the thorough coverage of the field. The arrangement of the methods could provide a more uniform look to the figure, but no insights could reliably be extracted from them. The methods were assigned to more than one stage as the iterative nature of the procedure forces methods to be used in early and later stages. This secondary and tertiary use of methods is done both in refinement loops but also in the process of building up a concept based on discrete and verified steps. The continuity of information is partly pictured here, since a full depiction would lead to an even more tangled diagram.

Marketing dimensions in service design and market launch stages are included, e.g. Bowman’s Strategy Clock in service design and BPA software for rolling out the new service. Another point of interest is the Laboratories in market launch that can be justified by the hybrid function of JOSEPHS lab, located in an urban and commercial setting. The versatility of the methods is also portrayed in the use of Dramaturgy in the implementation phase as a training tool. Fishbone Diagrams are an excellent example too as they span across the procedure, adaptable to the need on demand.

Density of the diagram is not even as ideation occupies significant space, followed by an increase in requirements analysis and service design and then gradually declining. This is consistent with the needs to visualize data and also reflects indirectly the maturity of the concept being developed. The more mature concept is in need of less different approaches to be visualized as it is more definite and comprehensive in all details.

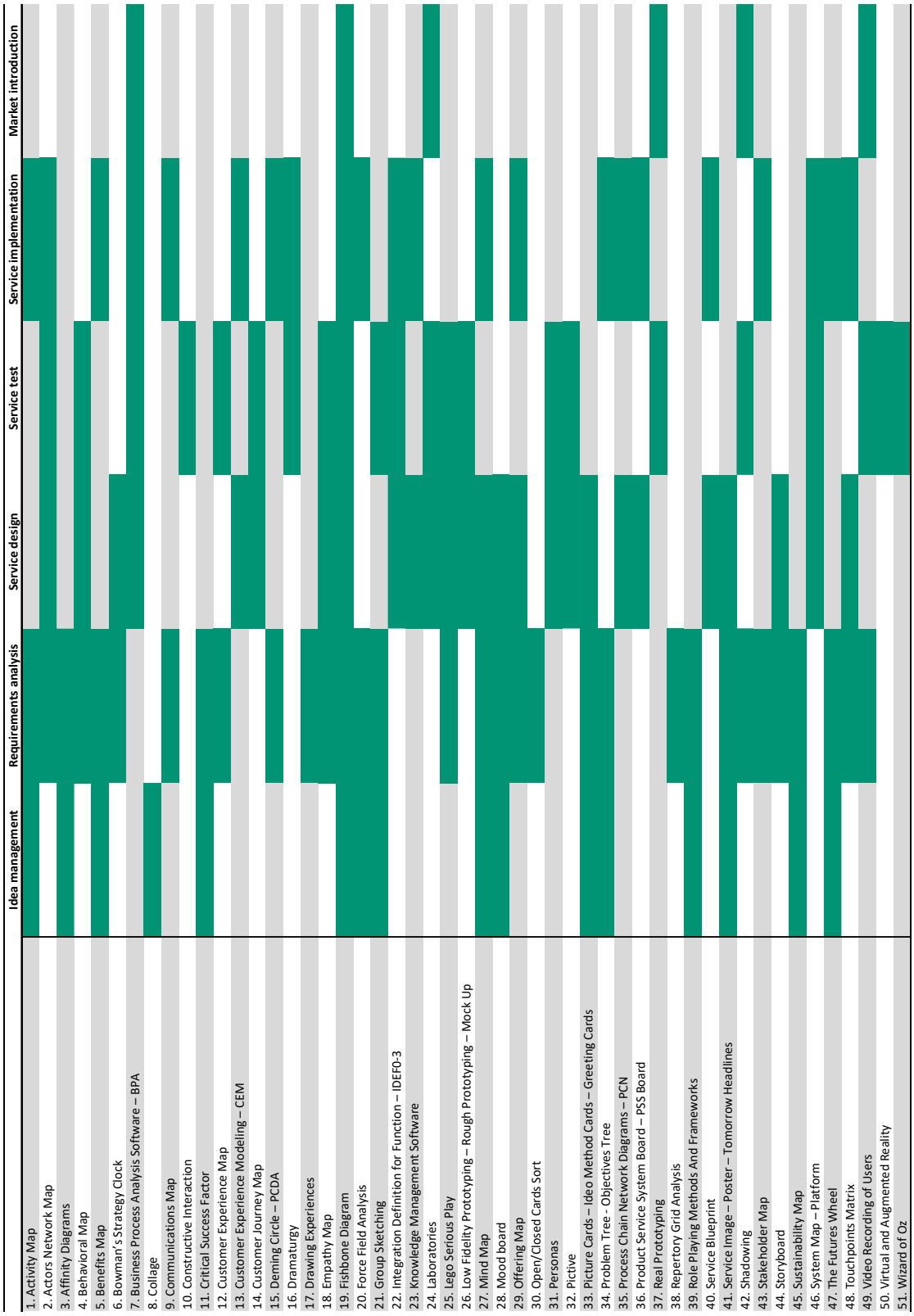


Figure 78 Methods to Service Design Stages Assignment Matrix

6. Conclusion

6.1 Summary of Research

Through the systematic research of methods used in SD, even limited to visual inclined methods, the abundance of tools and activity is revealed. The field has evolved to a discipline with high applicability demand (Meiren & Burger 2010) and therefore the traditional sense of shortage of tools has is no longer a shared understanding. Service design methods examined portray the historical origins of the discipline, from marketing offshoot to independent and self-sustaining. Being a relative young multidisciplinary field, service design has greatly benefited from ethnographic and interaction design methods. However, the introduction of frameworks like service engineering and other approaches has contributed to avoid fragmentation of methods and enabled the seamless exchange of information between them.

Visualization plays a great role in communication and is a corner stone of modern and coming digital tools. All methods within a small variation were visually efficient in conveying their respective goals. As the definition of criteria suggested the desired end result defines the effectiveness of a method. Therefore, the fact that ratings were seldom uniform, ensures that a suitable method will be available for most of the design scenarios. Elemental methods e.g. Personas can be integrated in more multidimensional ones e.g. Dramaturgy, enhancing the value of both methods. Consequently, the true value lies in the ability of the team not only to use them but also to successfully plan and select the procedure steps and combine the methods.

The navigation through the solution space, is in all cases better supported by the maps that these methods in combination plot.

6.2 Future Research Recommendations

In the extensive search for methods, various interesting concepts surfaced and even an alternative classification direction was developed to a preliminary stage. The latter will be presented in the Appendix C in a summarized form.

An underrepresentation of environmentally oriented elements was observed, besides the Sustainability Map 3.45. Part of a wider investigation in this direction could lead to the addition of a swim lane in Blueprinting so as to indicate energy i.e. energy consumption or CO^2-footprint. Especially in transportation and energy provision or even accommodation and travel

services, users have increased awareness of their actions impact on the environment.

Toolkits (Von Hippel 2001) to be used as the enabler to co-designing activity is an interesting direction for both true human centered design, with no intermediaries and interpretational misconceptions of needs. The participatory procedure can be enhanced by open to crowd Laboratories like SILK or DESIS and groupware or knowledge management software. Another interesting combination could be achieved by introducing a gamification approach (Huotari & Hamari 2012) that is already to some extent a familiar framework for users, as the omnipresent games are a global phenomenon.

Fitting amendment to this work, would be a traditional survey based research among practitioners and academics to enrich the list of criteria and validate quantitatively the ratings. Salient criteria can be defined and respective weightings assigned, leading to empirical benchmarking of methods. This study can precede or follow the next recommendation of explorative research.

Reverse engineering and a quantitative research of methods can be achieved by applying the research methodology of Repertory Grid Analysis and the use of Principal Component Analysis. These techniques could reveal spaces and needs not covered and both elicit and prioritize the criteria of methods. Results from such a study could have great value to improving existing methods as well as initiate the development of new ones. Especially in the case of toolkits, it could enable the design of methods efficient for use of this non-experts group.

It is obvious from the ubiquitous presence of the Virtualization criterion that digitalization will play a major role in the evolution of service design in the writer’s opinion. From cloud and groupware technologies already mentioned to the virtualization of every document. "*As we know and simply do not say, no human being writes anymore. [...] Today, human writing runs through inscriptions burnt into silicon by electronic lithography [...]. The last historic act of writing may thus have been in the late seventies when a team of Intel engineers [plotted] the hardware architecture of their first integrated microprocessor*." (Kittler 1993; Monoskop 2016). Embracing this mindset, the evolution to Virtuality, as in digitalization and Virtual Reality, subsequently Augmented Reality too, is to be not only expected, but also planned. Internet of Things allows the design of tools specialized and flexible at the same time and this breakthrough has to be studied and systematically integrated consequently transforming methodologies serving design procedures.

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Appendices

A. Laboratories

Table 5 Laboratories and their sites[63]

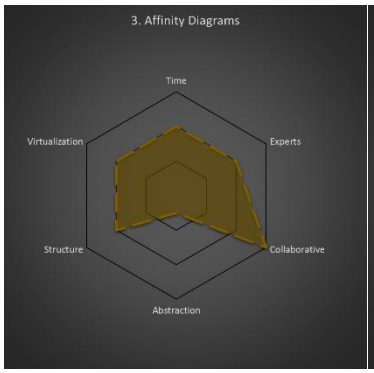
Laboratory	Url
Automotive Service Lab, Munich	http://www.mobility-services.in.tum.de/
AXA Lab, San Francisco	https://nbry.wordpress.com/2015/01/20/innovation-at-axa-innovating-like-fish-schools/
CTF Service Research Center, Karlstad	https://www.kau.se/en/ctf
Engine Service Design, London	http://enginegroup.co.uk/approach/
Innovation Lab Vodafone, Düsseldorf	http://www.vodafone.de/innovationpark/innovation-methodology.html
JOSEPHS, Nürnberg	http://www.josephs-service-manufaktur.de/en/for-companies/
Nesta, London	http://www.nesta.org.uk/resources/understand-how-innovation-works
Service Innovation Lab, Leipzig	http://www.sil.uni-leipzig.de/UEber-uns.333.0.html
ServLab, Stuttgart	http://www.servlab.eu/
SI Labs, Berlin	http://www.si-labs.com/about-us/#passion-for
SILK, Kent	http://socialinnovation.typepad.com/silk/about-silk-1.html
Sinco, Lapland	http://sinco.fi/sinco-lab/
S-Scape, Cheonan-si Chungcheongnam-do	Lee, J. et al., 2011. Service Modeling for Service Testing Laboratory. *Proc. of 41st International Conference on Computers & Industrial Engineering*, pp.205–210.
SSIL, Aachen	http://www.fir.rwth-aachen.de/en/cluster/innovation-labs/service-science-innovation-lab
Swedish ICT, Kista	https://www.tii.se/
MindLab	http://mind-lab.dk/en/
PEMANDU	https://www.pemandu.gov.my/
desis	http://sds.parsons.edu/desis/

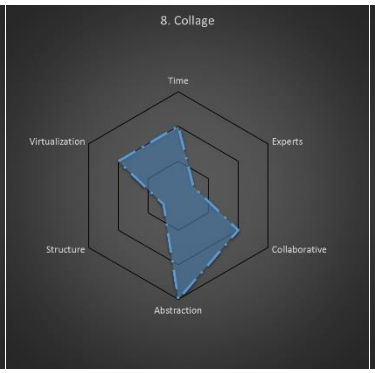
[63] Theoni Paschou. theonipaschou@gmail.com. Labs table. 06 April 2016.

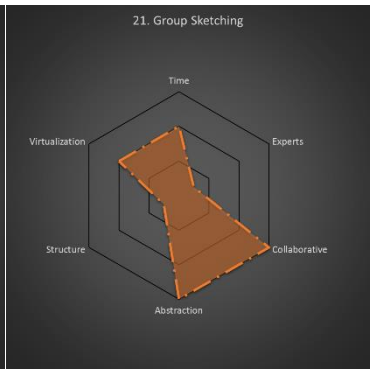
B. Radar Charts of Methods to Criteria

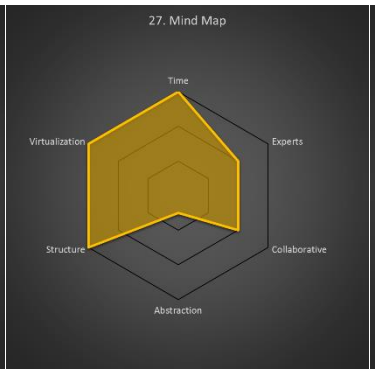
Idea

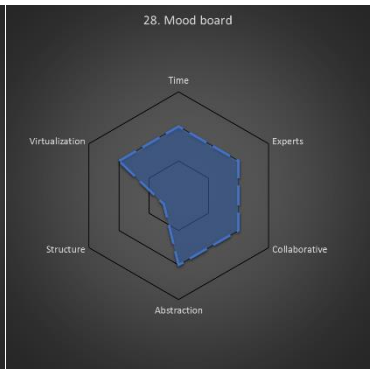
Idea	Time	Experts	Collaborative	Abstraction	Structure	Virtualization
3. Affinity Diagrams	2	2	3	0.5	2	2
8. Collage	2	0.5	2	3	0.5	2
21. Group Sketching	2	0.5	3	3	0.5	2
25. Lego Serious Play®	3	2	3	2	2	0.5
27. Mind Map	3	2	2	0.5	3	3
28. Mood board	2	2	2	2	0.5	2
39. Role Playing Methods And Frameworks	3	2	3	2	2	0.5
41. Service Image – Poster – Tomorrow Headlines	2	2	2	2	2	3

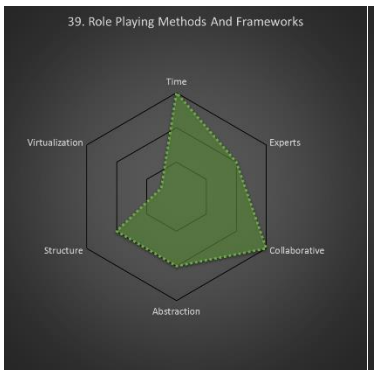


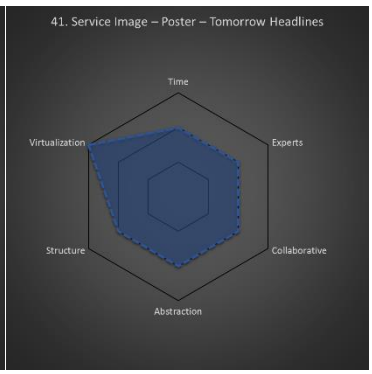






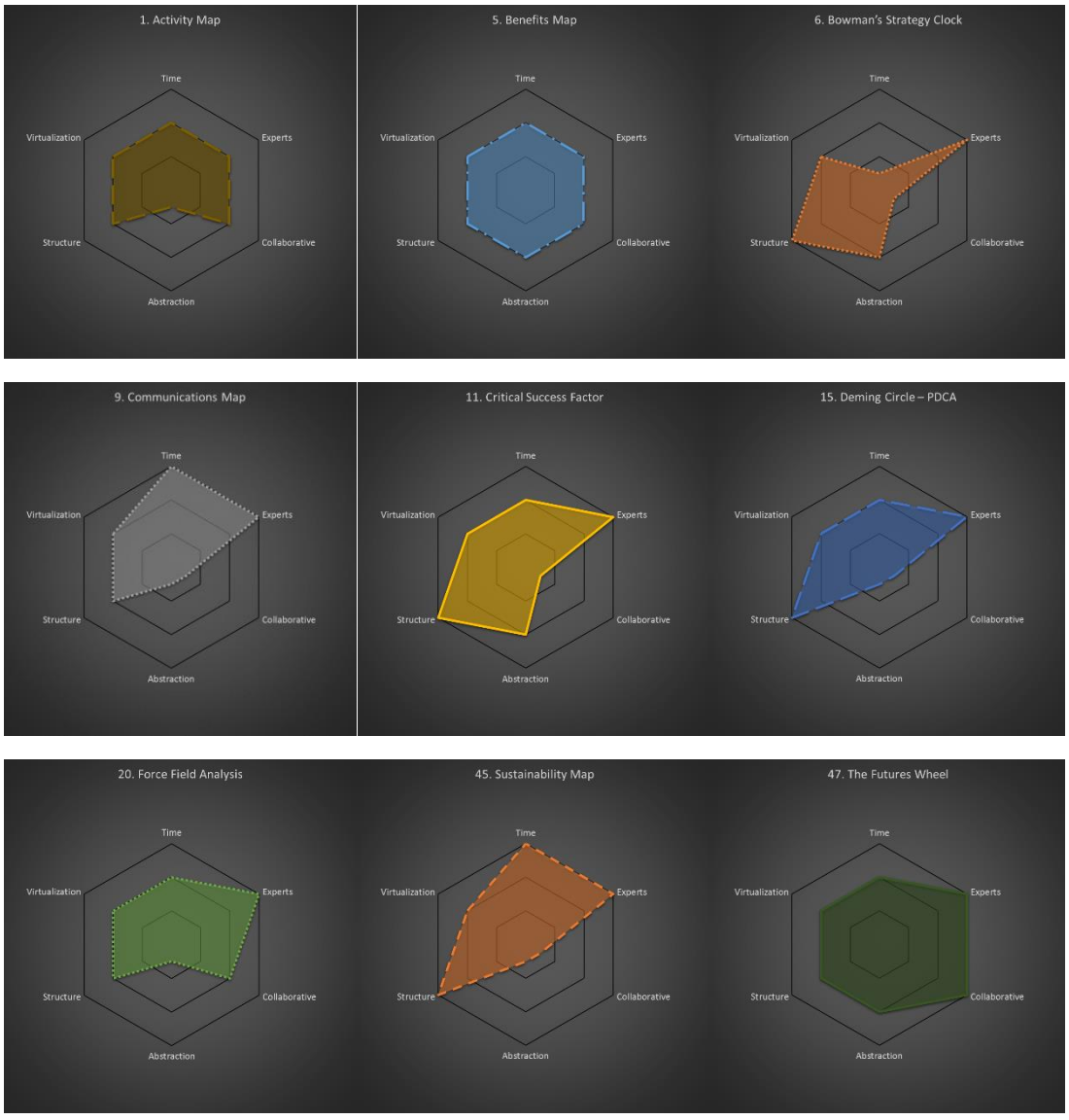






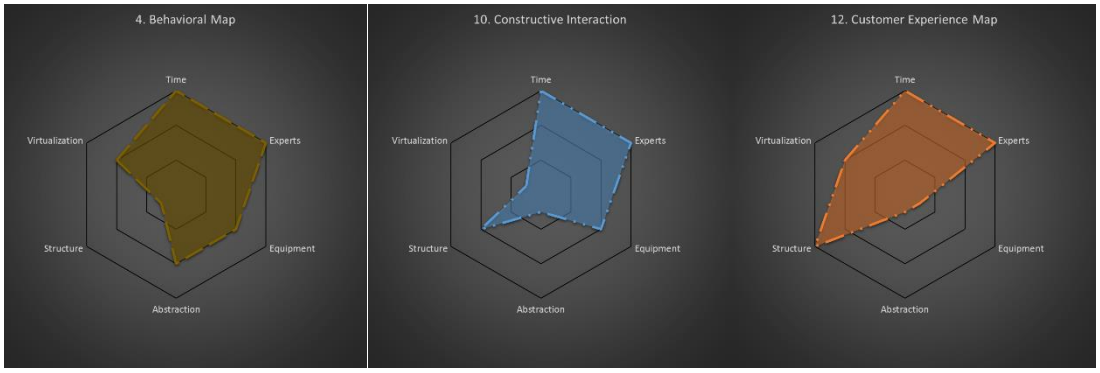
Organization

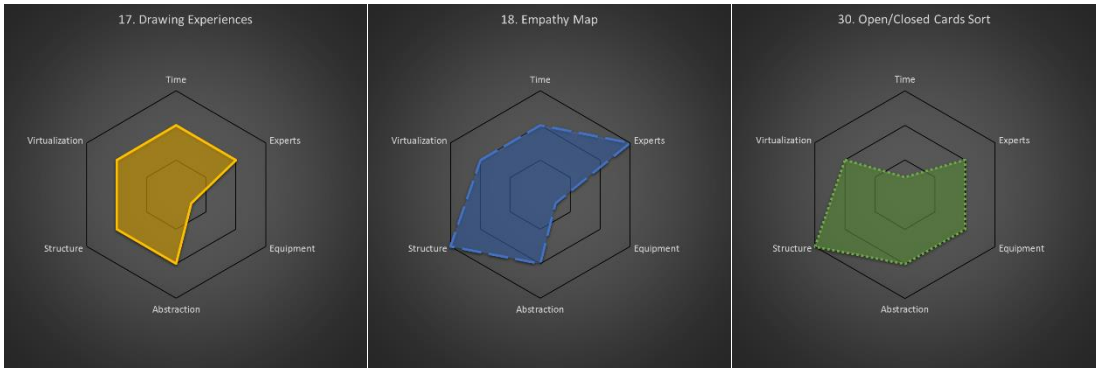
Organization	Time	Experts	Collaborative	Abstraction	Structure	Virtualization
1. Activity Map	2	2	2	0.5	2	2
5. Benefits Map	2	2	2	2	2	2
6. Bowman's Strategy Clock	0.5	3	0.5	2	3	2
9. Communications Map	3	3	0.5	0.5	2	2
11. Critical Success Factor	2	3	0.5	2	3	2
15. Deming Circle – PDCA	2	3	0.5	0.5	3	2
20. Force Field Analysis	2	3	2	0.5	2	2
45. Sustainability Map	3	3	0.5	0.5	3	2
47. The Futures Wheel	2	3	3	2	2	2

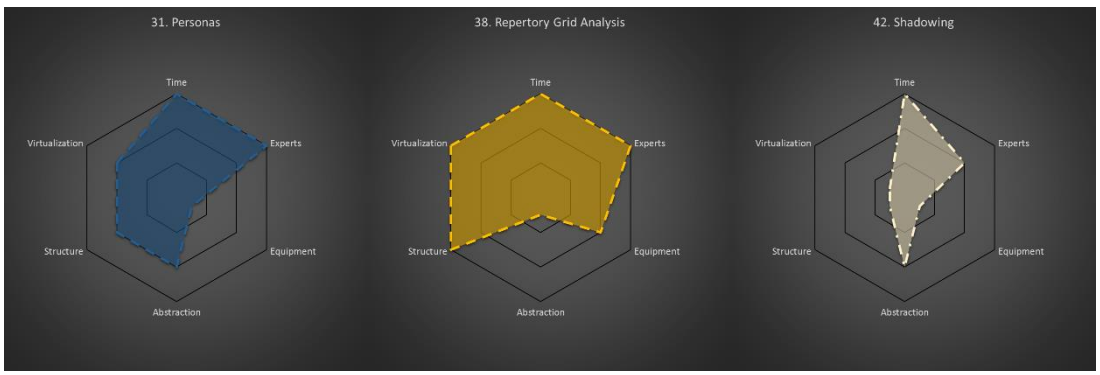


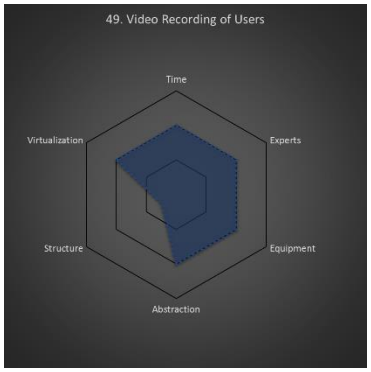
Users

Users	Time	Experts	Equipment	Abstraction	Structure	Virtualization
4. Behavioral Map	3	3	2	2	0.5	2
10. Constructive Interaction	3	3	2	0.5	2	0.5
12. Customer Experience Map	3	3	0.5	0.5	3	2
17. Drawing Experiences	2	2	0.5	2	2	2
18. Empathy Map	2	3	0.5	2	3	2
30. Open/Closed Cards Sort	0.5	2	2	2	3	2
31. Personas	3	3	0.5	2	2	2
38. Repertory Grid Analysis	3	3	2	0.5	3	3
42. Shadowing	3	2	0.5	2	0.5	0.5
49. Video Recording of Users	2	2	2	2	0.5	2



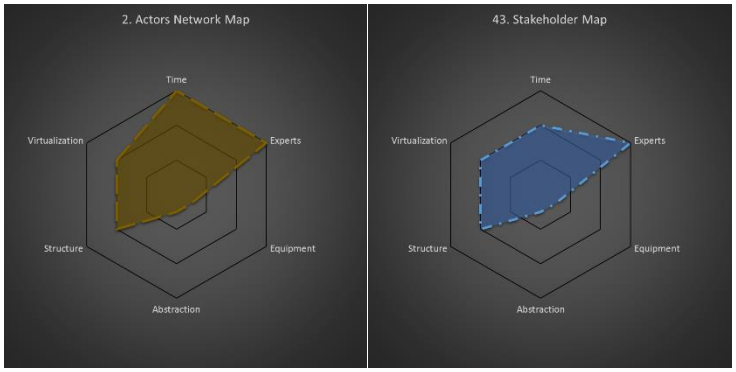





49. Video Recording of Users
Time
Experts
Equipment
Abstraction
Structure
Virtualization

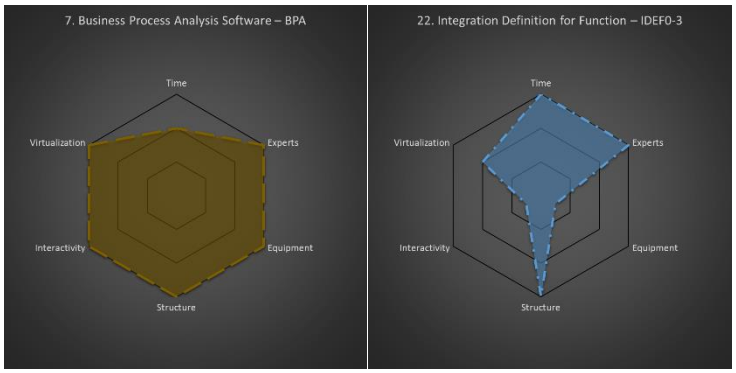
Stakeholders

Stakeholders	Time	Experts	Equipment	Abstraction	Structure	Virtualization
2. Actors Network Map	3	3	0.5	0.5	2	2
43. Stakeholder Map	2	3	0.5	0.5	2	2



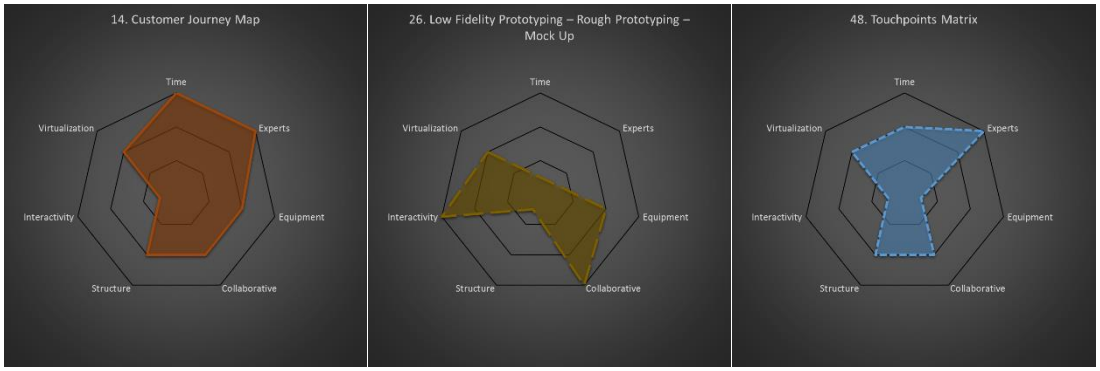
Process

Process	Time	Experts	Equipment	Structure	Interactivity	Virtualization
7. Business Process Analysis Software – BPA	2	3	3	3	3	3
22. Integration Definition for Function – IDEF0-3	3	3	0.5	3	0.5	2



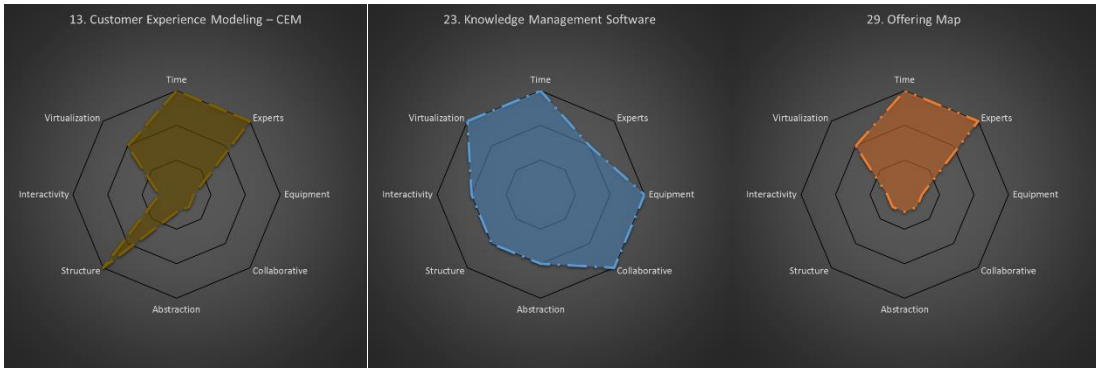
Tangibles

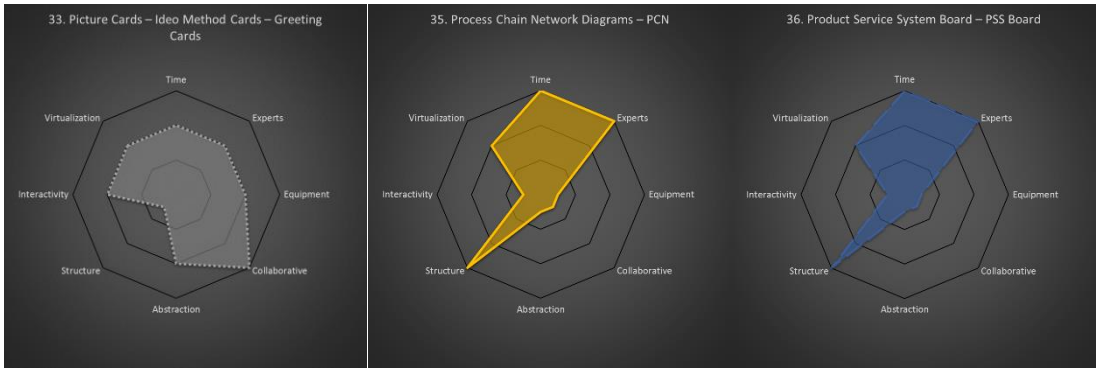
Tangibles	Time	Experts	Equipment	Collaborative	Structure	Interactivity	Virtualization
14. Customer Journey Map	3	3	2	2	2	0.5	2
26. Low Fidelity Prototyping – Rough Prototyping – Mock Up	0.5	0.5	2	3	0.5	3	2
48. Touchpoints Matrix	2	3	0.5	2	2	0.5	2

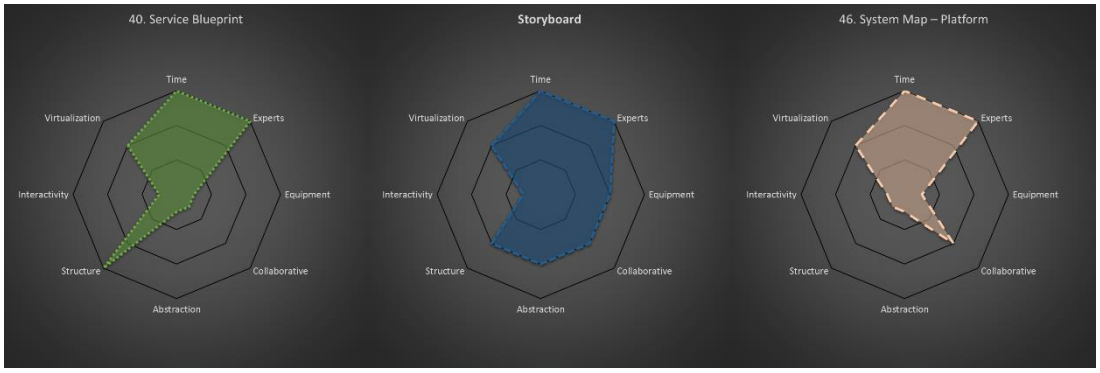


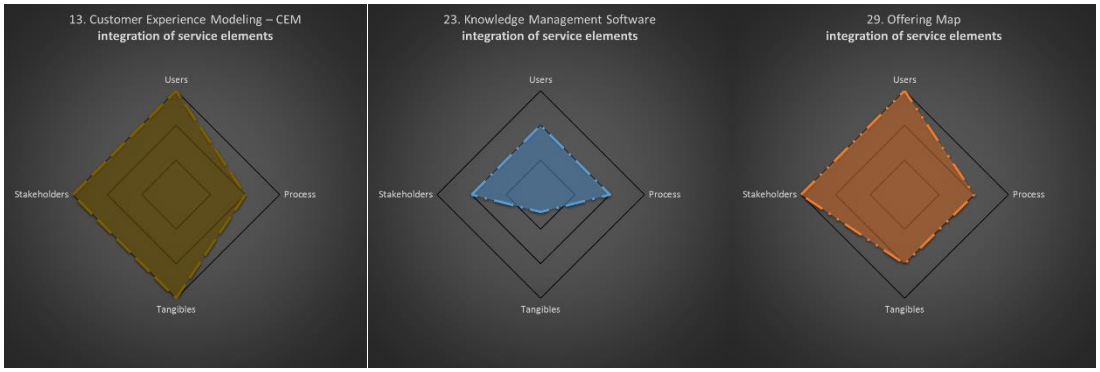
Concept Model

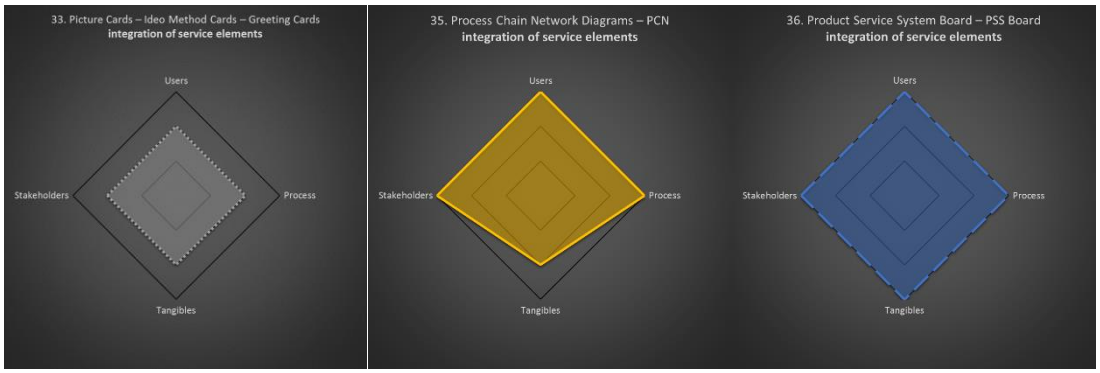
Concept model	Time	Experts	Equipment	Collaborative	Abstraction	Structure	Interactivity	Virtualization	*Users*	*Process*	*Tangibles*	*Stakeholders*
13. Customer Experience Modeling – CEM	3	3	0.5	0.5	0.5	3	0.5	2	3	2	3	3
23. Knowledge Management Software	3	2	3	3	2	2	2	3	2	2	0.5	2
29. Offering Map	3	3	0.5	0.5	0.5	0.5	0.5	2	3	2	2	3
33. Picture Cards – Ideo Method Cards – Greeting Cards	2	2	2	3	2	0.5	2	2	2	2	2	2
35. Process Chain Network Diagrams – PCN	3	3	0.5	0.5	0.5	3	0.5	2	3	3	2	3
36. Product Service System Board – PSS Board	3	3	0.5	0.5	0.5	3	0.5	2	3	3	3	3
40. Service Blueprint	3	3	0.5	0.5	0.5	3	0.5	2	3	3	3	3
44. Storyboard	3	3	2	2	2	2	0.5	2	3	2	0.5	2
46. System Map – Platform	3	3	0.5	2	0.5	0.5	0.5	2	3	3	3	3

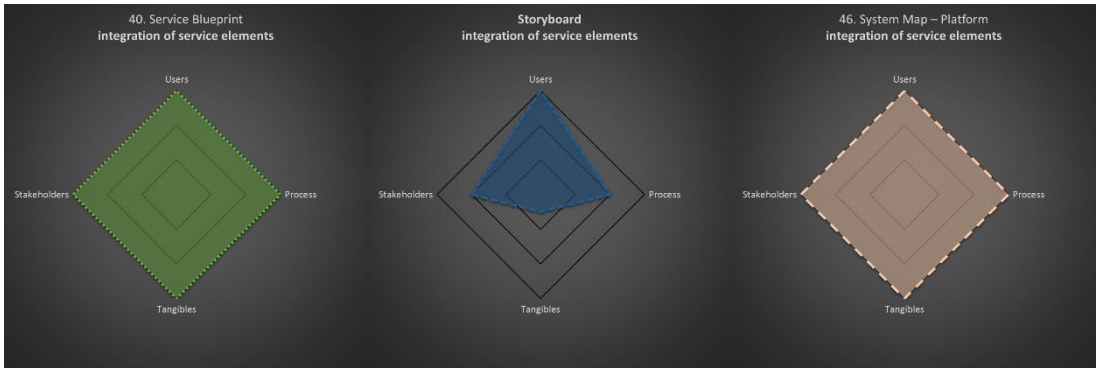






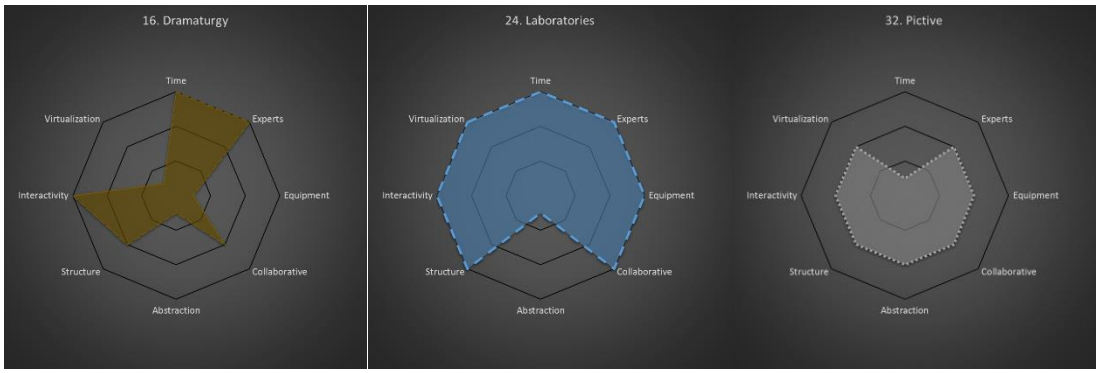

13. Customer Experience Modeling – CEM
integration of service elements
Users
Process
Tangibles
Stakeholders
23. Knowledge Management Software
integration of service elements
Users
Process
Tangibles
Stakeholders
29. Offering Map
integration of service elements
Users
Process
Tangibles
Stakeholders

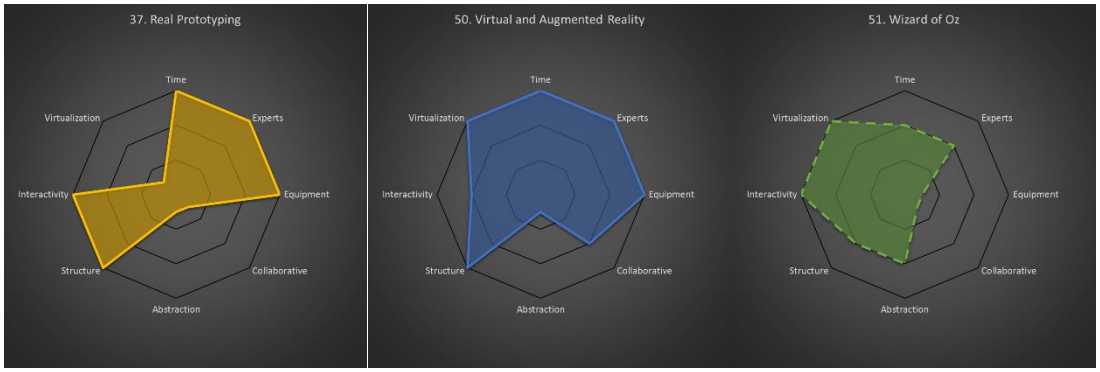

33. Picture Cards – Ideo Method Cards – Greeting Cards
integration of service elements
Users
Process
Tangibles
Stakeholders
35. Process Chain Network Diagrams – PCN
integration of service elements
Users
Process
Tangibles
Stakeholders
36. Product Service System Board – PSS Board
integration of service elements
Users
Process
Tangibles
Stakeholders

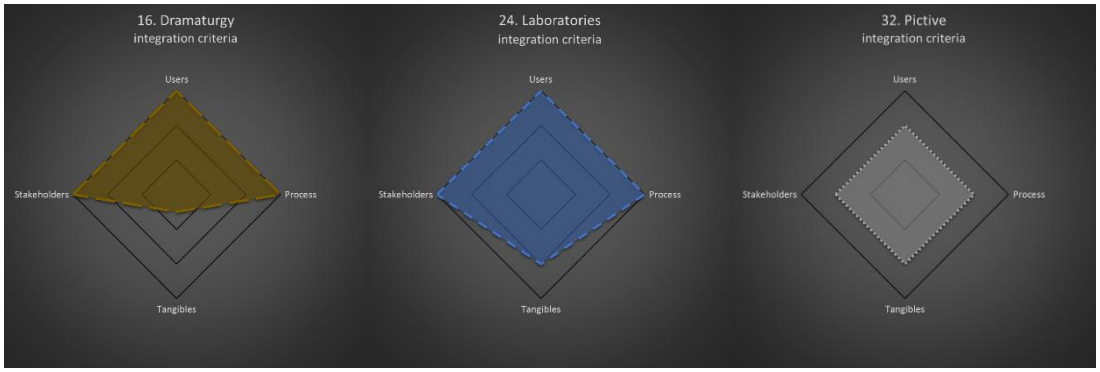

40. Service Blueprint
integration of service elements
Users
Process
Tangibles
Stakeholders
Storyboard
integration of service elements
Users
Process
Tangibles
Stakeholders
46. System Map – Platform
integration of service elements
Users
Process
Tangibles
Stakeholders

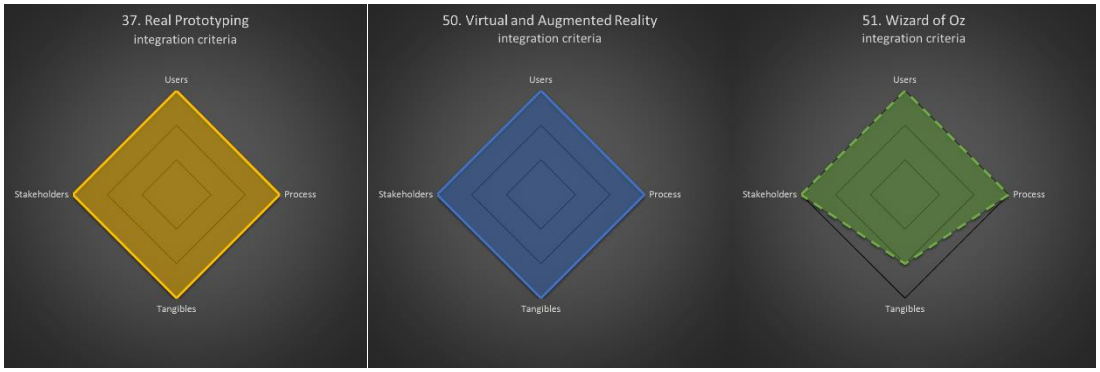
Test

Test	Time	Experts	Equipment	Collaborative	Abstraction	Structure	Interactivity	Virtualization	*Users*	*Process*	*Tangibles*	*Stakeholders*
16. Dramaturgy	3	3	0.5	2	0.5	2	3	0.5	3	3	0.5	3
24. Laboratories	3	3	3	3	0.5	3	3	3	3	3	2	3
32. Pictive	0.5	2	2	2	2	2	2	2	2	2	2	2
37. Real Prototyping	3	3	3	0.5	0.5	3	3	0.5	3	3	3	3
50. Virtual and Augmented Reality	3	3	3	2	0.5	3	2	3	3	3	3	3
51. Wizard of Oz	2	2	0.5	0.5	2	2	3	3	3	3	2	3



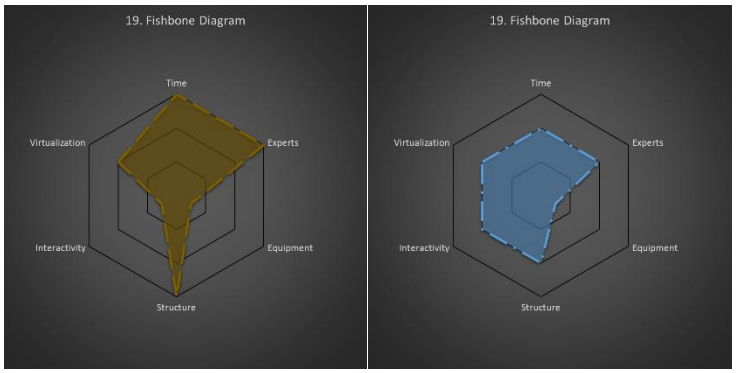






Troubleshoot Monitor

Troubleshoot-Monitor	Time	Experts	Equipment	Structure	Interactivity	Virtualization
19. Fishbone Diagram	3	3	0.5	3	0.5	2
34. Problem Tree - Objectives Tree	2	2	0.5	2	2	2



C. Alternative Future Categorization Research

Classification proposal:

1. Graphical Concepts
   Blueprinting, Storyboards, Moodboards, Collages, PSS boards
2. Experiential Concepts
   Theater, VR and AR
3. Group-activities
   Serious Play, Card Methods
4. Coding and Syntax Languages and their schematics
   IDEF0-3, Petri
5. Components and framework setting
   Critical Success Factor, Sustainability Map, Communications Map etc.
6. ……..