

## FRAMEWORK TO ASSIST IN SELECTING HUMAN CENTRED DESIGN TOOLS AND METHODS

إطار منهجي للمساعدة في اختيار الأساليب والأدوات المستخدمة في التصميم المتمركز على الإنسان

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### ABSTRACT

*Human Centred Design is a significant approach in design. It increases the value of design as well as helping businesses to overcome the challenges of not meeting user needs. However, the abundance of Human Centred Design tools and the difficulty to discriminate between them have created the urge to develop selection framework for these tools in regard to the design process. In this paper, I present a framework to assist in selecting Human Centred Design tools. I highlight the significance of the Human Centred Design approach. I also explain the theoretical background behind creating the framework. Then I describe the participatory design workshop method I used to support and validate the results of the theoretical background in order to further develop the selection framework. This framework can be adopted in the design field in order to facilitate the process and to support practitioners' decisions to select suitable tools.*

### KEYWORDS

Human Centred Design; Design process; Usability; Design Thinking

### المخلص

التصميم المتمركز على الإنسان هو أحد أهم الأساليب التصميمية. فهو يزيد من قيمة التصميم، كما يتيح الفرصة لتجنب المشكلات الاقتصادية المتعلقة بالاستخدام التي تظهر لاحقاً. ولكن وفرة الأدوات والأساليب المستخدمة أدت إلى صعوبة التمييز ما بين تلك الأدوات وكيفية استخدامها. لذا فالاحتياج إلى إطار منهجي لاختيار تلك الأدوات بات في غاية الأهمية. في هذه الورقة البحثية، أعرض إطار منهجي للمساعدة في الاختيار ما بين تلك الأدوات، كما أعرض بشكل مختصر أهمية التصميم المتمركز على الإنسان وأشرح أيضاً الخلفية النظرية التي تم بناء الإطار عليها. سأقوم أيضاً بوصف ورشة العمل التشاركية التي ساهمت نتائجها في تصميم الإطار المنهجى بعد اختباره في ورشة العمل. يمكن استخدام هذا الإطار المنهجى في مجالات التصميم لتيسير العملية التصميمية ومساعدة الممارسين على اتخاذ القرار الصحيح في اختيار الأدوات المناسبة.

### الكلمات المفتاحية

التصميم المتمركز على الإنسان؛ العملية التصميمية؛ الاستخدامية؛ الفكر التصميمي

## 1. INTRODUCTION

It feels sensible to begin this paper by introducing the concept of “Human Centred Design” and by accentuating the significance of the studies made in this area. Human Centred Design is defined by the International Organisation for Standardisation [ISO] as follows:

*“Human Centred Design is an approach to interactive systems development that aims to make systems usable and useful by focusing on the users, their needs and requirements, and by applying human factors/ergonomics, and usability knowledge and techniques” (ISO, 2010)*

In the Human centred design process, all the activities revolve around the user. These activities can be variable ranging from thinking about user needs and context of use to forecasting and preparing for future opportunities. It is a philosophy and mindset. Human Centred Design uses tools and methods dedicated to investigating human-design related aspects in each and every stage of the design process. This can be observing and interviewing users or even designing with them (Abrams et al., 2004) Human Centred Design helps designers to solve wicked problems but from different perspective, it puts the designer in the context and situation of the user and makes the designer think from the user’s point of view.

Donald Norman (1986), the scholar who coined the term, suggests that Human Centred Design puts the user in the centre of the design process. The designer’s role is to facilitate user’s task and to make the user use the object or space with minimum effort as intended, he also suggested that the user should know how to use the design without reading user manuals accompanying it. Human Centred Design increase the usability of design. Accordingly, this leverages the business benefits. The involvement of users throughout every stage of the design process helps ensuring the usability of the design during the process. This, in turn, will ensure that the product will be suitable to the intended use for a particular target audience (Abrams et al., 2004). Adopting Human Centred Design increases the probability of completing the project successfully, on time and within budget. Using the suitable tools and methods can reduce the risk of design failure and increase the likelihood to be accepted by the stakeholders involved. Business benefits can be framed through taking into account the life cycle of the product, service or system involved as well as design, implementation, and finally disposal. Bevan (2005) gave examples of cost-related benefits that can be gained through using Human Centred Design thus improving the usability of designed objects. These examples include reducing development costs, reducing support and maintenance costs and increased profitability.

The research problem of this paper arises from the fact that there are numerous Human Centred Design tools and methods. This comes along with a lack of practical usage instructions and difficulty to differentiate between them. These reasons make the planning stage of the Human Centred Design process very difficult to practitioners and sometimes might lead to unfavourable situations (Bevan, 2009). A diverse group of methods and methods collections have been presented by several researchers to support the adoption of HCD tools and methods. However, the growing number of toolkits and the complexity of decision making in regard to tools’ selection have precluded designers’ adoption to such tools (Tidball et al., 2010)

In order to address this challenge; along with the background literature-based research, I have used two qualitative methods in order to develop the framework for the tools’ selection. The first is an extensive comparative study for the most significant Human Centred Design tools. The second is a participatory card sorting workshop to define the terms that shall be used in the framework. In section two of this paper, I extend the explanation of the topic background with some extra details on the problem. I also introduce the existing selection frameworks available based on literature. In

section three, I describe the methods used which are: a comparative study for the significant Human Centred Design toolkits in terms of their selection criteria as well as a card sorting participatory workshop. In section four I present the results of this study which are the outcome of the studies made. I also introduce the main result of this study which is the framework for selection of Human Centred Design tools in regard to these four pillars:

- a) Application characteristics.
- b) Goals.
- c) Activities.
- d) Constraints.

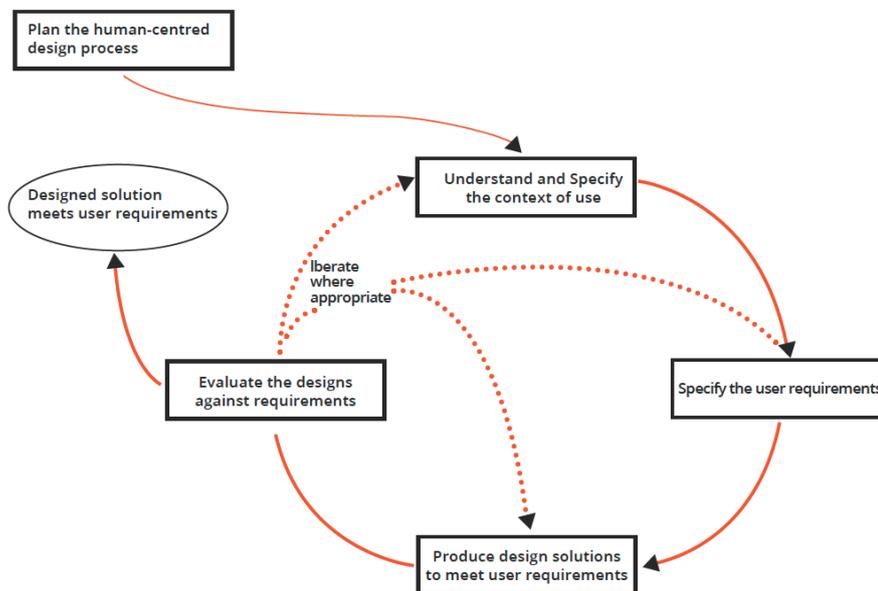
I follow the results by a discussion and conclusion in section Five. In the rest of this paper, I'll refer to Human Centred Design using the abbreviation (HCD)

## 2. BACKGROUND

In this section, I provide further details about the HCD activities and stages along with further definition for the research problem. Before introducing the tools used, I will introduce the key stages of the HCD process. The HCD process proposed in ISO 9241-210:2010 (Fig. 1) describes four types of HCD activities as:

*“There are four linked human-centred design activities that shall take place during the design of any interactive system” which are:*

1. *Understand and specify the context of use.*
2. *Specify the user requirements.*
3. *Produce design solutions.*
4. *Evaluate*”



(Fig. 1) Relationship between Human Centred Design activities (ISO,2010)

The HCD process starts with the planning stage. The next stage is to specify and to understand the context of use. Following this, identifying the requirements of the user. The stage after this is to create design solutions and then evaluating these solutions against the requirements. This process is an iterative process, a practitioner can do it several times and can re-start from any of the aforementioned stages. The evaluation phase is considered the most important one because it helps the practitioner or the design team to gain insights from the target users and to early evaluate the usage of the designed objects. These activities can be used to evaluate an existing design (Bevan & Ferre, 2010).

It feels appropriate now to introduce the concept of toolkits and methods collection before defining the problem. The toolkit concept is an emerging popular concept in design. Lockton (2013) identifies the notion of a toolkit or methods collection by: a collection of “ways of doing things” during the design process in the context under investigation or inquiry. Those can be templates for particular methods that can be applied in implementing particular principles in design practice. Many trials have been conducted in order to collate and gather HCD tools and methods; some are part of academic and scientific studies, and others are practitioner-oriented applications either analogue or digital. Yet, due to the different purposes for these toolkits and methods collections that were created to serve several design domains such as (spatial design, service design, product design and systems’ design). There has been significant variation in the selection terminology and/or segmentation tactics for the tools.

Stanton et al. (2005) identified more than 200 tools and methods and I’ve identified 259. HCD methods are still overlooked and underused because of the difficulty to understand by development teams and organizations. Tidball et al. (2010) support this statement and add to this the fact that the enormous number of tools makes it very difficult to identify the most appropriate tools especially for novice practitioners. Although there are many tools that might tend to solve this issue, the problem is still evident. Lucy Kimbell (2009) noted that the last decade has come to a plethora of toolkits and methods collections. Yet there is a continued misuse of common tools and ways of adoption (Tidball et al., 2010). In a very significant study, (Birkhofer et al., 2005) highlighted one of the very serious concerns to the current toolkits and method collections developed by academia; is the use of very complicated language. Sometimes academics included abstract models, unclear phrases or jargon that might be difficult to understand for practitioners. Tidball et al. (2010) agree with this issue of language difficulties which they found in methods’ collections. Another issue is the variation in naming of the same processes or stages. The descriptions are also different although describing the same activity.

In regard to selection models, there are some existing theoretical models for selection tactics available, (Bevan, 2009) identified four categorisations:

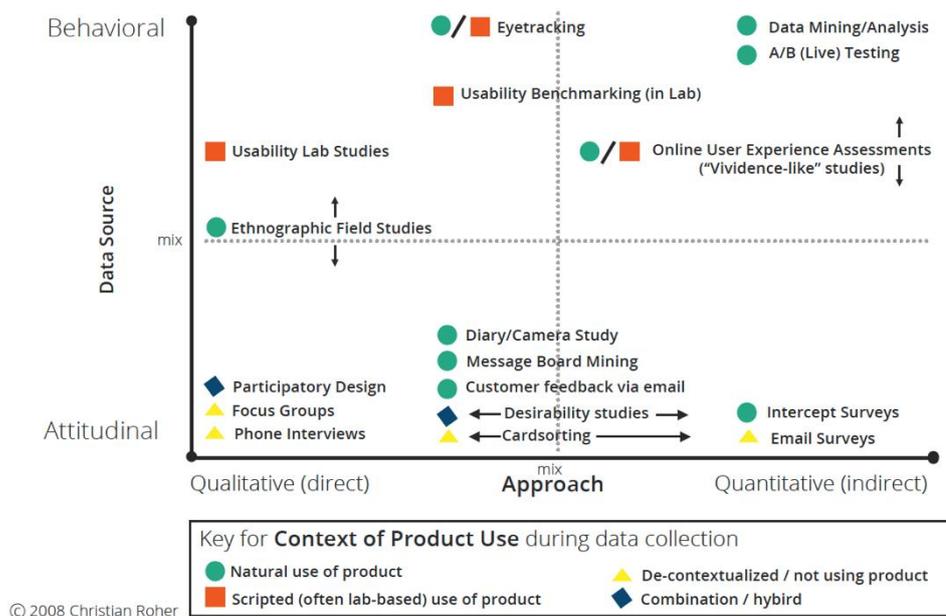
1. Activity groups/lifecycle stage.
2. Intrinsic properties as in ISO TR 16982.
3. Human Centred Design activities of ISO 9241-210 (mentioned above).
4. Detailed activities described in the ISO TR 18529 standards.

Another categorisation model made by Rohrer (2008) (Fig. 2) highlighted that “knowing when the use of each method can be understood by mapping them in three dimensions”

1. Attitudinal vs. Behavioural: this would investigate what people say or what people do.

2. Qualitative vs. Quantitative: qualitative methods tackle the challenges of why or how to fix an issue while quantitative methods tackle how many and how much of a particular phenomenon.

3. Context of Product Use: how and where the participants are using the application under investigation. However, this model was complicated in terms of graphics and the language might not be easy to understand for non-specialists. The other categorisation models are either based on the typology of the tools or on the design phases (stages)



(Fig. 2) - Rohrer's categorisation of methods (Rohrer, 2008)

### 3. METHODOLOGY

The methodology followed in this research is qualitative including comparative study accompanied by interviews and a card-sorting participatory workshop. In order to develop the framework, I've made an extensive comparative study for the most significant HCD toolkits and methods collections. This has been done through literature review as well as web search on google scholar and google web search engine, the web search used the terms: Human Centred Design (HCD), User Centred Design (UCD) tools and methods, usability, human factors, inclusive design, design thinking, design methods collection and design toolkits/guidelines.

The outcome of the web-based search came up with more than 30 toolkits and methods collections ranging from books, e-books, web applications to academic papers and presentations. The 30 were reduced down based on these criteria:

- a) Excluding the toolkits without direct relevance to HCD or UCD or Usability.
- b) toolkits with a very narrow focus (5 tools and less) were excluded.
- c) toolkits and methods collections that aren't providing any information or categorisation instructions.

The results of the narrow down process were 12 tools to be included in the comparative study. The selected tools were the most significant tools and the most widely used in design which are: The methods Lab (1999), IDEO Method Cards (2003), Usability Net (2003), Usability Bok (2003), KAIST (2007), IDEO HCD toolkit (2009), Rotterdam University Generic Work Process (2009), Usability planner (2010), Inclusive Design Toolkit (2011), LUMA Institute – Innovating for People (2012), DIY - Development impact and You (2014). During the comparative study, in-depth interviews have been carried out with the creators of some of the toolkits in order to delve into understanding the structure of the toolkits and how they were developed. The first was the Inclusive Design Toolkit by the Engineering Design Centre, Cambridge University. I have conducted an informal in-depth interview with Dr Joy Deane, Dr Sam Waller and Dr. Katie Kornish. The second toolkit is the “Development Impact and You” developed by the London-based consultancy STBY; I’ve conducted another informal in-depth interview with Megha Wadhawan, one of the principle creators behind the toolkit. The toolkits have been investigated in terms of number of tools included, categorisation of tools, medium/structure of presentation (cards, matrix, or diagram) and the information included on each tool. The comparison has been gathered in a matrix.

The second method used is the participatory card sorting workshop. (Martin & Hanington, 2012) identified that this method can be used when user comprehension and meaningful categorization is critical, it can help clarify meanings. They also identified it as “a participatory design technique that you can use to explore how participants group items into categories and relate concepts to one another. The card sorting participatory workshop has been used to clarify practitioners’ perceptions about the meanings and terms used in the HCD categorisation. The card sorting can help in identifying the terminology that could be excluded because they are vague or have different meanings. It can help to identify schemas for organizing toolkit classification, design phases and constraints. It can also support the process of distinguishing the terms that are difficult to categorize or aren’t associated with general consensus.

Based on the outcome of the comparative study conducted before the workshop, the terms have been extracted from the most significant toolkits and methods collections and then put into cards. Then the practitioners (designers) were asked to categorise these cards according to guided activities. The cards have been given to designers (69 cards) (Table 1) all mixed up, designers were asked to categorise the cards in response to four guided tasks. These tasks are unconstrained card sorting, constrained card sorting, elimination of cards, and HCD process sorting. All the cards have been designed using the same colour and font, each designer was given a set of blank cards to add terms whenever he or she thinks it is necessary. All the terms used without any change as I didn’t want to bias the answers, the terms used as they are being used in the original toolkits and collections (even if the term doesn’t make sense or seems to be old fashioned)

Participants were 8 practicing designers. They were chosen from 8 different nationalities speaking different languages (English, Italian, Spanish, Chinese, Indonesian, Russian, Korean and Lithuanian) all living and practicing in London, England, UK. The language diversity was key to investigate language challenges and to understand further implications for the diversity of cultural backgrounds. Their ages ranged from 23 to 27, 3 males and 5 females. The four tasks details are as follows:

1. The first task - unconstrained sort:

Each designer of the 8 participants has been asked to sort cards freely based on what he or she thinks not what it should be or based on models he/she knows. Designers were asked to add terms, if required, on the blank cards to add as many categories as needed (Fig. 3).

2.The second task – constrained sort:

Each designer was given a grid sheet of two-dimensional matrix with a dimension for the 3 header titles which are goals, activities, and constraints. While the side dimensions included these titles (familiar with, not familiar but know it, never heard of it) in order to identify the level of familiarity (Fig. 4).

3.The third task – elimination:

Designers were asked to eliminate cards that they think are not relevant and not necessary.

4. The fourth task - design a process

In this task each designer was provided by four picture cards for existing design with a picture and a cost estimate. The designs were selected in order to be relevant with the constraints of the HCD process on many layers (cost, time, safety and space) ranging from very simple plastic kitchenware to a complicated medical device. The aim of this task was to construct an HCD process based on each of the abovementioned products.

Table 1 – list of keywords put on cards

Goals	Activities	Constraints
Explore	Envisioning opportunities	Lack of Time
Research	Understanding User needs	Very Restricted Budget
Concept	Exploring Product Requirements	Users Cannot Be Involved
Planning	Generating Ideas	Users Have Disability
Manage	User research	Highly Complex Task
Develop	Task analysis	Task is Completely New to Users
Requirements	Cognitive models	Wide Task Spectrum
Making	Usability evaluation	Limited Skills/Expertise of Practitioner
Create	Future creator	Large Sized Product
Deliver	Imagine and Act Out	Uncertain Specification
Implementation	Professional Trackers	Difficult to Involve Users
Analyse requirements	Direct Design Experience	No access to Users
Test and measure	Co design	Some users have Disabilities
Analysis	Co research	Complex Task
Verification	Expert Observation	Many tasks
Evaluate	Stimulus and interview	Safety or business critical system
Hear	Current Customer Information	Organisational changes needed
Design development	Look Ahead	Efficiency or accuracy is important
Design	Develop a Clear Plan	Adaptation of an existing system
Planning and feasibility	Clarify my Priorities	Customisable product
Post release	Collect Inputs from Others	Product used in many different contexts
Concept design	know the people I'm working with	
Research and analysis	Generate New Ideas	
Scoping and project design	Test and Improve	
Test of new Concepts	Sustain and Implement	
Communication of Results	Learning About Users	
Measuring		
Learn		
Look		
Ask		
Try		



Fig. 3 - Card sorting matrix (unconstrained sort)

Fig. 4 – Card sorting matrix (constrained sort)

## 4. RESULTS

### 4.1 Participatory workshop results

I analysed the data results of the workshop using the following methodology: each participant sort has been codified in table sheets (using Microsoft Excel 2010). Each sort has been examined to investigate the terms with higher level of selections from the participants and in which category. For example, “Concept” card has been classified as a “Goal and Familiar with” by 6 participants then concept scored 75%. After this, the cards were grouped based on the notion of the card. For instance, (“research”, “research and analysis” and “explore”) are grouped together and then one term of them was chosen based on both the elimination percentage by the designers and the familiarity matrix results (e.g Planning scored 63% in familiarity while “scoping and project design” scored 50%, then the planning was chosen to be included. Elimination of cards has been done based on the selections of the participants and on the elimination exercise. This included the cards of “not familiar with” and “never heard of it” as well as the eliminated cards by users in the third task. Those were all excluded from the final refined matrix (Table 2).

Table 2 – Final list of selected keywords

Goals	Activities	Constraints
Planning	Hear	Very tight time schedule
Exploring	Envision Opportunities	Low Budge
Concept	Co-Research	Users cannot be involved
Creating	Understand User Needs	Users have disabilities
Evaluating	Analyse Requirments	Highly Complex Task
Delivering	Generate Ideas	Task is Completely New to Users
	Co- Design	Large Sized Product
	Evaluate Usability	Many tasks
		Customisable product
		Product used in many different contexts
		Adaptation of an existing system

## **4.2 Framework structure: the four pillars of Human Centred Design and factors influencing HCD tools and methods selection**

The framework of selection is the main outcome of this study (Fig. 5). I've collated the literature review made, the comparative study and the card sorting workshop results in order to create the Framework. The outcome of the previous studies has highlighted that the selection process should be flexible, adaptable and integrated. It means that designers can form their own process and be able to answer the following questions:

What are the application/product characteristics?

What goals do they have?

What activities do they need to do?

What constraints do they have? (in a particular design project)

Thus, the selection process should answer what is the appropriate tool for each combination of goal (s)+ activity (ies) + constraint (s)? and what is the most relevant tool to what a designer wants to achieve. The structure of the framework has been created based on the following four pillars:

### **4.2.1. Initial Understanding of application characteristics (parameters)**

The results of the study indicated that practitioners would rather start by defining the design outcome type at the very beginning of the project. This notion was thought to lead to a more effective HCD project. The application characteristics include:

a) Type of the product/application: whether it is physical tangible or digital. This would affect the type of tools and methods being used in the HCD approach.

b) Product/application size: the size of the product whether it is a large product or handheld small product. This influences the space needed and the nature of tools used- for example- in the evaluation stages.

c) Budget assigned to produce a design: what funding is made available for the HCD project influences the selection as well as prioritisation of tools and methods that should be used.

Consideration of the potential business benefits and/or risks reduction to the product should be carefully thought of before selecting particular tools and methods.

d) Time: the project timeframe. This is relevant to the tools selected and duration of each method or tool, some tools take longer times than others which might not be relevant to the nature of the project.

### **4.2.2 Goals**

The second pillar of HCD is the goals. A goal here means the intended goal of using a tool or a method. The list of goals includes:

a) Planning: the action to plan the project, where the project parameters are explored and defined.

b) Exploring: to map opportunities background research, define the gaps and bridge them.

c) Concept: concept design is a very important stage of the design phase as it stands for originality, creativity and coming up with solutions for a particular problem.

d) Creating: the realisation of concept design. finalising and refining a concept and turn it to be a solid outcome (prototype) with the basic needed features that should be in the final product/application.

- e) Evaluating: test and evaluate design outcome with users, evaluation is to test and work out features to be improved, it might lead the designers to go backward to previous steps such as concept or other stages.
- f) Delivering: the act of launching designs, communicate the results of the process.

### 4.2.3 Activities

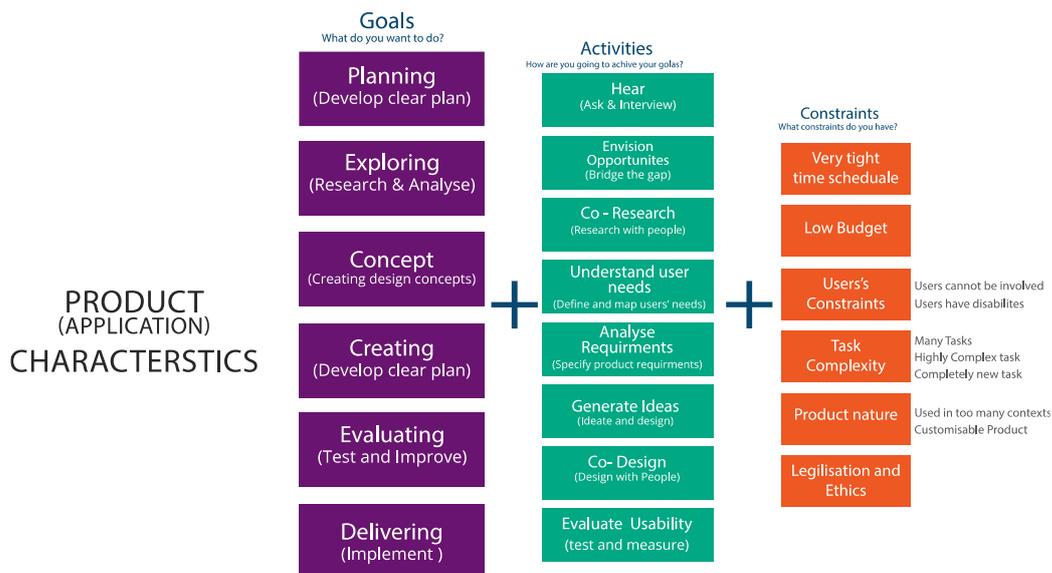
The third pillar is activities are what need to be done to achieve a goal(s), they actually correspond with the items in the goals list but with more “actionable sound”

- a) Hear: is to listen from users, interview and ask the target users.
- b) Envision opportunities: creating a future vision of a particular product
- c) Co-research: participate with the end users in the research phase.
- d) Understand user needs: Clearly defining user needs and desires (declared and undeclared).
- e) Analyse requirements: reflect on the needs and analyse what could be the users’ requirements and what specifications should be included.
- f) Generate ideas: creating concepts and ideation.
- g) Co-design: includes a set of methods that allows a practitioner to participate with the users in the design.
- h) Evaluate usability: evaluate usability here includes a set of methods that responds with the Idea of using a product in general it doesn’t stand for usability testing only.

### 4.2.4 Constraints:

Barriers that might obstacle particular activities or usage of specific methods. This includes:

- a) Very tight time schedule
- b) Low budget
- c) Users constrains
- d) Task complexity
- e) Product nature
- f) Legal issues and ethics



(Fig. 5) – HCD tools and methods selection framework

## 5. DISCUSSION & CONCLUSIONS

In this section I gather some insights from the previous studies conducted and I conclude the work done in regard to this research. I'll begin with insights from the participatory workshop. During the workshop, the practitioners inclined towards classifying the cards in regard to the classical well-known design phases (Research, Design, Develop, Evaluate, Deliver). They were resistant to use terms such as (hear, look and try) created by IDEO method cards although this the most popular HCD toolkit. In terms of language, all the participants created an unidentified group of cards that they didn't understand the meaning of them. Designers tended to understand the terms/expressions with straightforward description or simple grammar structure however terms with jargon and difficult vocabulary were usually classified as unidentifiable or confusing. In terms of process structure, some of the participants did perceive the process in terms of three main stages (early, middle and final) and they were more inclined towards a flexible process that can begin at the needed stage directly. The results showed that almost all of the participants agreed on the generic design process regardless the way of ordering the stages. Another insight that has been accentuated, is that the designers' own process varied greatly in terms of planning. For example, the very simple product, designers tended to reduce the design activities automatically while for the complicated design they tended to detail the process and think about activities carefully.

The results comply with previous research findings and do not conflict with the literature-based investigation. In this effect, the results of the workshop have been used as a basis for the model of the selection process. It was also evident that it was difficult for designers to spot the difference between the intended goal of method and the activities they do to achieve this goal. Yet designers perceived the typical design phases as the bigger issue (goal) and thus activities lie inside.

To conclude, the developed framework can be used to assist practitioners in developing & structuring their own HCD process. However future development is needed to further detail the framework. This development might include several participatory workshops with different samples of practitioners in order to refine the selection model. Also, the selection model should be accompanied with an application model to support designers in completing the HCD design process.

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