User Experience Design (UXD) Competency Model: Identifying Well-Rounded Proficiency for User Experience Designers in the Digital Age

Atthaves Borriraklert[1], Supaporn Kiattisin[2*]

[1,2]Information Technology Management, Faculty of Engineering, Mahidol University, Nakhon Pathom, Thailand

Abstract

Background The digital era has influenced the whole global economy and its job market. This environment has changed many current mandatory skills and has created many new job positions. User experience (UX) design is an emerging career for developing user experience and satisfaction, but there is no consensus for its competencies. We developed a competency model for UX designers, considering value creation for today's business climate.

Methods The elements of the UX competency model were extracted through a systematic literature review in design and human-computer interaction. Content and thematic analysis were deployed to cluster diverse elements into distinct units that illustrated the competency model for a UX designer. The model evaluation was based on judgments of 25 experts using snowball sampling.

Results Our UXD competency model had four domains, nine units and 63 elements of competency. CVI, modified kappa, and Cronbach's alpha confirmed the validity and reliability of the model. Each unit was classified into three types to differentiate functions and significance with t-tests. The Core competencies were design research and usability value. Functional competencies were design principle, design process, aesthetic value, information art, business acumen and project management. Information technology was found to be cross-functional competency.

Conclusions Our derived UXD competency model illustrated every dimension in the well-rounded proficiencies needed for UX designers in the digital age. The model covered UXD tasks and contexts in the digital age, and can be generalized for human resource development as a framework for UXD job analysis in a design or technology organization.

Keywords Design Competency, Competency Modeling, Human-Computer Interaction, User Experience Designers, Design Management

*Corresponding author: Supaporn Kiattisin (supaporn.kit@mahidol.ac.th)

Citation: Borriraklert, A., & Kiattisin, S. (2021). User Experience Design (UXD) Competency Model: Identifying Well-Rounded Proficiency for User Experience Designers in the Digital Age. *Archives of Design Research, 34*(3), 61-79.

http://dx.doi.org/10.15187/adr.2021.08.34.3.61

Received : May. 21. 2021 ; **Reviewed :** Jun. 23. 2021 ; **Accepted :** Jun. 28. 2021
pISSN 1226-8046 **eISSN** 2288-2987

1. Introduction

As the digital era influences the global economy, many mandatory skills have changed, added, adapted and substituted by digital technology. Many professional institutes forecast that there will be more demands in new careers, and some existing jobs will be decreased or eliminated, because of the emerging of digital technology (McKinsey Global Institute, 2017; Oxford Economics, 2018; World Economic Forum, 2018). It is undeniable that the advent of digital technology has shifted human activities, perception of values, and how people experience a product, service or system. Nowadays, many businesses focus on crafting customer satisfaction by enhancing the user experience, and user experience designers take full responsibility in designing the experience.

User experience design (UXD) is an emerging field, and an increasing need for all industries using digital technology. Since this idea developed by integrating the disciplines of human-computer interaction, product design, interaction design, communication design, business practices and information technology. The limits of its boundary are still being debated and there is no precise boundary yet. Although the idea of designing for experience is not entirely new in the world of art and design, there is no rigid consensus or standard in the role, function and specification of the career in user experience design. This situation is worldwide and employers now need clear job descriptions and specifications for user experience designers in the job market (Gonzalez et al., 2014; Kou & Gray, 2018). Therefore, competency modeling is needed to clarify user experience designer knowledge, skills, abilities and other characteristics.

A competency model is a set of competencies, that are combined from business requirements, industry trends, driving forces and industry ethics or standards. A competency model can be used to describe and evaluate worker performance in a specific occupation (Draganidis & Mentzas, 2006). A refined competency model details the essential criteria of worker behaviors in a particular career, and measures the performance that helps in human resource development planning by closing the skill gaps among workers (Paloniemi, 2006; Vakola et al., 2007; Stevens, 2012).

As the digital economy is growing, user experience design is an urgently needed job for maximizing a company's customer satisfaction. However, there is no comprehensive competency model to serve this situation yet. We developed a competency model that clarified the expertise of user experience designers in the digital era. We describe a well-rounded competency model for user experience designers, which different design companies, in each field, can use as a guideline in human resource management, for their user experience design department or projects.

2. Literature Review

2. 1. Definition of User Experience Design

Norman et al. (1995) introduced the term of user experience to the field of human-computer interaction (HCI) in the 1990s. They used the word "User Experience" to describe the relationship between the human interface and the usability of the application in the Apple Computer. User experience design explores a more effective innovation by observing a person's emotion using a product, service or system, besides the usability, which benefits the HCI community. Nevertheless, there is no consensus on user experience definition or an empirical standard in implementation, so the wisdom of user experience needs to be debated and reviewed before used in the competency modeling.

The term "user experience" has a wide range of meanings, from usability to beauty or function to emotion in experiencing the use of technology (Hassenzahl & Tractinsky, 2006). The International Standard ISO 9241-210 (2010) defined user experience as "a person's perceptions and responses resulting from the use or anticipated use of a product, system, or service." It also provided details of user experience, including user physical and psychological responses, resulting from design concerning usability, brand image, presentation, and function toward users' personal goals. From this standard definition, a user experience designer needs to be qualified with a large body of knowledge and skills to achieve the design objective.

2. 2. Concept of User Experience Design

The goal of user experience is to create a meaningful product, service, or system for users by enhancing their satisfaction and perception of the value of the product, service, or system. To achieve this goal, user experience designers need to understand multiple disciplines, for example, cognitive, psychological, affective aspects and traditional design practice, in designing a user experience, that results in user satisfaction (Zhou et al., 2012; Zarour & Alharbi, 2017).

Characterizing the nature of user experience design into a rigid process is challenging due to its complexity and subjective nature. However, the user experience design always starts with understanding user cognitive goals, expectations, frustrations, emotions and pain points (Pucillo & Cascini, 2014), through cognitive analysis methods, for example interviews, observations, process tracing methods, critical decision methods and conceptual methods (Zhou, Xu, & Jiao, 2011). This can be described as opportunity creation (Moon & Han, 2016), before deploying the classic design steps, for example, idea generation, design development, design refinement, design specification, prototyping and usability testing. User experience design integrates many design and engineering disciplines to create ‘touchpoints’, where users can interact with a business, for users. Some examples of those disciplines are visual design, information design, information architecture, interaction design and usability testing (Halvorson, 2010; Garrett, 2011).

The outputs of user experience design are not only a product, service, or system, but include product management, user training and change management, for implementing the design for the business and bridging the enterprise to the users (Finstad et al., 2009). From these perspectives, user experience design cannot focus only on the end-user, but also needs to gather the design requirements from other user roles, for example business owners, stakeholders, partners and workers, to set design parameters (Goodwin, 2009).

2. 3 Digital Technology and User Experience Design

Lately, digital technology has developed rapidly and affected most people, in any context, for example behavior, business, product and service development, marketing, social and culture. Digital technology also introduces many new challenges in design, as the behavior of users keeps changing, due to new demands for use of digital technology. In the era of the digital economy, digital technology remarkably affects user experience design and has brought it into a spotlight. The relationship between digital technology and design has three aspects: digital design and touchpoints, mixed-reality between physical and digital space and data-driven design: these are summarized in Table 1.

Table 1 The impact of digital technology on user experience design

Digital Technology Aspects	Impact on User Experience Design
Digital design and touchpoints	– Digital tools help designers in manipulating the design process, idea visualization, prototyping, implementing, and communicating the design instantly, across platforms and distance, in designing both analog and digital touchpoints (Wodehouse & Ion, 2010; Correia, 2011; Nylén et al., 2014). – Functions and statuses of some analog touchpoints have been transferred to the digital platforms (Jenkins, 2006).
Mixed reality between physical and digital space	– Mixed reality can deliver information with an understanding and meaningful user experience, while users extend their presence from the physical space to the digital world (Benyon, 2012).
Data–driven design	– Digital media gather user feedback and allow users to interact more with the business in real–time (Young, 2010). – Data and information impact design strongly. Many data–mining techniques are used in design research for investigating user behavior, identifying product configurations, segmenting users, comparing designs and constructing qualitative knowledge–based on user experience (Chien et al., 2016).

3. Method of Competency Modeling

Since competency modeling is broadly used, there is no consensus on the modeling method. However, academics and practitioners have explained similar modeling steps using different terms. Cheetham & Chivers (1996) illustrated competency modeling through ‘functional analysis’. This broke down competency modeling into ordered components, which were units of competence and elements of competence. The competency domain described a set of units and elements of competency, that characterized an area of competent performance.

There are three types of competency: core competency, functional competency and cross-functional competency. Core competency describes the competitive unique competencies of a career. Functional competencies are specific knowledge, skill, and personal worker attitudes in carrying out tasks in each job. Cross-functional competency illustrates a broad

set of knowledge, skills and attitudes to working across teams in an organization (Ljungquist, 2007; Ismail et al., 2020).

Our research methodology was designed in three phases, based on competency modeling. The three phases were systematic literature review and context analysis, competency model development and competency model evaluation. This is illustrated in Figure 1.

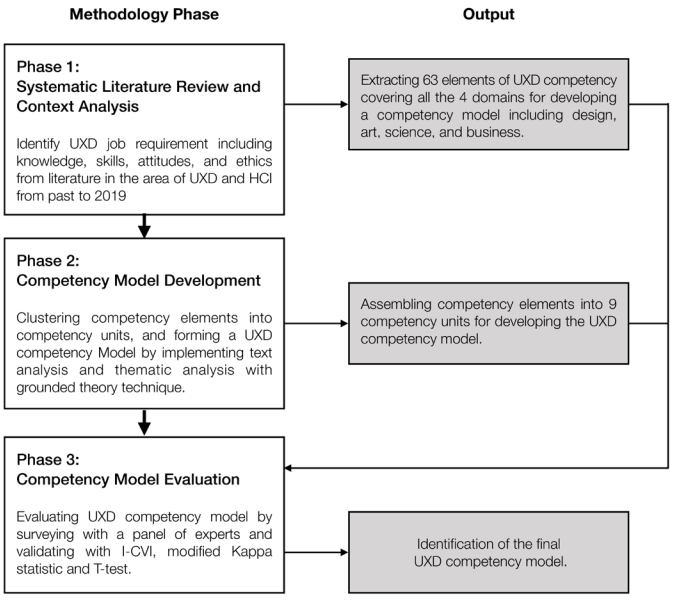

Figure 1 Overview of our three phase methodology

3. 1. Phase 1: Systematic Literature Review and Context Analysis

Our competency model development started with a context analysis. Context analysis can define requirements and criteria from the current situation for crafting a competency model, constructively aligned with business plans, goals, and needs (Draganidis & Mentzas, 2006). Also, the context includes concerns for ethics and standards in an industry, which are essential to every competency model.

Since user experience design boundaries are still being debated, we surveyed academic articles to optimize our studies, because they allowed us to gather various perspectives broadly and rapidly. In the literature from 1983 to 2019, we found 32 articles, that mentioned the roles and functions of user experience designers, 23 articles on user experience evaluation, and 14 articles on user experience design case studies, that we used as our materials for context analysis to identify the elements of user experience design competency. Also, we added data from ISO 9241-210 (ISO, 2010) and AIGA Designer 2025 (American institute of graphic arts [AIGA], 2018), since these two reports covered ethics and standards in user experience design.

Our context analysis used 'PEST analysis', a tool for examining trends in a business context with four aspects of political, economic, social, and technology factors, within a business

environment (Ward & Peppard, 2002). We altered the label of each factor, so that it was relevant to user experience design, e.g., business needs, user needs, design movement, and technology movement, as shown in Figure 2.

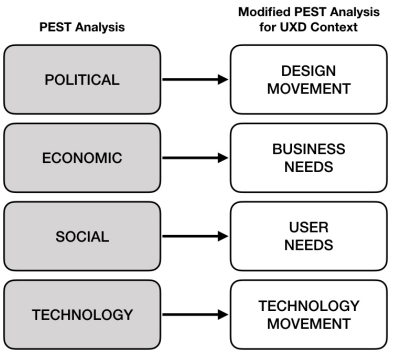

Figure 2 Modified PEST Analysis in the UXD Context

Table 2 Result of Context Analysis

Contexts	Summary of Analysis
Design Movement	– The design has grown as a practice in dealing with high–complex problems by integrating various disciplines and knowledge, including art, engineering, computing, psychology, anthropology and marketing (Buchanan, 1998; Oygur & Blossom, 2010; Aman et al., 2017; D. Lee & H. Lee, 2019). – Designers need to focus on developing a user experience, while using the product service or system, not only the beauty and function of the design (Norman, 1983; Hauser, 2007; Ashley, 2007; Forlizzi et al., 2008). – Designers must be concerned about content engaged to users and how users understand it, as a new form of design (Halvorson, 2010; Benyon, 2012; Pucillo et al., 2016).
Business Needs	– Businesses have changed their focus from business productivity to human experience, by concerning customer needs and meaning in developing a product, service or system (Zhou, Xu, & Jiao, 2011). – The digital transformation has forced many businesses to change their process and provide or communicate their values through digital touchpoints (Correia, 2011; Zhou et al., 2012). – Big data provides a significant advantage to a business; hence, businesses need to capture meaningful data, by designing their digital platform (Young, 2010; Yang et al., 2019).
User Needs	– Users need to organize and structure their data and content, on their own, with ease in the digital space 'on demand' (Davis & Hunt, 2017, Yang et al., 2019). – Users need a meaningful experience in interacting with physical objects or spaces, with the enhancement of digital touchpoints (Buchanan, 2001; Benyon, 2012).
Technology Movement	– Digital technology enhanced manipulation in design, including editing, storing, simulating, sharing design problems, ideas and solutions (Wodehouse & Ion, 2010; Correia, 2011). – Digital touchpoints need to be introduced to users and deliver a satisfying experience (Nylén et al., 2014). – Big data helps in improving design quality and extracting prototype features; hence data mining is an essential skill for designers (Chien et al., 2016).

The body of knowledge is an essential starting point of any competency model development. To better understand the body of knowledge in design, we examined the different concepts in developing the design profession, both in education and industry, and summarized the interesting concepts.

In the 21st century, the design profession was defined differently from the art and science of creating artifacts. Buchanan (1992) suggested that the field of design had grown as a discipline to resolve the wicked problem, and Cross (1993) depicted the design as a scientific

process and discussed the development of design science. Findeli (2001) classified design into three main domains: art, science and technology. He discussed how the design profession would develop to meet the new world view in the 21st century that the art domain would change to perception, and science and technology would combine into action. The perception concerned with visual intelligence, and action referred to the technological act reflecting the design logic. These ideas depicted design as a discipline of balancing between art and science knowledge that involved technology feasibility.

The design discipline became more apparent and vital with the emerging of the human-centric design movement. Moreover, the body of knowledge of design had extended beyond the area of art and science, as several experts suggested that it involves research activities, technology and business (Frayling, 1993; Swann, 2002; Faiola, 2007). Therefore, the design had already created its discipline, as a balancing activity between business stakeholders, through the design itself and design research (Oygur & Blossom, 2010; Åman et al., 2017). These ideas formed the rigid discipline of design and applied the design process into the business ecology.

We used thematic analysis by mapping the relationships between different ideas from many design experts, as shown in Table 3. The mapping and analysis helped to recognized different themes for the body of knowledge of design. We concluded that there are four domains for the body of knowledge in design: design, art, science and business. These four domains served as a framework in molding the UXD competency model.

Table 3 Mapping of different concepts in developing design profession

Authors	Design	Art	Science	Business
Buchanan (1992)	O			
Cross (1993)			O	
Frayling (1993)	O			
Findeli (2001)		O	O	
Swann (2002)	O			
Faiola (2007)	O	O	O	O
Oygur & Blossom (2010)		O	O	
Åman et al. (2017)	O	O	O	O

A brief description of each domain is:
Design Domain – As design had grown as its discipline, the design domain illustrated the design principle, process and research activities, reflecting the interdisciplinary nature of design for gathering insights from various perspectives.

Art Domain – The meaning of art always stands for a human perspective. Art provides an understanding of the human cognitive process and emotion, then creating the aesthetic artifacts for humankind.
Science Domain – Science served as logical thinking, resulting in the creation of artifacts, that fulfilled human needs in terms of usability, function and features of the product, service or system.

Business Domain – Design has a significant role in business. Designers need to understand the business environment, design for value, and manipulate a design project for business success.

From our literature review of user experience design, 226 memos of competency for user experience designers were extracted covering all four domains. These memos were clustered into distinct elements and units for molding the competency model in the next phase.

3. 2. Phase 2: Competency Model Development

Competency model development identifies components in a competency model, which are units and elements of competency. The units of competency are groups or clusters of abilities and proficiency levels in different tasks. Besides, the elements of competency refer to the details of knowledge, skills, behaviors and characteristics in the competency model. The components of a competency model are shown in the paths shown in Figure 3.

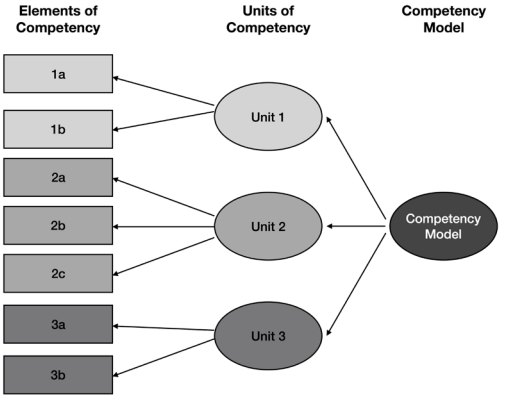

Figure 3 Path model of components in a competency model

We applied the text analysis and thematic analysis, with the grounded theory technique, a qualitative and inductive approach (Charmaz, 2006). This technique allowed us to classify elements of competency into different units of competency by recognizing themes and patterns from the text (Bernard, 2018). The procedure of thematic analysis is shown in Figure 4. We extracted 226 memos of key ideas from the literature and classified them by card sorting and mapping. We recognized 63 elements of competency for user experience design and categorized them into different themes to form distinct units of competency. An example of card sorting procedure is shown in Figure 5. Thematic analysis hypothesized that there are nine units of competency: design principle, design process, design research, aesthetic value, information art, usability value, information technology, business acumen and project management. Table 4 summarizes key factors in user experience design competencies from previous studies. Figure 6 shows a path model of the hypothesis of user experience design (UXD) competency model.

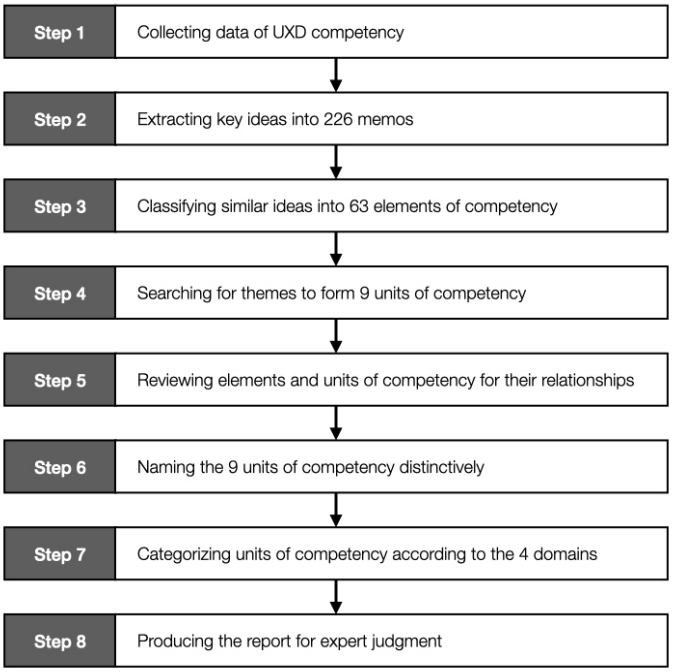

Figure 4 Thematic analysis procedure

1. DESIGN PRINCIPLE				
Addressing Design Problem	Address design problems at various scales (at the level of components, products, systems, and communities)	Locate areas of friction and leverage points where small changes or external forces could produce big differences in the state of the system	"Design complexity is therefore not necessarily in itself a problem. It is obviously something that gives designers rich experiences and variation, and makes it possible for them to be surprisingly creative in their design adventures. Complexity is probably even a required condition for innovative and creative design to happen. In contrast to the scientific focus on the universal and the existing, design deals with the specific, intentional and non-existing. It is about creating something in the world with a specific situation, for a specific client and user, with the specific functions and characteristics, and done within a limited time and with limited resources. (Stolterman, E., 2008). "	Identify researchable questions that are appropriately scaled to time, resources, and student expertise
Aware of Designer's role and importance	Identify the social and ethical responsibilities of designers and clients in addressing design challenges	Whatever the design process and allocation of responsibilities and roles adopted, a human-centred approach should follow the principles of HCD	the aim of designing experiences necessarily leads to the attempt of designing the user, which means trying to design something that is not there for us to design. (Pucillo & Cascini, 2014)	Futurecasting, foresighting, and speculative design as ways of anticipating changes in practice and co- creating client futures
Focus on Designing for User Experience	designing user tasks, user-system interaction and user interface to meet the user requirements, taking into consideration the overall user experience	Products, systems and services should be designed to take account of the people who will use them as well as other stakeholder groups including those who might be affected (directly or indirectly) by their use.	In order to achieve accessibility, products, systems and services should be designed to be used by people with the widest range of capabilities in intended user populations.	Although it is understood that designers cannot directly 'design experiences' or 'design impressions', since UX is generated and changed within different con- texts and at different phases of product use, designers and scholars maintain that designers have an ability to influence users' experiences and impressions of products. (Khalag & Pedgley, 2019)
Interdiciplianary and Open-minded	Most subject matters related to design disciplines overlap with the areas of expertise of other professions. Cognitive studies in design are informed by psychology;57 research on collaborative design uses literature from organizational studies in business.58 Similarly, studies on user research are mostly informed by research conducted in anthropology, sociology, psychology, and marketing.59,60 Design disciplines need more in-depth disciplinary studies on user research, user-centered design, and research-inspired design processes. (Oygur, I., & Blossom, N., 2010).	Design must embody socio-cultural, aesthetic, and symbolic elements while recognizing equally the technical dimensions. However, with the duality view of design, "firms can tap into fundamentally different sources of value creation by focusing on cultural innovation"32—where cultural resources com- plement the technical ones. (Åman, P., Andersson, H., & Hobday, M., 2017).	Psychology / Cognitive Science / Social Science / Anthropology	
Product Service and System Ecosystem	Product ecosystem design has its origin in designing products with centeredness on human users. This notion is consistent with user-centered design (UCD), which has been typically addressed in the fields of human–computer interaction (HCI), and human factors and ergonomics (HFE). (Zhou, Xu, & Jiao, 2011).	To ensure the interactive product's instrumental value became the major endeavour of the field. (Hessenwahl, & Tractinsky, 2006)	Identify ecologies of related information, products, and services that support the achievement of people's goals	Identify and design for important touch points or instances of friction where people change or lose support for continuous experiences
Balancing Between Differences	Potential conflicts between user requirements should be resolved.	Design is therefore not a fixed point but a set of balance points along a range of opportunities, on which exist boundaries to be crossed and gaps to be closed. Although closing the gap might seem impossible, we see from many historical examples that it can be done. Technical and economic considerations are required to meet efficiency criteria, while aesthetic and symbolic consider- ations are needed for meaningfulness. (Åman, P., Andersson, H., & Hobday, M., 2017).	User experience design is a creative task. Finding the right balance between vision and technical feasibility is always challenging. To succeed as a team, it is important to build good team spirit. (Hauser, 2007)	

Figure 5 Example of card sorting procedure

Table 4 Mapping of units of competency with key literature

Key Literature	Design			Art		Science		Business	
	1. Design Principle	2. Design Process	3. Design Research	4. Aesthetic Value	5. Information Art	6. Usability Value	7. Information Technology	8. Business Acumen	9. Project Management
AIGA (2018)	O	O	O		O		O	O	O
Aman et al. (2017)	O		O	O		O	O		
Benyon (2012)				O	O		O		
Blair-Early & Zender (2008)				O	O	O			
Buchanan (2001)			O	O		O			
Chien et al. (2016)				O	O		O		
Finstad et al. (2009)		O						O	O
Forlizzi et al. (2008)	O		O						
Halvorson (2010)		O		O	O				
Hassenwahl & Tractinsky (2006)	O			O		O			
Hauser (2007)	O	O						O	O
Innes (2007)		O	O						O
ISO 9241-210 (2010)	O	O	O		O	O	O	O	O

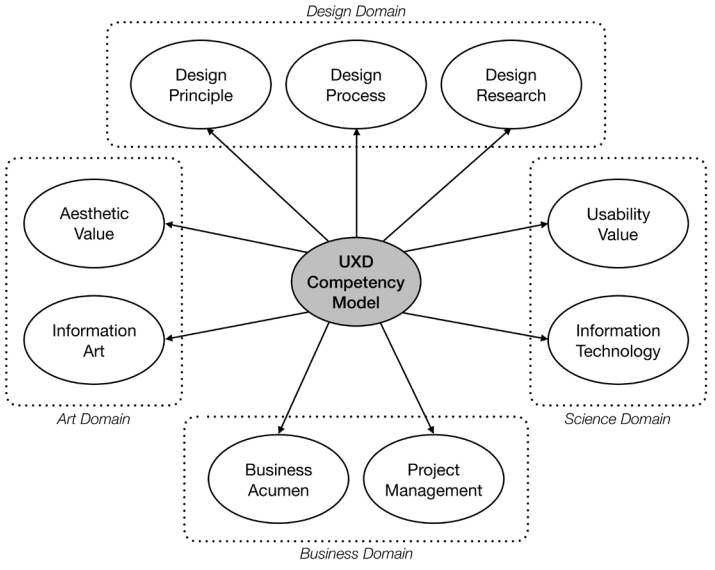

Figure 6 Hypothesis formed from nine units of competency in user experience design (UXD) competency model

3. 3. Phase 3: Competency Model Evaluation

Since competency modeling is a qualitative approach, previous studies used various qualitative and quantitative methods to evaluate their models. Qualitative methods included expert interviews, in-depth interviews, panels of experts, validation workshops or critical incident technique (CIT) interviews. Quantitative methods were based on basic statistics, *e.g.*,

analysis of variance, t-test or x^2. Many pieces of research on competency model or framework development suggested that subject matter expert judgment was an adequate method for evaluating the model to confirm the concept (Marrelli et al., 2005; Calhoun et al., 2008; Donohoe & Needham, 2009; Horng et al., 2011).

To evaluate the competency model, 25 experts were sampled, through the method of snowball sampling, from both academic and industrial fields. There were ten academic and 15 industrial experts. Our experts had an average 9.6 years of experience in user experience design, including interaction design, human-computer interaction, digital design, digital media design and digital platform development. Since the target population of this research was homogeneous, 25 expert judgments were adequate for assessing the validity and reliability of the model. Macmillan (1971) stated that if a number of experts ≥17 → an allowable error < 0.02, thus our sample was adequate for validating expert judgments.

A content validity index (CVI) was used to assess model validity, and a modified kappa statistic was used to measure inter-rater reliability and confirm the agreement. CVI is a good indicator for validating content, within a model or a research instrument through expert judgment on a 5 point scale (1=not relevant, 2=somewhat relevant, 3=quite relevant, 4=high relevant, 5=very high relevant). Item-level CVI (I-CVI) is a validity index for each item in a model by counting expert ratings of 4 or 5 and dividing by the number of experts. Lynn (1986) suggested that the cut-off for an excellent item was >0.80 when there were more than ten experts.

The modified kappa statistic (K^*) indicates the level of agreement of experts by calculating the probability of chance agreement (P_c) for each item, then calculating kappa following these formulas (Polit et al., 2007):

$$P_c = [N! / A! (N-A)!]*0.5^N$$

where N = number of experts, and A = number agreeing on good relevance (rating above 4 or 5)

$$K^* = (\text{I-CVI} - P_c) / (1-P_c)$$

If $K^* > 0.74$, it can be considered excellent, between 0.60 and 0.74 is good, between 0.40 and 0.59 is fair, and below 0.40 is poor. After calculating the modified kappa statistic, each item, with I-CVI ≥ 0.78, can be considered excellent reliability regardless of the number of experts. Also, CVI can evaluate each unit of competency through scale-level CVI (S-CVI) by calculating the average of I-CVI within a unit (S-CVI/Ave). If S-CVI/Ave ≥ 0.90, the content within a unit is valid (Polit et al., 2007).

4. Result

4. 1. The UXD Competency Model

The user experience design (UXD) competency model had four domains, nine units and 63 elements of competency, as shown in Figure 7.

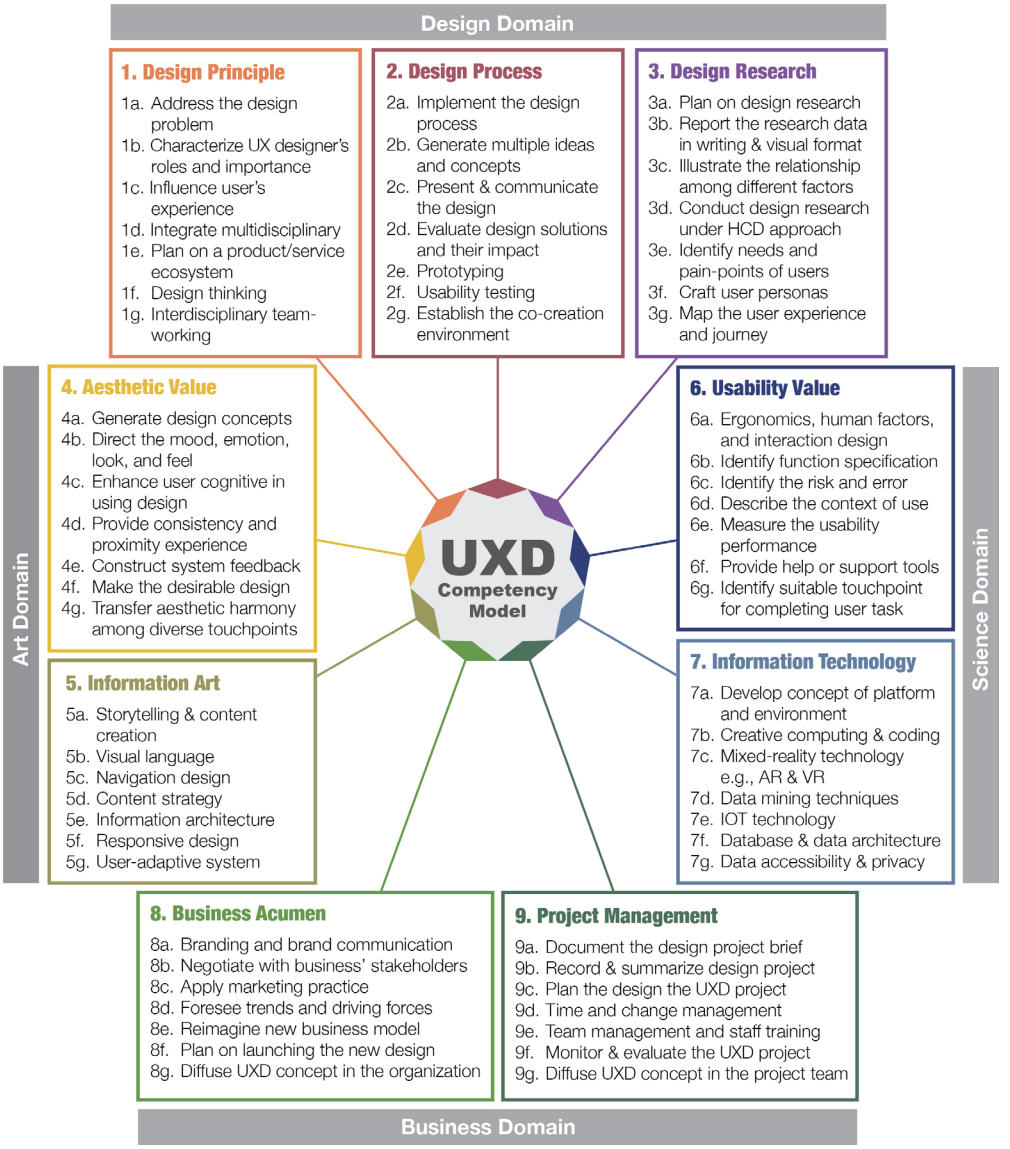

Figure 7 UXD competency model

First, the design domain for user experience competence consists of principle, process and research practice in design. For user experience design, the principle of design focuses on awareness of designer roles and responsibilities in creating opportunities and solutions based on design thinking, process and research for complex problems. UX designers must have well-rounded knowledge and skills for working with a multidisciplinary team. They need to control and facilitate the process and research for design-oriented projects.

Art Domain is always a significant competence for every design field, since art is the design fundamental. However, the art domain in the digital era differs slightly now, especially for the career of a user experience designer. In the UXD competency model, the art domain has two units – aesthetic value and information art. Aesthetic value is the perception of the emotional hemisphere of a human to a design output, where designers implement a look and feel to create a desirable design. User experience designers must focus more on the information and content, as the digital era allows users to create, edit, store, transfer, manipulate or erase information and content easily. User experience designers need to demonstrate an ability to direct and construct information and content into an information architecture, content strategy and story. Also, UX designers need to assist users in using, searching and extracting meaningful information.

Scientific practice and thinking provides logical and realistic factors in design activities, because design is a scientific process of experimenting from a new abstract idea to a credible output. For user experience design, satisfaction occurs when users can use a product, service or system that works for them. Therefore, user experience designers must consider the usability value in creating a usable, practical and safe design output for users. Design in the digital era is influenced by information technology, so user experience designers need to apply this technology and the big data to deliver a product ecosystem or a platform with a meaningful experience.

Finally, understanding the business context is a required competence for every career. However, there are some specific areas concerning the business context, that user experience designers need to understand. A promising task for user experience designers is to diffuse the user experience design concept from the team level to the organizational level. User experience designers can assist business in branding, generating new business models and foreseeing trends and driving forces, related to business research and development. To diffuse the user experience design concept to a business, user experience designers must use necessary skills in project management to prepare and control user experience design projects, and transfer the knowledge throughout a company in its specific terminology.

4. 2. Statistical Analysis of Expert Judgement of UXD Competency Model

Figure 8 shows I-CVI and κ^* values obtained from an expert discussion. CVI indicates that the content within this competency model was validated both at item level (elements of competency) and scale level (unit of competency). κ^* demonstrates the reliability of the model assessed by experts from snowball sampling. Cronbach's α was used to measure the reliability coefficient for each unit, which indicated that the expert' judgments were reliable (>0.60-0.80) to very reliable (>0.80-1.00) (Ahdika, 2017).

1. Design Principle				
No.	$\bar{X}$	I-CVI	κ*	Interpretation
1a.	4.800	0.960	0.959	Excellent
1b.	4.760	1.000	1.000	Excellent
1c.	4.920	1.000	1.000	Excellent
1d.	4.680	0.960	0.959	Excellent
1e.	4.600	1.000	1.000	Excellent
1f.	4.640	0.920	0.919	Excellent
1g.	4.720	1.000	1.000	Excellent
S-CVI/AVE		0.977	(Acceptable)	
Cronbach's α		0.755	(Reliable)	

2. Design Process				
No.	$\bar{X}$	I-CVI	κ*	Interpretation
2a.	4.760	1.000	1.000	Excellent
2b.	4.720	0.960	0.959	Excellent
2c.	4.720	0.960	0.959	Excellent
2d.	4.880	1.000	1.000	Excellent
2e.	4.640	0.960	0.959	Excellent
2f.	4.840	1.000	1.000	Excellent
2g.	4.640	0.960	0.959	Excellent
S-CVI/AVE		0.977	(Acceptable)	
Cronbach's α		0.741	(Reliable)	

3. Design Research				
No.	$\bar{X}$	I-CVI	κ*	Interpretation
3a.	4.760	1.000	1.000	Excellent
3b.	4.760	1.000	1.000	Excellent
3c.	4.840	1.000	1.000	Excellent
3d.	4.800	0.960	0.959	Excellent
3e.	4.880	1.000	1.000	Excellent
3f.	4.720	0.920	0.919	Excellent
3g.	4.800	1.000	1.000	Excellent
S-CVI/AVE		0.983	(Acceptable)	
Cronbach's α		0.761	(Reliable)	

4. Aesthetic Value				
No.	$\bar{X}$	I-CVI	κ*	Interpretation
4a.	4.560	0.920	0.919	Excellent
4b.	4.680	0.920	0.919	Excellent
4c.	4.880	1.000	1.000	Excellent
4d.	4.800	1.000	1.000	Excellent
4e.	4.880	1.000	1.000	Excellent
4f.	4.720	0.920	0.919	Excellent
4g.	4.600	0.960	0.959	Excellent
S-CVI/AVE		0.960	(Acceptable)	
Cronbach's α		0.763	(Reliable)	

5. Information Art				
No.	$\bar{X}$	I-CVI	κ*	Interpretation
5a.	4.520	0.880	0.879	Excellent
5b.	4.600	0.920	0.919	Excellent
5c.	4.720	0.960	0.959	Excellent
5d.	4.520	0.920	0.919	Excellent
5e.	4.840	1.000	1.000	Excellent
5f.	4.720	0.960	0.959	Excellent
5g.	4.760	1.000	1.000	Excellent
S-CVI/AVE		0.949	(Acceptable)	
Cronbach's α		0.870	(Very Reliable)	

6. Usability Value				
No.	$\bar{X}$	I-CVI	κ*	Interpretation
6a.	4.840	1.000	1.000	Excellent
6b.	4.880	1.000	1.000	Excellent
6c.	4.800	1.000	1.000	Excellent
6d.	4.840	1.000	1.000	Excellent
6e.	4.840	1.000	1.000	Excellent
6f.	4.720	0.960	0.959	Excellent
6g.	4.840	0.960	0.959	Excellent
S-CVI/AVE		0.989	(Acceptable)	
Cronbach's α		0.698	(Reliable)	

7. Information Technology				
No.	$\bar{X}$	I-CVI	κ*	Interpretation
7a.	4.640	0.960	0.959	Excellent
7b.	4.400	0.880	0.879	Excellent
7c.	4.280	0.840	0.839	Excellent
7d.	4.560	0.960	0.959	Excellent
7e.	4.440	0.840	0.839	Excellent
7f.	4.520	0.920	0.919	Excellent
7g.	4.760	1.000	1.000	Excellent
S-CVI/AVE		0.914	(Acceptable)	
Cronbach's α		0.847	(Very Reliable)	

8. Business Acumen				
No.	$\bar{X}$	I-CVI	κ*	Interpretation
8a.	4.560	0.880	0.879	Excellent
8b.	4.800	1.000	1.000	Excellent
8c.	4.640	0.920	0.919	Excellent
8d.	4.680	0.920	0.919	Excellent
8e.	4.280	0.840	0.839	Excellent
8f.	4.520	0.880	0.879	Excellent
8g.	4.520	0.880	0.879	Excellent
S-CVI/AVE		0.903	(Acceptable)	
Cronbach's α		0.913	(Very Reliable)	

9. Project Management				
No.	$\bar{X}$	I-CVI	κ*	Interpretation
9a.	4.520	0.960	0.959	Excellent
9b.	4.680	0.960	0.959	Excellent
9c.	4.800	0.960	0.959	Excellent
9d.	4.680	1.000	1.000	Excellent
9e.	4.640	0.960	0.959	Excellent
9f.	4.720	1.000	1.000	Excellent
9g.	4.640	0.920	0.919	Excellent
S-CVI/AVE		0.966	(Acceptable)	
Cronbach's α		0.757	(Reliable)	

Figure 8 I-CVI and κ* for each element of the UXD Competency Model

The average value of each unit was compared with the model mean (the grand mean) using t-tests to classify different types of competencies. T-test results are in Table 5. The unit of competency that has a high significant score can be considered a core competency. On the other hand, it can be classified as a cross-functional competency, if it has a low significant score. A functional competency is a unit that is not significantly different from the model mean. The classifications are shown in Figure 9.

Table 5 Two-Tailed T-test for each unit mean to the model mean

Rank	Summary of Analysis	Mean	t-Score	p-Value
1	6. Usability Value	4.823	4.896*	⟨0.001
2	3. Design Research	4.794	3.696*	0.002
3	2. Design Process	4.743	1.249	0.240
4	1. Design Principle	4.731	0.842	0.421
5	4. Aesthetic Value	4.731	0.726	0.489
6	5. Information Art	4.669	−0.507	0.626
7	9. Project Management	4.669	−0.687	0.508
8	8. Business Acumen	4.571	−1.911	0.098
9	7. Information Technology	4.514	−2.864**	0.024

Note: Model mean = 4.694, *high significance (p⟨0.05), **low significance (p⟨0.05)

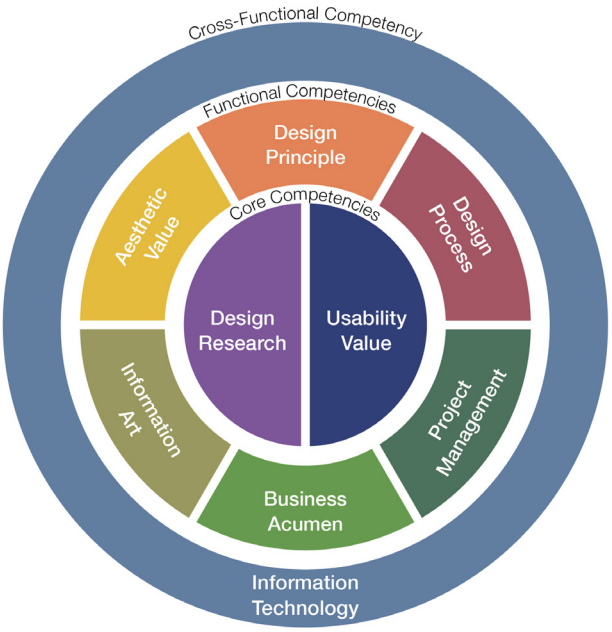

Figure 9 Core, functional, and cross–functional competencies of user experience designers

The usability value and design research units are core competencies for user experience design, because they have highly significant scores. Experts had a consensus that user experience designers were responsible for conducting design research and finding user insight for a successful digital product, service, or system design project. Usability value was a mandatory competence in designing user experience, since the basis of a successful design is a usable product, service or system. Moreover, UX designers needed to be aware of user risks and errors, and provide help and support for users to complete their tasks using the design outputs.

Design principle, design process, aesthetic value, information art, business acumen and project management were not significantly different from the model average and can be considered functional competencies. The functional competencies were required knowledge, skills and attitudes in designing a user experience. However, they were adjusted to the conditions and criteria of different design projects. The design principle and design process units allowed designers to work on complex design projects. They needed to generate multiple ideas and control the process of making tangible design outputs. Aesthetic value and information art identified that designers need to express and enhance the user experience in understanding and using products, services or 'beautiful' systems. To possess a successful design role in any organization, designers must understand the business value, work in a business environment, and diffuse the concept of user experience to teams and organizations.

Although many experts considered information technology an important competency for user experience designers, they recommended that user experience designers were not technicians, who work with technical issues in the product, service or system development. However, it is a 'nice-to-have' competence, that helps designers in working

with multidisciplinary teams. Accordingly, information technology was classed as a cross-functional competency for user experience designers.

5. Conclusion

We developed a competency model for user experience designers. Nine units and 63 elements of competency were extracted and validated through user experience expert judgments. Units of competency fell into three types. The core competencies, the unique expertise of user experience designers, were design research and usability value. These competencies were mandatory for user experience designers, since they must empathize with user pain points, gain user insight, and create easily used solutions. The functional competencies were the abilities of user experience designers to complete their given tasks. These abilities were diverse and reflected the interdisciplinary nature of the work of user experience designers. These competencies were design principle, design process, aesthetic value, information art, business acumen and project management. Finally, a cross-functional competency was information technology. This unit contained knowledge, skills and attitudes that allowed user experience designers to work with multidisciplinary teams in the digital industry, including programmers, system developers, system operators, database architects and business developers.

In conclusion, the user experience design competency model illustrated every dimension in the well-rounded proficiency needed for user experience designers in the digital age. Hence, the user experience design competency model can be generalized and used by the human resource departments in organizations, considering user experience design as a significant step for improving customer satisfaction and driving their business for digital economy success. The user experience design competency model can be used as a framework for user experience design job analysis to differentiate the requirement between different user experience design job levels. Moreover, this model can facilitate assessing conditions for various user experience design projects.

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