USER EXPERIENCE TEAM KNOWLEDGE IN CHINA'S HIGH-TECH INDUSTRY

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User Experience Team Knowledge in China's High-Tech Industry

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Certificate of originality

I hereby declare that this thesis is my own work and that, to the best of my knowledge and belief, it reproduces no material previously published or written, nor material that has been accepted for the award of any other degree or diploma, except where due acknowledgement has been made in the text.

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Abstract

This study investigated user experience (UX) team knowledge in China's high-tech industry. UX refers to the overall experience of users when engaging with a product or service. Currently, UX is a significant research area in human-centered design, with existing studies examining aspects such as UX competence, processes, maturity, tools, methods, resources, and user perception. UX designers typically work in teams, honing their knowledge and skills through interactions with team members. Therefore, as design is a collective effort, managing and understanding UX teams are crucial. Despite this importance, the topic of UX teams has not been studied sufficiently. Additionally, the interdisciplinary nature of UX poses a challenge for designers—they have to continually update their knowledge for practice across different industries. To address this challenge, this study proposed the primary research question: "What constitutes UX team knowledge?" This central question guided this study to explore and demonstrate UX team knowledge in China's high-tech industry by providing a comprehensive understanding of its composition, characteristics, distribution, and utilization.

The study employed a qualitative approach through constructivist grounded theory (CGT). In the first phase, interviews were conducted with 16 UX designers in high-tech industries to form the foundation for constructing a UX team knowledge framework and mapping knowledge distribution across four distinct teams. This phase yielded valuable insights into four primary knowledge circles—professional, project, collaboration, and organizational—comprising 24 components that characterize UX team knowledge. Furthermore, two pairs of dimensions emerged through theoretical coding: power-centralized/decentralized and pragmatic/hedonic, representing leadership and reasoning styles, respectively. These dimensions shaped four distinct UX team types, each reflecting different knowledge distributions: performance team, operation team, strategy team, and transformative team.

Building on the findings from the first phase, the second phase involved four in-depth case studies to validate and provide real-world examples of the identified team types. Interviews with both team members and managers provided a holistic understanding of team collaboration and knowledge utilization patterns. The study explored four teams' historical development across four stages—beginning UX, constructing UX, realizing UX, and promoting UX. In addition, knowledge transformation, sharing, reflection, and team dynamics also were discussed to reveal UX practices. The case study results suggest that the most advanced and ideal UX team is the transformative team, which maximizes creativity through cooperative and equal decision-making processes, resulting in increased knowledge sharing and reflection.

This study proposes a conceptual framework that structures UX team knowledge into four knowledge domains and identifies different team types based on leadership and reasoning styles. While the UX team knowledge framework organizes concepts systematically, it does not aim to predict outcomes, distinguishing it from a formalized model. Furthermore, by focusing on UX teams within China's high-tech industry, the study offers context-specific insights.

Building on the proposed framework, this study contributes to UX research in three ways. Firstly, it offers new perspectives for UX management, particularly regarding goals, strategies, and resource planning. Secondly, it provides a structured reference for adjacent fields such as product and interface design, helping to analyze knowledge elements across different leadership and reasoning contexts. Thirdly, it informs UX education by identifying specific competencies and learning outcomes relevant to team-based design practices. In practice, the framework serves as a guiding tool for both managers and practitioners, allowing them to navigate the complex scope of UX management effectively and offering a structured approach to competence development. Overall, the UX team knowledge framework and case studies highlight the different leadership and reasoning styles among UX teams, encouraging companies to reflect proactively on their design management practices.

Publications Arising From the Thesis

Peer-Reviewed Journal

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Book Chapter

Wu, X., Siu, K. W. M., Buhring, J., & Villani, C. (2023). Team creativity by integrating knowledge management: A guide for andragogical leadership. In V. Wang (Ed.), *Handbook of research on andragogical leadership and technology in a modern world* (pp. 214–236). IGI Global.

Conference Paper

Wu, X., Siu, K. W. M., & Buhring, J. (2022). Empathy between designers in the design synthesis stage. In C. Stephanidis, M. Antona, S. Ntoa, & G. Salvendy (Eds.), *HCI International 2022 – Late breaking posters* (pp. 217–224). https://doi.org/10.1007/978-3-031-19679-9_27

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Abbreviations

UX: User Experience

CUD: User Experience Model

TUXM: Total User Experience Management

KCC: Krebbs Cycle of Creativity

SECI: Knowledge Socialization, Externalization, Combination, and Internalization

CGT: Constructivist Grounded Theory

PT: Performance Team

OT: Operation Team

ST: Strategy Team

TT: Transformation Team

Chapter 1: Introduction

1.1 Research Background

The high-tech industry in China has undergone significant development in recent years, resulting in substantial changes to the country's economic structure (Wang & Liu, 2023). The Chinese High-Tech industry refers to the technology-intensive sectors with high research and development investment, high product added value, and strong prospects in the international market. These sectors are characterized by intellectual property, innovation, strategic significance, and low resource consumption (China National Bureau of Statistics, 2021). High-tech industries include six major categories: pharmaceutical, aerospace and aircraft equipment, electronic and communication equipment, computer and office equipment, medical instruments and devices, and information chemicals (High-Tech Industry Classification, 2017).

High-tech industry growth has been supported by national macro and micro policies aimed at fostering innovation and driving economic advancement (Pan et al., 2021). In alignment with these efforts, China has made significant strides in enhancing its research and development capacity within the high-tech sector to increase the competitiveness of its companies (Han et al., 2017).

Under these circumstances, the importance of user experience (UX) capabilities has become increasingly pronounced, playing a pivotal role in driving high performance and product success (Lermen et al., 2023). ISO 9241 (2010) defines UX as " UX includes all the users' emotions, beliefs, preferences, perceptions, physical and psychological responses, behaviors and accomplishments that occur before, during and after use." UX is a critical factor in facilitating effective product and service design (Zhou et al., 2022). Given the rapid technological advancements and evolving consumer needs inherent in the high-tech industry, the identification of user needs and the integration of new technologies have become critical

processes for maintaining market competitiveness (Ulrich & Eppinger, 2016). Consequently, UX design has emerged as a user-centered approach that facilitates product innovation and fosters a deeper understanding of user requirements (Law et al., 2009; Norman & Verganti, 2014). This shift has led to the widespread adoption of UX concepts in product and service design and development (Becker & Jaakkola, 2020).

To enhance UX understanding and practice, scholars have explored various aspects of its implementation and application. Some have focused on specific contexts, such as the design of human-robot interaction or the integration of agile methods in UX practices (Brown, 2012; Garcia et al., 2017; Prati et al., 2021). Others have proposed general design knowledge frameworks applicable to teams and individuals in any design field, offering insights into the levels and circulation of design knowledge (Åman et al., 2017; Giaccardi & Redström, 2020; Mortati, 2022; Thoring et al., 2022).

Notably, several frameworks have been proposed to deepen individuals' understanding of UX within product development processes. Hassenzahl (2008) introduced the "pragmatic versus hedonic" framework, which explains the multifaceted nature of products by considering both their practical and emotional dimensions. Similarly, Thüring and Mahlke (2007) presented the components of the user experience model (CUE), distinguishing between instrumental and non-instrumental qualities of user experience. This model offers a structured framework for understanding how users perceive the inherent qualities of a system, contributing to a holistic view of UX. Additionally, Chapman and Plewes (2014) developed a UX maturity framework to assist organizations in assessing their maturity level in UX practices, thereby enabling them to identify areas for improvement and enhance their efficiency in delivering superior user experiences. Collectively, these frameworks offer comprehensive perspectives on UX, encompassing both functional and emotional aspects and providing valuable theoretical guidance.

The transformation of knowledge within UX teams is a critical aspect of effective collaboration. Leinonen and Roto (2023) highlight the significance of communication in facilitating the transfer of knowledge from service design teams to UX teams. Similarly, a data-driven framework proposed by Yang et al. (2023) integrates design and UX information to drive UX design concepts, leveraging design patents data to support UX innovation.

1.2 Defining Knowledge

Defining knowledge is a complex and multi-faceted endeavor that varies across disciplines and philosophical traditions. Ontology, which explores the nature of being and reality, provides a foundational understanding of knowledge. Foucault (1972) posits that knowledge encompasses the domain constituted by objects that gain scientific status. It is the space where subjects can take positions and discuss these objects, coordinating and subordinating statements where concepts are defined, applied, and transformed. Knowledge, therefore, is defined by its possibilities of use and appropriation offered by discourse. This broad perspective implies that knowledge is derived not only from empirical demonstrations but also from fiction, reflection, narrative accounts, institutional regulations, and political decisions.

Conversely, epistemology focuses on the nature and scope of knowledge, questioning how humans what they know. Popper (1969) emphasizes that knowledge statements must align with facts, correspond to reality, and be consistent with observations. He suggested that, although all arguments might be relevant, most knowledge is derived from tradition; human beings learn through examples, books, instructions, and critical dialogues. In the design context, designing does not provide final solutions; it continuously creates new problems. This viewpoint aligns with the rationalistic tradition highlighted by Coyne and Snodgrass (1995), who aimed to articulate design knowledge in a clear and shareable manner.

Design-specific knowledge merges both ontological and epistemological aspects, encompassing the nature of being and knowing within the field of design. Cross (1999) defined three key areas of design knowledge: design epistemology explores the unique ways designers acquire and understand knowledge; design praxeology focuses on the practices and processes involved in the act of designing; and design phenomenology examines the forms and configurations of the artifacts that result from design activities. Together, these areas provide a comprehensive framework for understanding the complexities of design as a discipline.

Friedman (2003) elaborated on this classification, describing design as a purposeful process focused on problem-solving, fulfilling needs, enhancing conditions, and generating new or valuable results. This definition aligns with Herbert Simon's view of design as the process of devising courses of action to change existing situations into preferred ones. Buchanan (2001) further highlighted the interdisciplinary nature of design knowledge, linking it to cognitive science, engineering, anthropology, and fine art. Friedman (2003) also stated that design knowledge originates from practice. However, design research is distinct from design practice, even though they can overlap. Design research entails systematic and methodical inquiry into practice and other relevant issues.

Schaathun (2022) explored the reasoning and epistemology promoted by Schön and Simon, seeking a common essence to further their vision of design as a culture uniting sciences and humanities. There is a need for interdisciplinary conversation, especially in developing new technology, to combine scientific understanding with designerly understanding.

However, Cross (1999) states that knowledge originates from processes and objects, including both tacit and explicit features. Tacit knowledge is crucial as it is embedded in objects and practices, often intuitive and context-specific, making it challenging to articulate and transfer into explicit terms. Explicit knowledge, in contrast, can be easily communicated and shared.

Nevertheless, by converting tacit knowledge to explicit knowledge, one risks losing the nuanced insights and skills developed through practice. The embodied nature of tacit knowledge means that it is not fully transferable through verbal or written means, which is the major challenge in this study.

In general, Van Dijk (2003) categorizes four types of knowledge: cultural, personal, general, and group knowledge. Hence, a team's knowledge may constitute these four types of knowledge or encompass collective knowledge, which is constructed through accepted and justified procedures to build common ground rules and values for coherence in design-incentive firms (Åman et al., 2017).

Based on the previous discussion, this study defines a UX team as "the collective effort of individual designers to meet organizational goals while considering end-users' need for simple, usable, and enjoyable products and services." A UX team typically comprises a diverse set of roles, including UX designers, UX researchers, interaction designers, visual designers, product designers, UX writer, and information architects, among others (Fard,2023). These professionals bring together a range of skills such as user research, wireframing, prototyping, visual design, and usability testing. The structure of a UX team can vary, but it often includes a mix of specialized and cross-functional roles that collaborate closely with other departments like product management, engineering, and marketing. Fard (2023) proposed three UX team structures: centralized design teams, where designers report to a UX manager who serves as the primary decision-maker; decentralized teams, where designers report to the product team and stay informed about the entire project; and mixed teams, where the UX manager focuses on the professional growth of designers rather than solely on task completion. In general, the UX team's goal to create seamless, user-centered experiences that align with both business objectives and user needs, ensuring that the products and services are not only functional but also engaging and pleasance to use.

This study focuses on UX teams' knowledge, where each team member's roles and responsibilities are clearly defined to aid collaboration. UX team knowledge refers to the collective expertise, insights, and skills accumulated and shared among team members working collaboratively on UX projects. This knowledge encompasses both explicit and tacit elements, combining structured information that can be easily documented with an intuitive understanding that is more difficult to articulate but is crucial for design excellence. Team knowledge is not just a sum of individual contributions but a combination of collective deliberate thinking. Each member's unique perspectives and expertise contribute to a richer, more nuanced understanding of user needs and design challenges. Understanding and leveraging this team knowledge is essential for effective UX design and organizational success.

1.3 Research Gap

Despite the advancements in design knowledge studies, recent discourse underscores differences in the information and knowledge held by individual UX designers versus UX teams (Zaina et al., 2021). Agile UX team members may primarily consume UX information rather than produce it, with a stronger focus on user product interactions over user needs or goals. Additionally, contextual variations necessitate diverse skills and experiences within UX teams, particularly in startups, where collecting and interpreting user feedback, conducting user research, and understanding usability theory are essential (Saad et al., 2021). As UX designers predominantly operate within teams, aligning individual and team knowledge to foster effective collaboration and shared outcomes becomes challenging (Tan et al., 2023). Thus, team collaboration is vital as it is a shared outcome achieved by a collective effort (Tan et al., 2023).

Furthermore, Cannon-Bowers et al. (1993) categorized four types of mental models within teams, highlighting the importance of addressing both task-related and team-related knowledge in team research. Task-related knowledge encompasses design goals, project

planning, and problem-solving skills, while team-related knowledge pertains to collaboration, coordination, and information exchange (Mathieu et al., 2000). Shared mental models on both task and team aspects contribute positively to team performance (Bierhals et al., 2007).

In parallel, the growing importance of teams in psychology and management underscores their role in fostering creativity and innovation (Kratzer & Mrożewski, 2021; Tang & Schmidt, 2021). Teams serve as invaluable repositories of knowledge, with their problem-solving experiences contributing to continuous learning and knowledge creation (Kazanjian & Drazin, 2012). This accumulation of knowledge is a bedrock for innovation, driving the development of cutting-edge products and services (Leonard-Barton, 1992).

Design represents a deeply ingrained form of knowledge rooted in personal experiences, resulting in the creation of distinctive solutions or artifacts shaped by specific social environments rather than simply rational decision-making (Åman et al., 2017). Hence, integrating individual experiences into team dynamics is pivotal for enhancing overall team performance (Ployhart, 2004). For this transition to be successful, Hunter et al. (2018) identified key individual predictors within teams, such as the importance of establishing trust, fostering psychological safety, and developing shared mental models to mitigate conflicts and facilitate effective problem-solving.

Building on Gray et al.'s (2015) framework, which indicates four quadrants of beliefs and actions within individuals and groups, this study underscores the significance of considering a team's beliefs, actions, and relevant UX competency. Individual beliefs include the tacit understanding guiding designers in shaping their professional identity, while individual actions entail observable behaviors reflecting these beliefs in the design process. Group or organizational beliefs, on the other hand, dictate the criteria used to reward specific design competencies, thereby shaping behaviors and cultivating a distinct tacit culture. All shifts in

competence occur through the performance of beliefs, which are translated into explicit actions.

Mortati (2022) claimed that design transforms tangible artifacts into intangible systems, strategies, and relationships in the high-tech industry. This assertion highlights the importance of understanding the knowledge required by UX teams to ensure effective work practices. Team performance will be improved when the team knowledge is well appointed, structured, and understood among members, facilitating the compatible evaluation of projects (Cooke et al., 2000).

However, existing literature on UX teams' knowledge lacks comprehensive coverage of this essential aspect. Kashfi et al. (2017) identified several UX challenge characteristics, including the lack of a clear definition of UX and the absence of defined UX competencies and responsibilities. UX scope is expanding along with new technology and social priorities, emphasizing the need to clarify the scope of UX work in the digital context (Roto et al., 2021). Similarly, Caglar et al. (2022) emphasize the necessity of a clear knowledge base to generate UX models or theories that facilitate design practice.

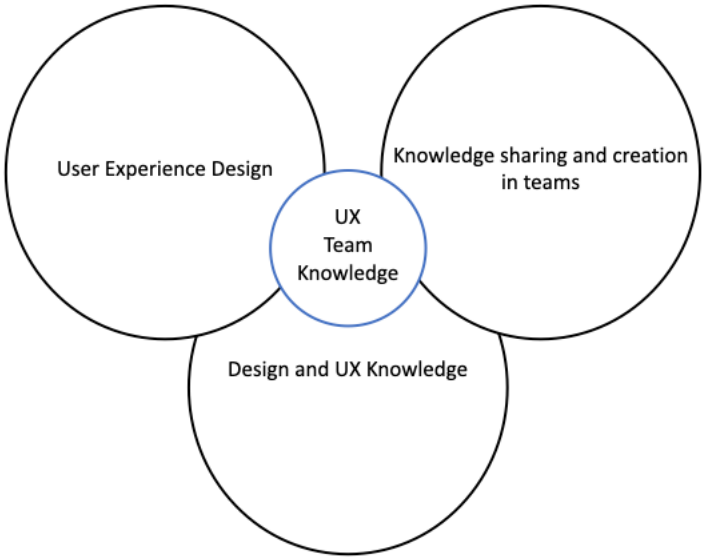
This study builds on these recognized importance and deficiency in the current UX field. Thus, this study aims to address these challenges by exploring the characteristics of UX teams with varying knowledge and leadership types. Given the rapid technological advancements in high-tech industries, understanding how team knowledge is distributed across different teams can help firms optimize and rethink their UX practices. This benefit highlights the significance of addressing the identified research gap.

1.4 Research Scope, Questions, and Objectives

By discussing key UX theories and models, this study lays the groundwork for further exploration of UX practices within high-tech companies. It encompasses various aspects, including the scope of UX, design knowledge, UX knowledge, and knowledge sharing and creation (Figure 1.1). Although there has been substantial exploration of UX concepts, frameworks, and their application in product development processes. There is a significant research gap concerning the knowledge within UX teams, particularly in the context of high-tech industries.

Figure 1. 1

Research Scope



Existing studies have focused either on user-related aspects, such as emotions, behaviors, and influential factors, or on UX management practices such as agile processes, relevant tools, and team collaboration. However, there is a lack of research explicitly addressing the composition, distribution, and utilization of knowledge within UX teams. Therefore, this study aims to demonstrate the UX team knowledge composition and distribution in high-tech

industries. Existing design and UX knowledge models and studies serve to underpin the development of a UX team knowledge model in this study.

The primary research question arises from the lack of investigation into UX team knowledge within the high-tech industry context: "What constitutes UX team knowledge?" To address this central question, four research questions are formulated, guiding two phases of the study aimed at filling this research gap.

RQ1. What types of knowledge do UX designers apply in the UX team setting?

The objective for this question is to provide a comprehensive description of the types of knowledge that UX designers draw upon in team-based work.

RQ2: How do UX designers articulate UX team knowledge?

To explore how UX designers express and prioritize different types of knowledge in the UX team.

RQ3: How is knowledge distributed within UX teams?

The objective is to indicate how the knowledge is shared, allocated, or concentrated among different types of UX teams.

RQ4. How do different types of knowledge shape and characterize different UX teams?

To explain how varying knowledge practices contribute to the formation and functioning of different types of UX teams.

1.5 Contribution of the Study

Unlike previous research, this study focuses on UX team knowledge, particularly in the high-tech industry. There are two main findings in this study. The first finding is the UX team

knowledge framework that encompasses four types of knowledge. They are represented by circles, from professional knowledge (smallest circle), project, and collaboration to organizational knowledge (largest circles). Twenty-four elements are distributed in four circles, and each element is described in detail. By revealing how UX members use and adjust their knowledge, this effort can aid organizations in improving their UX practices and enhancing their competitiveness. Moreover, practitioners can leverage this framework to identify areas for improvement and acquire the necessary competencies to excel in their roles.

The second finding is the four UX team types with distinctive knowledge distribution, leadership, and reasoning styles: performance team, operation team, strategy team, and transformation team. These team types are verified through four case studies that offer real world examples by articulating the team timeline and knowledge transformation, sharing, and creation processes. This result provides valuable insights into the complexities of UX team dynamics and organizational challenges, highlighting the importance of psychological empowerment and early project involvement, the struggle to prove UX value, and the benefits of coopetition. They underscore how leadership and reasoning styles influence team mindset and behavior, prompting companies to proactively reflect on their design management practices. Managers can utilize these findings as a reference to adapt and optimize UX team structures, ultimately fostering a supportive and innovative environment that maximizes the potential of UX practices.

Theoretically, this study benefits existing research in three significant ways. First, it introduces a novel approach to understanding UX knowledge within team contexts, supporting UX practice and contributing to UX management studies by examining team dynamics and their impact on organizational success. Second, the presented structure of UX team knowledge composition can serve as a reference for other fields such as user interface or product design, offering a structured approach to knowledge management and skill development. Lastly, the study highlights the importance of developing competencies across various knowledge

domains in UX education, suggesting that the framework can be used to align curriculum content with industry needs, ensuring students acquire the necessary skills to excel as UX professionals.

1.6 Thesis Outline

The thesis comprises eight chapters, each serving a distinct purpose in advancing the understanding of UX team knowledge.

Chapter 1 introduces the research background, identifies gaps in existing literature, and articulates the research questions and objectives. Additionally, it outlines the contributions of the study to the field of UX design.

Chapter 2 conducts a comprehensive review of relevant literature, analyzing the definition of UX, exploring various models and theories related to UX knowledge and skills, discussing concepts of general design knowledge, and examining models of design knowledge. Furthermore, it explores the dynamics of team knowledge sharing and creation, laying the foundation for the subsequent chapters.

Chapter 3 elucidates the research methodology employed, detailing the two-phase study approach based on constructive grounded theory. It outlines the sampling strategy, interview design and procedures, and data analysis methods employed in both phases of the study.

Chapter 4 presents the findings derived from the two-phase study, including the development of the UX team knowledge framework and a detailed description of its components. It highlights the distribution of knowledge within four distinct team types identified through research. Furthermore, it presents the case study results, focusing on dimensions such as team timeline, knowledge transformation, and knowledge sharing and reflection.

Chapter 5 provides a critical discussion of the UX team knowledge framework and the identified team types in comparison to previous studies. It synthesizes the findings from the two-phase study and positions them within the existing body of literature, emphasizing their relevance to UX practice, industry, and academia.

Chapter 6 offers a concise conclusion that summarizes the key findings and their contributions to the field of UX design. It acknowledges the study's limitations and suggestions for future research, offering a comprehensive overview of the study's scope and impact.

Chapter 2: Literature Review

2.1 Introduction

In this chapter, the most relevant studies are selected and discussed to frame the research scope. The review begins with a definition of UX to establish a clear understanding of the research topic, followed by a summary of UX teams and designers to confirm the target group. Relevant UX knowledge, design knowledge models, and knowledge sharing in teams are then reviewed to reveal the dimensions, levels, and characteristics of design knowledge. This chapter sets the foundation for developing a knowledge framework for UX teams in this study.

2.2 UX Definition

Rooted in human-centered design and human-computer interaction principles, user experience (UX) refers to the overall experience of users when engaging with a product. Scholars have made numerous attempts to define UX and develop relevant models due to its multidisciplinary nature (Table 2.1). This study specifically reviews two closely related research fields: the definition of UX and existing UX models.

Table 2.1

UX Definition

Author	Year	Focus	Definition
Hassenzahl & Tractinsky	2006	UX factors	A result of the user's internal state, the features of the designer system, and the context in which the interaction takes place.
Desmet & Hekkert	2007	Different aspects of product experience	Product experience encompasses the full spectrum of responses elicited through user interaction with a product. This includes the satisfaction of the senses (aesthetic experience),the meanings the user associates with the product (experience of meaning), and the emotions and feelings that are evoked (emotional experience).

Author	Year	Focus	Definition
Lallemand et al.	2015	UX factors	User-related (motivation, expectations, emotional, need) and contextual factors (cultural background, industry) are crucial in shaping UX.
Norman & Nielsen	2016	UX in practice context	UX is an interdisciplinary and multidimensional field in which numerous factors interact and interdepend to form and modify the context and the user's experience in real time.
Gray & Kou	2019	UX discipline	UX is shaped by various disciplines, resulting in a broad and decentralized collection of UX disciplinary knowledge.
ISO 9241	2010	Standardization	Individual perceptions and responses resulting from the use or anticipated use of a product, system, or service
Hinderks et al.	2022	UX criteria	UX definition as a series of quality criteria that pertains to the usability, controllability, and hedonic quality such as aesthetic features

Norman et al. (1995) defined UX as a person's experience with a system. However, some studies relate UX knowledge or models with their usability (Tullis & Albert, 2008). For example, Zarour and Alharbi (2017) assert that UX is part of the satisfaction component for usability.

In other terms, UX is associated with programmatic features that emphasize the issues beyond task-related standards (Alben, 1996). According to Forlizzi and Battarbee (2004), UX is related to the usability, beauty, emotional, and technological aspects of the product. Gradually, academic papers framed and established UX in different scopes and dimensions beyond usability. Gil Urrutia et al. (2017) state that UX has evolved from merely addressing the accessibility or effectiveness of a specific function to a holistic view that encompasses the user's emotions, preferences, and culture, as well as the product's usability and attributes.

Pucillo et al. (2016) examined UX from the perspective of UX affordances, which are explained as a need satisfaction of users.

To create a common definition of UX, Law et al. (2009) investigated 275 researchers and professionals to summarize the keywords for UX definition: dynamic, context-dependent, and subjective. Across the various UX definitions, one common factor is that UX is an interaction result caused by three elements: the user, the system, and the context (Roto et al., 2011).

In practice, the benefits of UX include improved user satisfaction (Alves et al., 2014), increased efficiency, higher market share in agile product development (Lin et al., 2016), and customized products (Krueger et al., 2020). Consequently, an increasing number of organizations are seeking UX practitioners and forming UX teams to optimize their products. In the current technology industry, UX design skills are among the most in-demand abilities. Software professionals have acknowledged that incorporating UX work into software development can significantly enhance the value of the product (Gray, 2016; Kashfi et al., 2017). Software functionalities and quality characteristics perceived by users are the major elements in the UX concept (Hassenzahl, 2010). More holistically, Caglar et al. (2022) summarized the motivations for UX implementation and research (fix problems, improve work, support design, raise discussion) and the contextual factors that influence UX (task, temporal, interpersonal interactions, technology, offsite or distributed work), providing a context-specific knowledge base for UX.

UX is influenced by several factors, such as individual experience, expectations, and social and cultural contexts (Hassenzahl, 2008; Roto et al., 2011). Particularly, users' perceptions and emotions emerge when interacting with products before, during, and after using them (Minge & Thüring, 2018). Kitchenham et al. (1997) stated that the precondition for controlling something is to measure it, and the precondition for measuring something is to define it, which highlights the challenge in understanding UX. Therefore, some studies have tried to

build the UX concept by reviewing literature or interviewing professionals (Lallemand et al., 2015).

Law et al. (2014) identified measurable (reliability, expectation, affective response) and non-measurable (love, happiness, enlightenment) UX qualities, as well as the challenges in measuring UX, which include theoretical, methodological, and practical issues (Table 2.2). This study may help UX practitioners break down the elements to measure UX accurately.

Table 2.2

Challenges in measuring UX

Dimensions	**Challenges**
Theoretical issues	1. It is difficult to break down the UX components and measure them in a holistic way. 2. Memory about the experience fades quickly 3. Time and feature of tasks are critical to UX measurement.
Methodological issues	1. Different stakeholders have different preferences regarding qualitative and quantitative approaches. 2. The need for substantial resources to accommodate the diverse needs of heterogeneous users. 3. The challenge of creating high-fidelity prototypes that accurately replicate real products.
Practical issues	1. lack of knowledge to leverage feedback to improve future products 2. lack of standard UX metrics. 3. lack of knowledge on how to communicate UX measures to decision makers.

Furthermore, Zarour and Alharbi (2017) proposed a theoretical framework that summarized the UX aspects (spatio-temporal, user journey, cultural, and context of use) and dimensions (user needs experience, technology experience, and brand experience). Cultural factors impact both the hedonic and pragmatic aspects of UX, aligning them with user needs. Additionally, the user journey and spatio-temporal elements are linked to the length of time a user interacts with a product or organization, connecting these experiences to the context, brand, and technology dimensions. Each dimension with different aspects requires different ways to measure it.

To break down the UX concept, Berni and Borgianni (2021) summarized the dimension and key components of UX that shape users' overall experience as follows:

1. Ergonomic Experience: This dimension pertains to the characteristics of a system that users assess through interaction, extending beyond sensory perception and emotion. It focuses on how effectively a system meets user needs during use, encompassing aspects such as usability, functionality, effectiveness, efficiency, and affordances. The goal is to enhance comfort, safety, efficiency, and satisfaction in the overall UX.
2. Cognitive Experience: This dimension relates to how users perceive and understand the system based on its appearance and its sensory appeal, including touch, smell, hearing, and vision. It involves the cognitive processes of perception, comprehension, and interpretation, influencing users' mental models and understanding of the system.
3. Affective Experience: This dimension goes beyond cognitive perception by including users' emotional responses when using and perceiving a product. It includes their feelings, empathy, hedonic experiences, pleasure, and appreciation. Understanding and designing for affective experiences are crucial for creating products that evoke positive emotional responses and foster user engagement.

Key components of UX that shape users' overall experience include four components: Subject-User, Verb-Interaction, Object-System, Complement-Context of Use (Berni & Borgianni, 2021), as listed in Table 2.3.

Table 2.3

Key components of UX

Components	Definition
Subject-User	The individual who interacts with a system or product is commonly referred to as the "user" or "final user" in most studies. However, they can also be simply described as a "human," "person," or "individual." From a business perspective, they may be termed a "consumer" or "customer," and they can represent either an individual or a group.
Verb-Interaction	Interaction involves how humans perceive stimuli through their senses. When individuals first encounter a product, their initial interaction is typically through sight, which closely influences their perception of its appearance and aesthetics.
Object-System	The term "system" encompasses both tangible and intangible aspects of a product, including its technological components and associated services. Tangible features are critical in shaping the interaction between the product and the user. Elements such as shape, dimensions, and materials, along with more abstract aspects like semantics and emotions, contribute to the overall UX.
Complement-Context of Use	In a broader setting, the term "context" encompasses physical space and time. From a subjective perspective, context encompasses the user's background, cultural factors, and previous knowledge and experiences, all of which influence how they perceive and interact with the product.

Karapanos et al. (2009) identified anticipation, orientation, incorporation, and identification as the four phases in the adoption of a product in the UX process. Anticipation precedes the use of a product, while orientation signifies how users characterize their internal state when

encountering new features of the product. Over time, users incorporate the product into their daily lives, highlighting the critical role of usability for long-term use. Finally, as users fully embrace the product, it becomes intertwined with their social interactions, conveying aspects of their identity and either setting them apart from others or fostering connections within a community. This phase is termed identification.

In general UX studies, Berni et al. (2023) have identified issues such as vague terminology, participants, research objectives, and lack of context. Since context is crucial in understanding the perceived value of products and user judgments (Boztepe, 2007), gaining more knowledge about context could lead to more effective UX. Regardless of these issues, Berni et al.'s results highlight that UX can reveal evaluations, preferences, unspoken needs, and design requirements like an umbrella concept that benefits different design phases.

2.3 User Experience Designers and Teams

In general, designers' role spectrum indicates three roles and competencies—design leader, design facilitator, and design producer (Chung et al., 2022).

1. The core competencies for design leaders are effective collaboration and building relationships, balancing analytical and intuitive thinking, clearly defining design objectives, and ensuring they align with the broader business strategy (Kang et al., 2015). Generally, a design leader is characterized by their strategic and proactive involvement in shaping an organization's vision, fostering innovation, and driving towards its goals.
2. Design producers are primarily concerned with the production of the end product within the design process (Na et al., 2017, as cited in Chung et al., 2022). This notion underlines the importance of not just the creative aspects of design but also the practical and managerial tasks necessary to bring a design concept to fruition.

3. Design facilitators are engaged at both the process level and the creative input level; they not only contribute to the overall design process but also provide creative insights and ideas as part of their role (Minder & Lassen, 2018).

Regarding creative input, design facilitators adopt a more open approach to work by incorporating reflective process steps and methods (Table 2.4), which concerns UX designers or teams' work.

Table 2.4

Designers' Facilitation

Dimension	Designers' Facilitation	Facilitation Description
Process level	Project management	1. Creating trust among team members 2. Encouraging voluntary participation in the work process
Creative input level	Creative methods	1. Promoting engagement with diverse viewpoints 2. Offering a break from daily routines 3. Encouraging self-reflection while providing guidance to facilitate effective participation and decision-making
	Provide external information	Inviting experts to share up-to-date knowledge
	Creative idea acceptance	1. Creative an inclusive space for proposing novel ideas

		2. Offer chance to implement the ideas in a participatory approach
	Creativity	Introduce creative and fresh ideas
Interplay	Balance	Involve individuals regardless of their hierarchical position to form a co-creation process

Note. Sourced from Minder and Lassen (2018)

Regardless of UX designers working individually or collectively, user research and perception are crucial to UX practice, which facilitates the design process. Brown (2012) has identified two common types of user research: validation of design and exploration of design. To validate the design, user feedback is collected, which supports iteration and revision through the display of concepts, sketches, prototypes, and wireframes. To explore design opportunities, user research aims to probe and discover user needs by developing personas and scenarios, which requires more time and effort through well-designed research questions or methods. Either way, understanding and predicting the emotions of users is a crucial capacity (Norman, 2004).

When a prototype is developed, usability testing is required to evaluate its effectiveness, efficiency, and adequacy in achieving the specific goals for its intended users. The testing results are then debriefed to the team, and the problems are resolved based on priorities that match the timeframe. Skilled designers identify usability issues during the design process to prevent them from being forwarded to development teams (Rayipangesti & Fajar, 2019). In addition, incorporating user feedback into the design process by systematically observing user behavior and collecting data in controlled settings is essential to improving usability.

Moreover, UX designers define and articulate their designs to the developers or product managers for each page, frame, and flow. This process ensures that the team approaches the

common goal with a shared understanding and vision. Furthermore, visual intelligence is emphasized in design, which refers to using imagination to create and manipulate ideas. Rather than real objects, sketches, drawings, and diagrams serve as means to visualize ideas for communication and transformation (Rittel, 1987). Cross (1982) shares a similar view, stating that imagination is a key problem-solving component. Prototypes, wireframes, and sketches also allow other team members to perceive designs, facilitating understanding.

The multidisciplinary nature and ever-evolving landscape of the UX field create a situation where traditional disciplinary boundaries are often absent (Süner-Pla-Cerdà et al., 2023). This lack presents specific challenges, particularly for newcomers, in terms of their professional development. Süner-Pla-Cerdà et al. (2023) found that some factors are crucial when an industrial designer becomes a UX designer. First, receiving appreciation and affirmation of the designerly output could strengthen their intrinsic motivation and foster confidence in daily work. Second, observing the immediate results of the designer's efforts serves as external validation of their work, enabling constant learning by doing. Third, social acceptance and a sense of belonging encourage creative behaviors. Last, user-centeredness motivates designers to produce positive effects in society.

In UX teamwork, there are four levels of design activity that constitute the daily work: project, process, practice, profession (Lawson & Dorst, 2013). These four levels of design activity inspire the researcher to think beyond just projects and understand design in a more holistic way.

1. Design Project: This level represents the basic unit of work within an organization. UX teams focus on accomplishing tasks within the defined scope of specific design projects. They work toward meeting project objectives and delivering tangible outcomes.
2. Design Process: UX teams adhere to established methods and approaches in their work. They closely monitor the design process from project initiation to completion. Reflection

is crucial for refining design methods and strategies, enhancing team expertise, and ensuring continuous improvement.

3. Design Practice: Beyond individual projects, UX professionals develop their professional identity and expertise. Each team member forms their own stance, comprising principles, skills, and approaches cultivated through experience. This personal development contributes to the team's collective expertise.
4. Design Profession: At this level, UX teams contribute to shaping the broader design profession. Through active participation in communities of practice, teams collaborate with other designers to define and redefine professional standards, update techniques, share skills, and advance design concepts. This ongoing dialogue and collaboration contribute to the evolution and growth of the UX profession as a whole.

To achieve design activity, Süner-Pla-Cerdà et al. (2023) have identified three significant UX-relevant design competencies that define UX designer identity: methodology, mindset, and grounded approach.

1. Design as methodology indicates the distinct ways in which designers approach tasks and activities. In UX practice, user research, gathering requirements, iterative cycles management, and prototype testing are assembled similar to industrial design.
2. Design as mindset signifies the designerly way of thinking and knowing, which includes a broader approach to achieving tasks based on general design concepts, problem-solving orientation, self-reflection, and independent thinking.
3. Grounded approach refers to making reasonable design decisions by understanding and valuing user needs, for example, by asking the right questions and framing them to conduct research before finalizing the solutions.

2.4 UX Knowledge and Skills

Defining the knowledge and skills necessary for UX practitioners is essential for guiding education, training, and professional development. UX encompasses a broad spectrum of disciplines, including design, psychology, research, and technology, making it crucial to articulate the core competencies required for success in this multidisciplinary domain. This section provides an overview of relevant UX models that are used to define UX knowledge and skills for both individual designers and teams.

2.4.1 User Experience Model

Thüring and Mahlke (2007) proposed the components of the user experience model (CUE) to demonstrate how users perceive the inherent qualities of the system by distinguishing between two types of qualities: instrumental and non-instrumental. Instrumental qualities refer to the system's controllability, effectiveness, usability, and learnability. Non-instrumental qualities concern visual aesthetics, haptic quality, and identification. Both qualities influence the user's emotions along with the interaction process.

2.4.2 Hassenzahl's User Experience Model

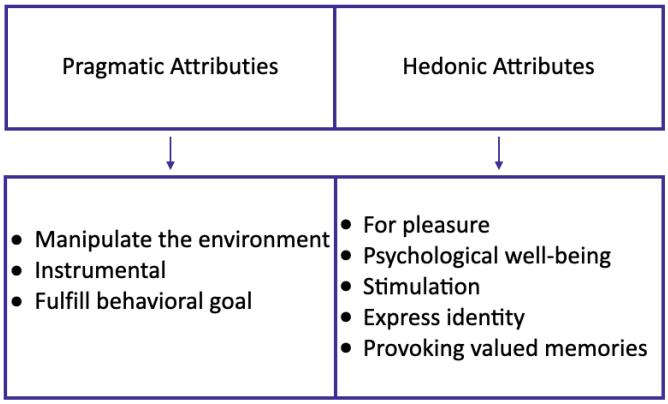
Hassenzahl (2008) proposed the pragmatic versus hedonic framework to understand the product character by considering its attributes (Figure 2.1).

Pragmatic Attributes: The Essence of Utility and Usability

Pragmatic qualities refer to the practical aspects of a product or service that fulfil functional needs and enable users to accomplish tasks efficiently. They are associated with usability, efficiency, and effectiveness. Usually, pragmatic attributes include clear, supporting, useful, and controllable features that create instrumental value for users to fulfil behavioral goals (Hassenzahl, 2018).

Figure 2.1

Hassenzahl's Pragmatic and Hedonic Attributes



Hedonic Attributes: Beyond Functionality to Psychological Fulfilment

Hedonic attributes transcend the mere functionality of products to emphasize psychological pleasure. Hedonic qualities refer to the experiential and emotional aspects of a product, focusing on the enjoyment, pleasure, and aesthetic appeal that users derive from the experience (Hassenzahl, 2018).

Hedonic attributes are significantly different from pragmatic attributes. While pragmatic features emphasize users' goal fulfilment, hedonic attributes focus on their psychological well-being. Commonly observed hedonic attributes associated with software products include terms such as "exceptional," "remarkable," "exciting," and "captivating." Moreover, the hedonic role of products can be divided into three specific facets: delivering stimulation for personal development, expressing identity to others, and eliciting cherished and important memories (Hassenzahl, 2018).

The framework recognizes that users' perceptions and evaluations of UX extend beyond its practical functionality and encompass emotional experiences.

2.4.3 Core UX Competence

In a 2014 longitudinal study, Gray identified several core design competencies for UX practice:

1. Handling complexity such as timeline pressure or multiple tasks
2. Using common vocabulary and language to communicate with other teams
3. Employing design leadership bring change and influence in the organizational level
4. Self-learning and sharing expertise to others
5. Learning about the organizational culture and reconciling personal goals with organizational goals
6. Adapting to the environment while keeping the designerly identity

Among these competencies, understanding the organizational culture is the precondition to ensure effective outputs within the bureaucracy. Regarding personal factors, self-learning is a significant indicator of designers' competence growth holistically and tactically. Drawing from the research findings, Gray (2014) concluded that UX competence is not a fixed or static state; instead, it is fluid and contextually dependent. It is shaped by personal factors, organizational influences, and the collaborative efforts of individual designers.

However, as highlighted in Gray's study (2016), which explored the experiences of novice professionals entering the field of UX practice, the key competencies essential for success in this field extend beyond mere content-related knowledge and emphasize the importance of possessing the appropriate mindset and judgment. These competencies can be concisely summarized as "having the right attitude and approach to navigating complex situations, fostering collaboration within corporate environments, and effectively communicating with a diverse range of stakeholders to advocate for the needs of users" (Gray, 2016, p. 4052). Leinonen and Roto (2023) investigated the knowledge transfer from service design to UX in digital service creation projects. They summarized that communication quality and quantity

and verifying the communication results are major factors that influence the knowledge transfer.

Moreover, Rose et al. (2020) proposed three critical skill sets for UX work:

1. Technical skills refer to the standard UX industry practices that the practitioner is expected to equip. This dimension is compulsory in the UX occupation and constitutes diverse user research methods, visual and interaction design, design process, information architecture, business strategy, product thinking, software tools, UX fundamentals such as sketching, wireframing, prototypes, data analysis, and understanding complexity.
2. Human skills refer to interpersonal matters, such as engaging with team members to achieve goals by communicating, approaching problems together, collaborating, and storytelling. Apart from these major skills, other skills relate to handling conflict, persuading, giving and taking critiques, working with clients, leading project, listening, critical thinking, and innovative approaches.
3. Disposition skills demonstrate a person's internal motivation to act under certain conditions. It is related to ownership, flexibility, curiosity, and passion.

The skill sets highlight the interdisciplinary nature of UX knowledge. Consequently, Kou and Gray (2018) stated that UX occupation lacks clear boundaries, unlike other professions, which require a distinct a body of knowledge. Therefore, they investigated an online UX community to gain insights into how UX professionals delineate their occupational expertise and establish their professional boundaries. The results revealed several knowledge areas and skills that are distinct to UX professionals. These include the unique blend of seemingly "polar opposite" skills, such as being both logical and empathetic. UX practitioners are also adept at supporting other teams, contributing to organizational change, and showcasing the value of UX to different departments. Additionally, they excel in communicating and advocating for UX practices in public, helping to raise awareness and understanding of the field across various audiences.

Alternatively, Roto et al. (2021) examined the boundaries between service design and UX design and found that UX possesses the following features:

1. UX design focuses on the interaction between users and digital artifacts. Thus, a more intricate analysis is needed for the development of specific interactions within a product or system.
2. "Experience" is the key concept—user experience, stakeholder experience, and customer experience.
3. Prototype testing, user testing, and implementation are the UX designers' expertise.
4. UX designers' work scope varies according to organizational needs and project needs.

Kashfi et al. (2017) identified multiple UX challenges within software companies, offering insights into the necessary UX knowledge needed to address these challenges in the future. To increase the granularity, Branch et al. (2021) summarized that user-research, project management, collaboration, evaluating and testing, prototype, design software skills, design thinking, and creativity and problem solving are the key domains of knowledge and expertise that are fundamental to the practice of UX. Still, issues such as the absence of agreement regarding UX competencies and responsibilities, as well as communication gaps between UX teams and other departments, emerge as significant concerns.

Cajander et al. (2022) examined why and how UX professionals learn UX methods in practice to improve their work performance. The results indicate that there are four primary ways in which they learn new UX methods: learning from colleagues and sharing knowledge within teams; following mentors on social media and other platforms to stay updated on the latest UX trends and techniques; participating in formal learning opportunities, such as lunch lectures, expert talks, and conferences; and gaining experience by applying UX methods in practical projects.

UX professionals are motivated to constantly improve their UX skills because the work context is rapidly changing and requires them to learn and adapt. However, if UX designers are already familiar with certain techniques, they risk not learning new, relevant skills. In this circumstance, colleagues are the major motivators to forming a learning culture.

2.4.4 UX Maturity Model

UX maturity refers to an organization's ability to successfully deliver UX outputs, including the knowledge or competence of its UX teams. Chapman and Plewes (2014) developed the UX maturity framework, which helps organizations assess their maturity stage and improve their UX efficiency by evaluating six key indicators.

1. The timing of UX involvement: Early involvement of UX in the design and development process indicates a higher level of maturity.
2. UX expertise and resources: The presence of in-house UX expertise and resources, or the ability to quickly access UX professionals as needed, signifies UX maturity.
3. The use of appropriate techniques and deliverables: Mature organizations employ a variety of techniques and deliverables to gather and understand user input effectively.
4. The leadership and culture: The leadership's appreciation of the value and necessity of UX design is crucial for UX maturity.
5. UX integration and connection in the company: Highly mature organizations integrate UX processes seamlessly with other corporate processes. This alignment enables cross-functional collaboration and ensures that UX considerations are integrated into various stages of product development, marketing, and support.
6. Design thinking: When applied in the broadest perspective, it drives consistent customer experiences. Mature organizations embrace design thinking principles throughout their operations, encouraging innovation, empathy, and iterative problem-solving to create meaningful UX.

Although the UX maturity framework primarily assesses the overall maturity level of an organization's UX practices, it indirectly reflects the competence of the UX team and their knowledge and skills, such as the ability to effectively utilize techniques to generate high-quality wireframes and prototypes that accurately reflect user needs and preferences.

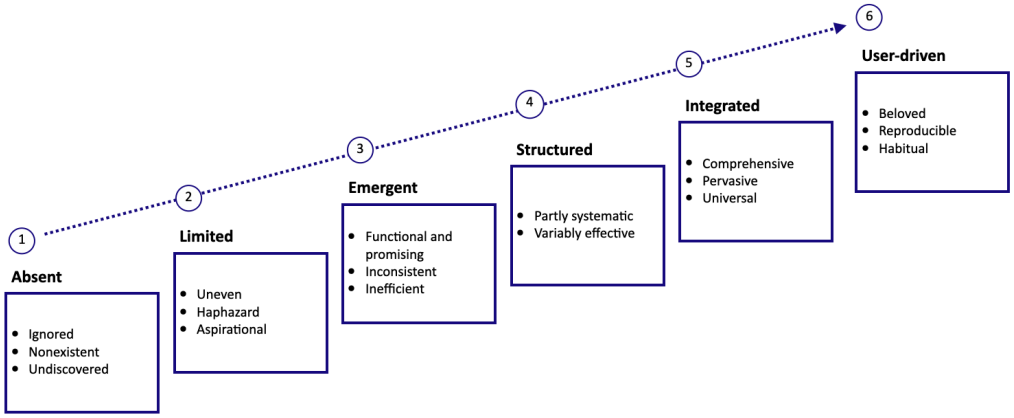
Moreover, a user-centric culture supported by leadership encourages continuous learning and skill development within the UX team. In addition, competent UX teams possess strong communication and collaboration skills, enabling them to effectively work with stakeholders from diverse backgrounds. Hokkanen et al. (2016) introduced the concept of minimum viable user experience to help startups incorporate sufficient UX elements in early product versions to communicate value and gather meaningful feedback. Their study, based on interviews with 17 entrepreneurs from 12 small startups, identified four key elements: attractiveness, approachability, professionalism, and selling the idea. This framework guides startups in focusing on essential UX aspects to ensure user engagement and informed product development.

Pernice et al. (2021) identified four crucial factors for enhancing UX maturity: strategy (UX leadership, resource planning, and prioritization), culture (relevant UX knowledge and career development for practitioners), process (adopting systematic UX research and design methods), and outcomes (defining and quantifying UX-generated outcomes). These factors are interdependent, mutually reinforcing, and supportive of each other. Merely possessing knowledge of UX processes is insufficient for building a great UX team unless there is strong support for UX work from the organization's leadership. Similarly, recognizing the value of UX is effective when backed by established methodologies. Advancement across all these dimensions is necessary for achieving UX maturity and fully leveraging the benefits of user-centered design.

In addition, Pernice et al. (2021) specified six stages to address UX processes, as shown in Figure 2.2.

Figure 2.2

Stages of UX Maturity



Note. Adapted from Pernice et al. (2021)

The six stages of UX maturity are as follows:

1. Absent: At this stage, companies are either unaware of the importance of UX or believe it to be unnecessary. User-centered thinking is absent from their operations, with users not driving their strategic, tactical, or decision-making processes. In addition, UX work is not planned or integrated into the organization's vision, and individuals who advocate for user-centric approaches may be disregarded.
2. Limited: In the limited stage of UX maturity, organizations exhibit occasional engagement with UX practices. These efforts typically arise due to legal requirements, the initiative of a UX-aware individual, or experimental teams attempting UX methods. While there may be some level of UX awareness within the organization, UX work is not conducted consistently or integrated into strategic planning. It is not prioritized or officially

recognized as a discipline. Consequently, there are no dedicated roles, processes, or budgets allocated for UX activities.

3. Emergent: In this stage, organizations demonstrate increased UX activity across multiple teams, with some level of UX-related planning and budgeting. However, these efforts are typically small, inconsistent, and driven by individual manager initiatives rather than organizational policies. While certain teams may employ various research and design methods, the overall UX processes lack systematic implementation. Similarly, although there are individuals in UX roles, their numbers and skill sets may be inadequate. Organizations in this stage are still in the process of demonstrating the value and impact of UX, with limited widespread adoption of UX processes. While some leaders may advocate for usability, UX is often deprioritized when trade-offs are necessary, indicating that it has not yet been recognized as a critical strategic component.
4. Structured: Organizations acknowledge the importance of UX and have dedicated UX teams. Leadership often supports UX and may integrate it into overarching strategies. There is a unified design framework and an iterative human-centered design process. Moreover, user research is pervasive throughout the product lifecycle. However, political issues and miscommunication may lead to resource misallocation and overspending on unnecessary UX-related work or products.
5. Integrated: UX work is widespread and crucial across the organization. Most teams handle UX-related tasks efficiently. There is ongoing innovation in UX methods and contributions to the field.
6. User-driven: UX practices have become habitual and standardized and are embraced throughout the organization. User-centered design is deeply ingrained, with user needs driving strategy and project prioritization. Development emphasizes iterative, user-focused design. From leadership to individual team members, everyone prioritizes UX in their daily work, spanning from high-level strategy to minute design details or research studies. The organization actively plans for change and innovation, recognizing the importance of staying ahead in the UX landscape.

The UX maturity model identifies the strengths and weaknesses of a team, current accomplishments, and areas for improvement. However, UX teams alone cannot improve the firm's UX maturity level. According to this maturity framework, UX is integrated and consistent across other teams at the highest maturity levels. Additionally, UX knowledge and methods need to be shared at the organizational level and not only within UX teams. Nevertheless, not all companies are required to have the highest UX maturity level. It is highly situational and based on the industry and development stage.

2.4.5 Other Relevant Studies

Cajander et al. (2022) investigated the most frequently used UX methods in an agile context by UX professionals: prototyping, user testing, user journey, and workshops. The user journey includes project goals, requirements, and user stories to indicate users' needs and expectations, especially in the early stages of project development. After the initial project ideas are formed, low-fidelity or high-fidelity prototypes are generated to evaluate the ideas. Prototypes can be used in the user testing stage to collect feedback as early as possible to avoid mistakes in the implementation stage. Moreover, workshops are common in every stage to brainstorm ideas or create user journeys. Although UX professionals could use these methods to facilitate their daily work, time limitations often lead professionals to neglect some methods, such as conducting user testing with actual users (Cajander et al., 2022).

Branch et al. (2021) investigated the curricula design in undergraduate and postgraduate UX education and found that institutions and employers emphasize different UX competencies. Employers prioritize practical skills related to production in visual and interactive designs, whereas higher education institutions emphasize transferable, cognitive, and interpersonal skills in the leadership and teamwork areas. Prototype, user research, project management, web design, and visual design were found to be the most common competencies required within the industry that highlight practical knowledge. Branch et al. identified the gap

between UX education and practice; the current study could further guide UX education design in the team context.

2.5 Design Knowledge

Design is evolving from focusing on concrete elements to embracing more abstract concepts by integrating with the culture of innovation. Currently, design prioritizes identifying problems over solving them, as AI and algorithms may respond more swiftly and efficiently to specific issues in some cases. As Mortati (2022) stated, "Algorithms are emerging as the primary providers of highly tailored solutions" (p. 22). This shift suggests algorithmic solutions is prevalent, indicating new possibilities and requirements may be needed to demonstrate the value of design to companies. Design is a type of media that can portray current technology to an audience (Hernández et al., 2018). Design innovation adds new characteristics to a product by addressing its appearance, performance, usability, and aesthetics. Furthermore, design promotes excitement and curiosity, which stimulates new market demand. To deliver economic value, the role of design in innovation should be considerably more than the commonly assigned function of “adding value;” it includes creating new value (Heskett, 2017).

Given the significance of design, scholars have actively worked to define its meaning and constituent aspects. According to Narváez (2000), design knowledge is the experience and knowledge that emerge from the synthesis of design thinking and actions. Because technology advances swiftly, design expertise must be continuously learned over time. Design knowledge requires a comprehensive and adaptive understanding. Giaccardi and Redström (2020) suggest the term "more-than-human" to describe design knowledge in which intelligent tools and data feedback loops function as active participants rather than passive collaborators.

Similarly, Jodi Forlizzi (2018) argues that design should shift to "stakeholder-centered design," in which "we are no longer building one thing for one person" but instead consider the multiple characteristics of the variety of people who engage with the products. Giaccardi (2019) highlighted three significant shifts in artifacts: (1) an agential shift, where objects are increasingly seen as active partners in the design process; (2) a temporal shift, emphasizing the continuous opportunities for co-creation; and (3) an infrastructural shift, focusing on the evolving forms of value.

Specifically, Meyer & Norman (2020) have proposed four types of knowledge challenges for designers: performance challenges, which involve what designers are obligated to do, such as meeting human needs and desires and generating the tangible and intangible to link the world; systematic challenges, which concern how designers think holistically rather than in a single part; contextual challenges, which signify the involvement of the environment, local culture, and political consideration; and global challenges, which involve global issues.

Many discussions exist about the transformation and challenges of design knowledge. However, a more accurate and sophisticated definition and list of components are needed so that knowledge creation, sharing, storage, and application can be systematically captured in firms.

2.5.1 The Unique Features of Design Knowledge

Design is a competitive advantage for organizational development, offering creative solutions to challenges. Hence, design acts as a bridge between social responsibilities, technological requirements, and market demand for innovation (Mortati, 2022). However, design is an abstract concept, and scholars have strived to clarify its meaning and components. Design knowledge refers to the experience and knowledge produced by the synthesis of design thinking and design actions (Narváez, 2000).

Åman et al. (2017) categorized design knowledge into three conceptual pairs: declarative-procedural, tacit-explicit, and individual-collective (Table 2.5).

Table 2.5

Knowledge Classification

1	**Declarative**	This includes design theories, methods, rationality, and measures, which are difficult to articulate
	Procedural	It pertains to how to put declarative knowledge into practice through sketches and prototypes. In UX, declarative knowledge refers to understanding the industry, users, stakeholders, and design problems, while procedural knowledge involves a rational and rigorous analysis to obtain a solution.
2	**Tacit**	Michael Polanyi (1966) introduced "tacit knowing" in his book *Tacit Dimension*. The challenge is that tacit knowledge is difficult to articulate, verbalize, and express to others. It involves intuition, insights, instinct, and procedural skills or memories. In design, designers often face situations such as "I know why this plan over another, but I cannot explain it." This invisible thinking and tacit knowing make knowledge difficult to capture, store, and exchange.
	Explicit	Explicit knowledge is the rationality of design, which can be easily transferred, learned, or documented.
3	**Individual**	Individual knowledge refers to personal experience, motivations, expectations, and skills.
	Collective	Collective knowledge is constructed through accepted and justified procedures to build common ground rules and values for coherence in design-incentive firms.

Design knowledge creation in an organization is an iterative process, as the problem and solutions need to be refined through the design thinking process. In addition, design knowledge is generated from the interaction of people and objects; it is socially critical, transformative, and emancipatory. The distinct difference between design knowledge and other scientific knowledge has been suggested by Cross (2006), as shown in Table 2.6.

Table 2.6

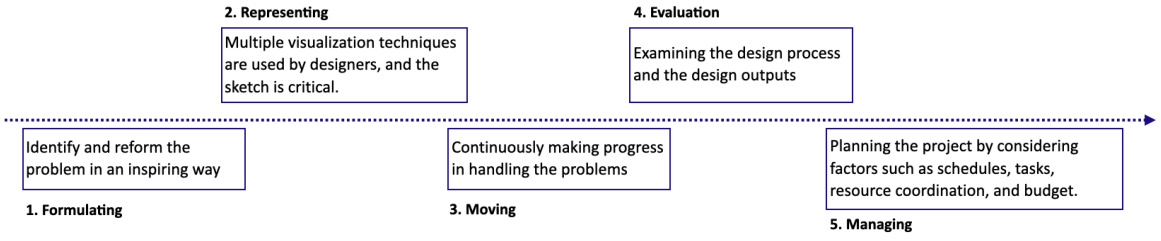
Design knowledge and scientific knowledge

Design knowledge	Scientific knowledge
Designers solve problems through synthesis.	Scientists solve problems through analysis.
Design activities aim for a satisfactory result within a limited time.	Scientists aim to reach an optimized result in a short time.
Designers find solutions by redefining the problem and accepting that it is unstructured and not well-defined.	Scientists find solutions by answering the well-confirmed problems.
Design is a constructive process involving pattern synthesis.	Scientific study is a systematic process of testing and analysis.
Articulating the problem-solving process is difficult in a designer's mind because much of it involves tacit knowledge.	Scientists can articulate the decision-making and problem-solving processes because the knowledge is presented in explicit formats.

Based on these differences, Lawson and Dorst (2009) developed a comprehensive summary of typical design activities to illustrate how design knowledge is generated, including a general description of what a designer does while designing. The five core design activities encompass formulating, representing, moving, evaluating, and managing, as shown in Figure 2.3.

Figure 2.3

Five design activity



Note. Adapted from Lawson and Dorst (2009)

Therefore, the characteristics of design knowledge are tacit, and design knowledge should be more clearly explained to prepare designers or design-centered organizations to cope with the challenge. Understanding the existing resources and knowledge is essential for the learning process associated with creative outputs.

2.5.2 Design Knowledge Models

The Unified Model of Design Knowledge

Due to today's rapidly advancing technology, design expertise must be updated continuously, which requires a comprehensive and adaptive understanding of design knowledge. The unified model of design knowledge highlights four types of knowledge essential to effective design: artifact knowledge, design intuition, design language, and design theories (Thoring et al., 2022), as demonstrated in Figure 2.4. This approach recognizes that successful designers possess various skills and expertise that must be effectively managed to create innovative solutions. Artifact knowledge indicates design knowledge that can be displayed in a physical format for a specific function. Design intuition represents designers' tacit knowledge. Design language refers to symbolic knowledge, including text, figures, sketching, drawing, and symbols, while design theories include abstract and compressed knowledge that can be transferred to and tested in various projects, such as product patents, design management, and ergonomic norms.

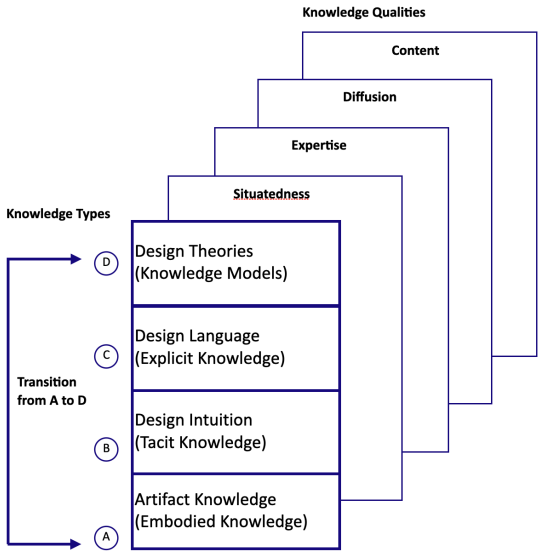
The design knowledge model combines four levels:

1. Artifact Knowledge: Physical artifacts represent the design knowledge that a specific function can display in the physical format. Embodied knowledge, precedents, and object knowledge are similar concepts that express how knowledge can be transferred to designed physical products.

2. Design Intuition: This refers to the tacit knowledge that designers possess. Designers often rely on their intuition or gut feeling when evaluating the quality of a design, even though they may not be able to explain why. Their design knowledge operates at a neuronal level that is difficult to articulate in words. However, this tacit knowledge can be trained and developed through experience and exposure to different design contexts. Intuition, talent or skills, tacit knowledge, body knowledge, memory knowledge, and knowledge within people are similar concepts used to describe the internal representation of design knowledge.
3. Design Language: This level indicates symbolic knowledge, including text, figures, and symbols. Usually, it shows in the explicit knowledge, i.e., the designer's expression skills, such as visual languages, sketching, drawing, and design software.
4. Design Theories: Design knowledge in this level includes a highly abstract and compressed form that can be transferred to and tested in different projects such as product patents, design management, and ergonomic norms. For example, a helmet designed based on ergonomic norms can be tested on different individuals.

Figure 2.4

Design Knowledge Model



Note. Adapted from Thoring et al. (2022, p. 30)

Different levels of knowledge are transferable from artifacts to design intuition, or from design language to design theories. In total, three transitions exist among the four knowledge types:

1. Transition A–B: This includes filtering signals from the physical level. The designer's perspective about problems or opportunities may be adjusted as their perception of the world changes.
2. Transition B–C: Moving from level B to C, the tacit knowledge becomes externalized, such as codes and symbols, through the design skills learned (sketching, drawing).
3. Transition C–D: Exploring the models or theories could facilitate the designer's work, which could be affected by user observation, interview, and field research. The model can be the user persona, journey, or service blueprint.

This model consolidates various design knowledge theories and serves as a foundation for developing knowledge management for design teams. The model identifies four key qualities of knowledge: Situatedness, which reflects how domain- or context-specific knowledge is and its transferability; Level of expertise, which refers to the designer's expertise, from novice to expert; Knowledge diffusion, indicating the extent to which design knowledge is distributed and accessible; and Knowledge content, which includes various topics applicable to knowledge incentives, systems, and interdepartmental coordination.

The Fifth Order of Design Knowledge

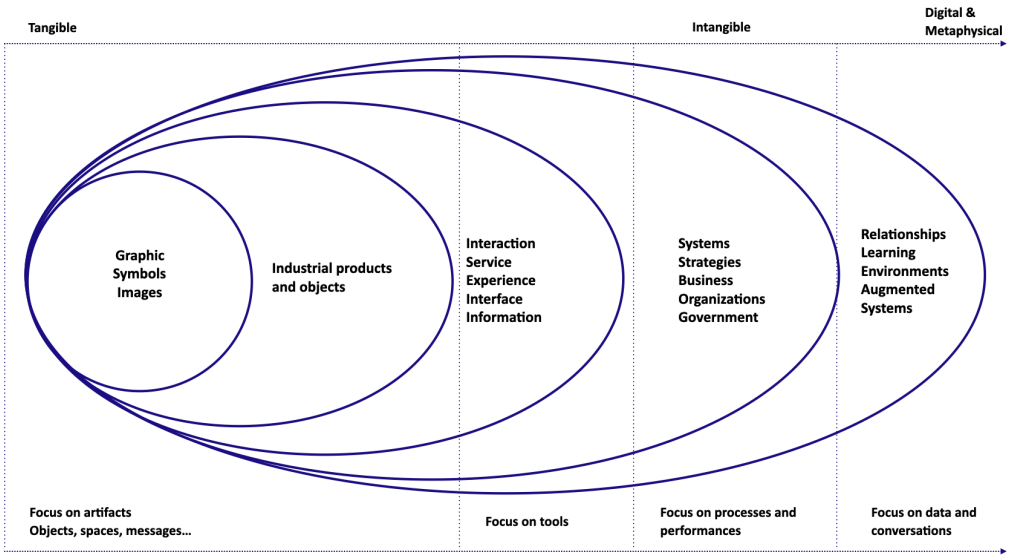
Mortati (2022) proposed the fifth order of design knowledge, which emphasizes the importance of building bridges between multiple species involved in complex problem-solving processes (Figure 2.5). This approach acknowledges the need for a holistic and interdisciplinary perspective when tackling complex design problems by integrating scientific, aesthetic, ethical, and cultural knowledge. It requires reflecting deeply on traditional human-

centric approaches and other disciplines, such as biology and ecology, to create innovative and sustainable solutions.

The fifth order of design knowledge demonstrates how design knowledge should evolve to master rapid technological change by combining cognitive processes. Particularly, Mortati (2022) references Neri Oxman (2016), who proposed the Krebbs cycle of creativity (KCC). The KCC map illustrates the flow of human creative energy across the domains of science, engineering, design, and art. In this process, the role of design is to create solutions that not only optimize functionality but also enhance the human experience. The KCC model is significant as it explains how design aligns with the virtual and metaphysical and emphasizes perceptions and culture instead of physical and material aspects.

Figure 2.5

The Fifth Order of Design Knowledge



Note. Adapted from Mortati (2022, p. 27)

The fifth order model is a conceptual framework that describes how design practice has evolved. It is divided into five orders, each indicating a distinct design intricacy and

sophistication level. The first order emphasizes craft and aesthetics, in which designers construct visually beautiful products without functional or contextual considerations; this early stage is rich in tangible knowledge, focusing on objects, spaces, and messages. The second order of design involves utility, with designers producing items that serve certain purposes. The third tier considers systems and processes in addition to individual products, emphasizing the significance of user experience and usability. The fourth order entails designing for complicated social and cultural contexts while considering sustainability, ethics, and diversity concerns. Lastly, the fifth order denotes a new period in which designers must address complicated problems involving various species (including humans), time dimensions, evolution, and learning, all creating unique challenges for traditional design techniques.

In today's world, design tends to be digital and metaphysical. The data are actively used to predict consumer choice, determine solutions, and influence preferences. Besides, the system can evolve and learn as the data feed the algorithm. Previously, designers conducted user research and observation to obtain useful insights from first-hand information to create a persona and user journey to make the design innovative. Now, designers need to find patterns from data to enrich their understanding of user behaviors. Hence, the two ways of thinking need to merge in the design process to contribute to the development of solutions and increase the complexity of the design. Overall, the fifth order model provides a useful tool for understanding how design has evolved while highlighting new challenges that require innovative solutions from designers.

The unified model of design knowledge (Thoring et al., 2022) and the fifth order of design knowledge (Mortati, 2022) offer different approaches to defining and evaluating design knowledge, providing a solid foundation for generating a knowledge framework for UX teams. Thoring's model identifies specific types of knowledge that must be managed effectively to design solutions successfully within the context of a single project or problem-solving scenario. The model helps this study assess the existing knowledge within UX teams to identify the

specific knowledge components of the teams. It also enables exploration of how the different levels and categories interact and contribute to the overall UX design process. In contrast, Mortati provides a broader perspective on how different levels or orders represent increasing complexity and sophistication in designing solutions across multiple disciplines, which sets the ground for this study to investigate how UX designers engage with other disciplines and integrate diverse knowledge, as well as the extent to which non-design knowledge is valued and incorporated.

2.6 Knowledge Sharing and Creation

Teams are particular types of groups that emphasize the collaboration of individual commitment to fulfil shared goals and outcomes. In contrast, groups usually include two or more individuals who influence each other through interaction (Tang & Schmidt, 2021). Team literature addresses the innovation aspect, which includes different phases, such as idea selection, development, and implementation, whereas literature about group creativity emphasizes the ideation phase of collaborative creativity (Paulus et al., 2021). This study focuses on design, which shares more common characteristics with teams. Kozlowski and Ilgen (2006) define a team as a group composed of two or more individuals who interact socially and share common goals. These individuals come together to perform tasks that are relevant to the organization. Within a team, members are interdependent in terms of their workflow, goals, and outcomes, and they each have distinct roles and responsibilities. Additionally, a team operates within a broader organizational system, with defined boundaries and connections to the larger organizational context and task environment. Additionally, the strong commitment among members, shared responsibilities, interdependence, and a diverse combination of skills enable teams to make more focused and intentional efforts, which are essential for leveraging diversity and fostering team creativity (Hülsheger et al., 2009).

2.6.1 Knowledge Sharing in User Experience Teams

The team is the fundamental unit that executes organizational goals (Gerard, 1995). In the design field, a team usually comprises members from diverse backgrounds to cope with ill-defined problems based on their experiences. Designers often work with and learn from team members by creating and sharing professional knowledge. How a team, as a collective unit, reflects on knowledge is different from how individual designers reflect on the same situation (Tan et al., 2023). Therefore, a collective perspective is generated through team reflection and learning based on practice, which alleviates the limitations of individual reflection and learning. Team learning and reflection create significant team knowledge that utilizes various past individual experiences to solve current problems with a new and collective perspective (Bell et al., 2012).

In UX team knowledge research, Zaina et al. (2021) demonstrated the different types of UX information existing in the agile team and how the information flows within and among teams. The result revealed that the most used agile artifacts are user stories and mock-up captures, which convey concrete information regarding users' interaction with the products and the functionalities. The information on how users interact with the products is more common than the information relating to their goals or needs. However, agile UX team members often play a passive role as receivers of UX information and are not actively involved in its creation, which reduces their engagement and impacts their shared understanding of UX concepts.

In a more specific context, Caglar et al. (2022) identified several contextual factors to consider when studying UX in the workplace. These factors include task, temporal, social, technical, and physical contexts. The task context is the most analyzed factor and is categorized into three types: routine tasks, specific tasks, and temporary tasks. Temporal context involves considerations such as deadlines, busy work periods, time constraints, the duration required to complete tasks, specific phases of work, task repetition, and the overall duration of research. Social context focuses on interpersonal interactions, including collaboration

practices, teamwork, information sharing, consulting, and communication structures. Technical context indicates the online tools and physical tools that could be used in the project. Physical context includes the on-site and off-site work, body gestures, and physical settings such as furniture, lighting, and audio.

Saad et al. (2021) examined how UX is integrated into software design in start-ups. One key point is that the team's experience and knowledge significantly influence UX practice. Particularly, when the lack of UX expertise and awareness affects the developer's vision, UX activities reduce, and the technical aspects of the product are emphasized rather than user needs. Usually, teams in startups focus more on technical rather than UX aspects, which affects how UX is implemented in the project. However, Saad et al. (2021) argued that collecting and interpreting user feedback and information are key skills for UX work. Subsequently, Zaina et al. (2023) proposed an initial theoretical framework that includes four groups of knowledge to address the UX needs of startups: customer information, UX measurement, UX practices, UX value and culture.

In the latest research, some researchers have focused on specific tools that UX teams use, such as the alienation of user journey in cross-functional teams (Tan, 2023); collaborative UX tools to enable teams of UX practitioners (Feng et al., 2023); strategies that improve UX competencies at the individual, team, and organizational level in the robotics industry (Nielsen et al., 2023); and the application of cognitive mapping to understand needs and facilitate decision making and prioritization for UX teams (Taraghi et al., 2023).

The knowledge generated by teams is implicit capital. Firms should maximize the value of teams by exploiting this knowledge and encouraging individuals to be more engaged in the creative process to generate valuable outcomes. Team knowledge is valuable for new product or service development. For example, design teams at Apple developed the iPod and iPhone, while at Sony, design teams developed the classic Walkman. UX teams play a pivotal role in

generating and sharing knowledge through identifying problems and fostering long-term innovation. The collaborative nature of UX teams ensures that knowledge is continuously exchanged, refined, and expanded upon. This ongoing process of knowledge creation and sharing is vital for maintaining a competitive edge, particularly in industries that rely heavily on creative and innovative solutions.

In particular, teams' problem resolution processes can be referenced later in different design stages or tasks. Teams need to understand and identify the knowledge required for the current task before engaging in it, and if the knowledge does not exist, they must introduce new knowledge.

This discussion is supported by Nonaka and Takeuchi (1995), who examined two management processes: the top-down and the bottom-up models (p. 124). However, neither is adequate in stimulating organizational knowledge. The top-down model is led by the leaders who transfer their ideas to the subordinates; the ideas need to be concise and without ambiguity to be implanted. During the process, employees who deploy the idea will accumulate knowledge but have to be provided with the chance to communicate it to their seniors. The top-down model is more suitable for explicit knowledge conversion but unsuitable for knowledge socialization and externalization. The bottom-up approach, in contrast to the top-down model, is driven by the initiative and ideas of lower-level employees that emphasizes the flow of information and knowledge from the operational levels of the organization to senior management. It is more suitable for knowledge socialization and externalization, as it fosters the sharing and development of ideas across different levels. However, it is less effective for combining knowledge and internalization due to the potential challenges in aligning diverse ideas with strategic objectives and ensuring cohesive implementation (Nonaka & Takeuchi, 1995, p. 226).

Neither approach is suitable for knowledge conversion. Therefore, Nonaka and Takeuchi (1995) proposed the middle-up-down model, which includes explicit and tacit knowledge creation and conversion, putting the team and middle manager in the center. The authors believe that significant knowledge creation happens at the team level as teams can communicate with each other frequently through metaphor or analogy, stimulating the sharing of tacit knowledge; they mentioned, "The team is the intersection of the vertical and horizontal flows of knowledge within the company" (Nonaka & Takeuchi, 1995, p. 127). In the middle-up-down model, the high abstract vision is created by the top management, and middle managers interpret the vision and generate concrete concepts for front-line employees to implement.

In UX management practice, Duh et al. (2016) proposed the total user experience management (TUXM) model that comprises six elements: UX objectives, integrated-design system, strategic communication, continual improvement, fact-based decision making, and a T-type design team, which reflects the multidisciplinary nature of UX teams by combining broad knowledge across various design disciplines. The TUXM model inspires the composition of a knowledgeable UX team by highlighting the importance of multidisciplinary expertise, data analysis and research skills, communication and collaboration skills, continuous learning and adaptation, and innovation and creativity. By assembling a team with diverse talents and capabilities, organizations can enhance their ability to deliver exceptional user experiences that meet both user needs and business objectives.

However, it is unclear how UX designers articulate, share, and apply their knowledge — such as design principles, user data, and domain-specific expertise — to enhance team collaboration and design outcomes, particularly in China's high-tech industry. This study targets UX as a starting point to investigate the UX team knowledge composition and how it is distributed in teams. I view the design process and outcome as a collective effort but also

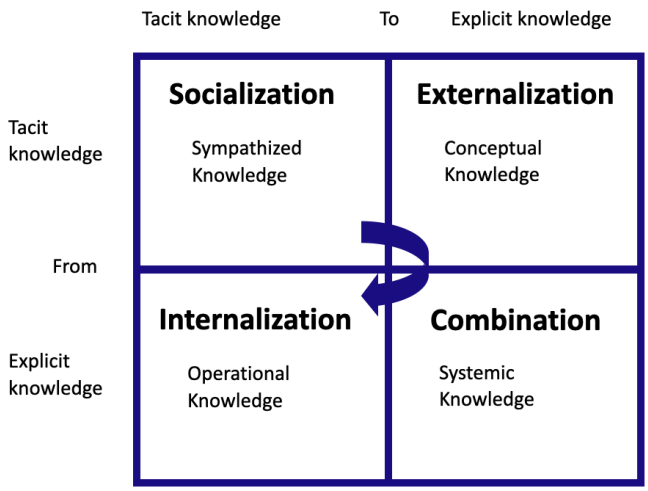
acknowledge that designers may not always engage as part of the team and may be motivated by self-ambition instead.

2.6.2 Knowledge Creation in User Experience Teams

Knowledge creation is the precondition for firms to improve their performance and gain competitive advantage. The process of knowledge creation holds immense significance for firms aiming to innovate and devise novel products or marketing strategies (Kim & Atuahene-Gima, 2010). Nonaka and Takeuchi (1995) proposed the SECI model, with four knowledge creation processes between tacit and explicit knowledge: socialization, externalization, combination, and internalization (p. 72), as shown in Figure 2.6.

Figure 2.6

SECI Model



Note. Adapted from Nonaka and Takeuchi (1995, p. 72)

1. Socialization involves the blending of tacit knowledge through individuals' social interactions. It is a process where people share experiences to create new tacit knowledge from existing tacit knowledge, acquiring it without the use of language but through

observation, imitation, and practice. This process results in the creation of “sympathized knowledge,” including shared mental models and technical skills.

2. Externalization is the process of converting tacit knowledge into explicit knowledge. This involves expressing implicit knowledge through the use of metaphors, analogies, concepts, collective reflection, and hypotheses, making it more accessible and understandable.
3. Combination refers to the process of creating new explicit knowledge by synthesizing different types of external knowledge. It involves organizing and systematizing explicit knowledge into a unified system, typically through activities such as archiving documents, conducting meetings, and using other media.
4. Internalization is the process of converting explicit knowledge into tacit knowledge through "learning by doing." During this stage, individuals develop operational knowledge, which includes insights into project management, new product development, and policy implementation.

The four types of knowledge creation and conversion act differently in the design process. For example, the brainstorming phase requires a tacit knowledge exchange between designers, and after the concept is generated, the tacit knowledge must be transferred into an external format, such as a sketch or prototype. Subsequently, the production process requires systematic planning by knowledge combinations from different parts. However, organizations have difficulties in translating tacit knowledge into explicit knowledge, as the transfer and utilization of tacit knowledge are nested in relationships. Nevertheless, project innovation is primarily associated with replicating and encoding knowledge (explicit dimension) rather than interpretation and assimilation (tacit dimension; Oluikpe, 2015).

Nonaka and Takeuchi (1995) proposed the following five stages of knowledge creation in the general business field:

1. Sharing tacit knowledge: Tacit knowledge is the basic element of creating organizational knowledge. When team members hold discussions for a project goal, they share each other's tacit knowledge.
2. Creating concepts: Intensive interaction occurs in this phase. Once the team members have built a shared mental model for a project, the field of interaction is formed. The knowledge can be further articulated through dialogues or words to become explicit concepts, a step connected to externalization.
3. Justifying concepts: The project team members need to screen these concepts further to ensure they meet the needs of the users or the market.
4. Building an archetype: A tangible or concrete prototype can be developed in this phase through newly created explicit knowledge.
5. Cross-levelling knowledge: This is a continuous process aimed at updating organizational knowledge, including intra-organizationally and inter-organizationally. The former refers to knowledge expanding horizontally and vertically inside the company, triggered by an archetype that stimulates a new knowledge creation cycle. The latter refers to dynamic interaction, which is crucial to mobilize knowledge from customers, suppliers, and relevant companies.

Regarding design, the team's knowledge is generated from three types of design creative activities: extending product lines, developing new platforms, and creating new business opportunities (Kazanjian & Drazin, 2012). Product line extensions are frequently seen in both software and hardware industries. For example, companies such as IBM, Apple, and Dell initially started with first-generation hardware products such as laptops and then progressively broadened their product lines by leveraging the knowledge gained and feedback from users. This expansion process depends significantly on the sharing of knowledge among team members.

A new product platform, on the other hand, involves targeting a new market or technology field, with careful design to provide the foundation for several product line extensions. This approach allows companies to benefit from economies of scope and resource sharing. Finally, new business creation occurs when a firm ventures into an entirely new and unrelated market using existing or new technology, thus internally diversifying its position. A notable example is Apple's transition from the computer market to the music market with the development of the iPod. Regardless of the type of creative activity, leveraging existing knowledge and combining it with new insights is crucial for a firm's development.

These models were instrumental in forming the interview questions and understanding the UX teams' knowledge creation and transformation processes.

2.7 Definition of UX Team Knowledge

In this thesis, I introduce the term UX team knowledge to describe the dynamic, situated, and multi-layered knowledge that emerges within UX teams operating in high-tech industry. This study defines a UX team as "the collective effort of individual designers to meet organizational goals while considering end-users' need for simple, usable, and enjoyable products and services." UX team knowledge refers to the collective, evolving body of knowledge formed through interactions among UX designers, users, organizational practices, and interdisciplinary collaboration. It goes beyond individual expertise, emphasizing the collective, relational, and performative aspects of knowledge within UX teams.

Unlike traditional views of design knowledge-such as declarative vs. procedural, tacit vs. explicit, and individual vs. collective (man et al., 2017), or established frameworks like the User Experience Model (Thüring & Mahlke, 2007), Hassenzahl's UX Model (2008), Core UX Competence (Gray, 2014), Skill Sets for UX Work (Rose et al., 2020), the UX Maturity Model

(Chapman & Plewes, 2014), and UX Maturity Stages (Pernice et al., 2021), UX team knowledge emphasizes the following:

1. A collective perspective generated through team members' interactions and reflections on their shared practices.
2. A focus on collaborative work, where individuals contribute to collective goals across tasks such as idea generation, research, product development, implementation, and usability testing.
3. A developmental trajectory, where UX team knowledge grows and matures as teams move through stages-from initial formation and role clarification to the institutionalization of UX standards and leading innovation.
4. UX team knowledge is typically shaped by the interplay of various specialized roles within the team—such as UX designers, user researchers, interaction designers, visual designers, product designers and managers.

These definition and conception respond to the limitations of existing terms like "UX knowledge," which often focus on individual or generalized expertise, or "team knowledge," which is too broad to capture the unique dynamics of design collaboration. UX team knowledge thus fills a theoretical gap by offering a design-specific, team-based, and context-sensitive understanding of how knowledge is co-created and enacted in practice.

2.8 The Role and Function of UX Teams

UX practice is particularly prevalent in the software industry, especially in conjunction with agile development methodologies (Kashfi et al., 2019). The roles and responsibilities of UX teams vary depending on the size and maturity of the organization. In start-up environments, UX teams are often expected to adopt agile approaches that support rapid iteration and development. However, when agile practices dominate UX processes, user-centered design can be deprioritized, as time constraints and the focus on functional deliverables often limit

deeper engagement with user needs (Cajander et al., 2022). Saad et al. (2021) identified that UX teams in start-ups frequently lack the expertise necessary to effectively understand users. Instead, these teams often adopt a technical mindset that emphasizes product functionality over experiential quality, thereby reducing the influence of UX considerations during project development.

Despite these challenges, UX teams typically engage in a range of core activities that support design outcomes in startups. These include: (1) conducting user research through interviews, focus groups, and observations; (2) identifying potential solutions by analyzing similar products and generating insights during the ideation phase; (3) observing user behavior through interaction logs; and (4) developing prototypes to evaluate user scenarios and design alternatives. These practices illustrate how UX teams contribute both to immediate product development needs and to long-term user value creation (Saad et al.,2021).

In broader organizational contexts, UX teams play a central role in enabling user-centered innovation throughout the entire product development cycle. Their function extends beyond traditional interface design to encompass strategic planning, user research, validation of design concepts, and facilitation of cross-functional collaboration (Cajander et al., 2022). First, prototyping is used not only to test design ideas but also to align diverse stakeholders around a shared vision. Teams employ varying levels of fidelity—from wireframes to interactive mockups—depending on the development stage. Second, user testing is regarded as a vital activity in early-stage development, helping prevent misalignment between product features and user expectations. Third, user journey mapping supports the articulation of user needs and the development of user stories, serving as a foundation for strategic planning. Lastly, workshops are used across all stages of development, enabling co-creation, problem clarification, and stakeholder engagement. These sessions also position UX professionals as facilitators of inclusive, design-led thinking within the organization.

Beyond their operational contributions, UX teams influence design management at multiple levels. As shown in studies by Kashfi et al. (2019) and Cajander et al. (2022), UX teams: (1) play a transformative role in shaping organizational attitudes and practices related to user-centered design through the introduction and normalization of UX methods; (2) promote a culture of continuous improvement by actively sharing knowledge across teams and departments; and (3) act as mediators between user needs and business objectives, navigating organizational constraints while advocating for user value.

In summary, UX teams play a critical and evolving role in design management. Their responsibilities are beyond the application of UX methods, extending into the realms of organizational learning, cultural transformation, and strategic decision-making. Therefore, effective design management must acknowledge and support UX teams not merely as service providers, but as essential contributors to innovation and the institutionalization of user-centered values, particularly in fast-paced and high-tech environments.

2.9 Section Summary

The literature review encompasses discussions on the definition of UX, UX knowledge and skills, frameworks for design knowledge, and knowledge sharing and creation within UX teams. From this review, four research questions and corresponding objectives have been identified.

Relevant models and frameworks relating to design knowledge, UX practice, and knowledge sharing have been reviewed. These models typically address either the individual competencies of UX designers or general organizational knowledge management processes. While existing UX models and theories primarily focus on supporting individual practitioners' work and professional development, there remains a notable gap concerning the UX team knowledge. To address this gap, this study aims to generate a conceptual framework rather

than a predictive model to offer a structured understanding of how UX knowledge is generated, shared, and applied within teams operating in the Chinese high-tech industry.

This focus aligns with the observations of Kashfi et al. (2017), who emphasized the need for developing methods and tools tailored to the specific practices of UX and design activities. By offering a structured framework rather than a generalized model, this thesis seeks to contribute to a more nuanced understanding of UX team dynamics, particularly in the rapidly evolving, innovation-driven environments characteristic of China's high-tech industry.

Chapter 3: Research Methodology

This chapter outlines the methodology employed in this study, which comprises two distinct research phases within a qualitative research framework. The chapter describes the sampling strategy, research methodology, procedures, and data analysis applied in both phases. Grounded theory serves as the foundational theoretical framework. During the first research phase, 16 semi-structured interviews were conducted to gather data to address RQ1, RQ2, and RQ3.

RQ1. What types of knowledge do UX designers apply in the UX team setting?

RQ2: How do UX designers articulate UX team knowledge?

RQ3: How is knowledge distributed within UX teams?

Subsequently, in the second research phase, four case studies were undertaken to corroborate the findings of the initial phase and address RQ4.

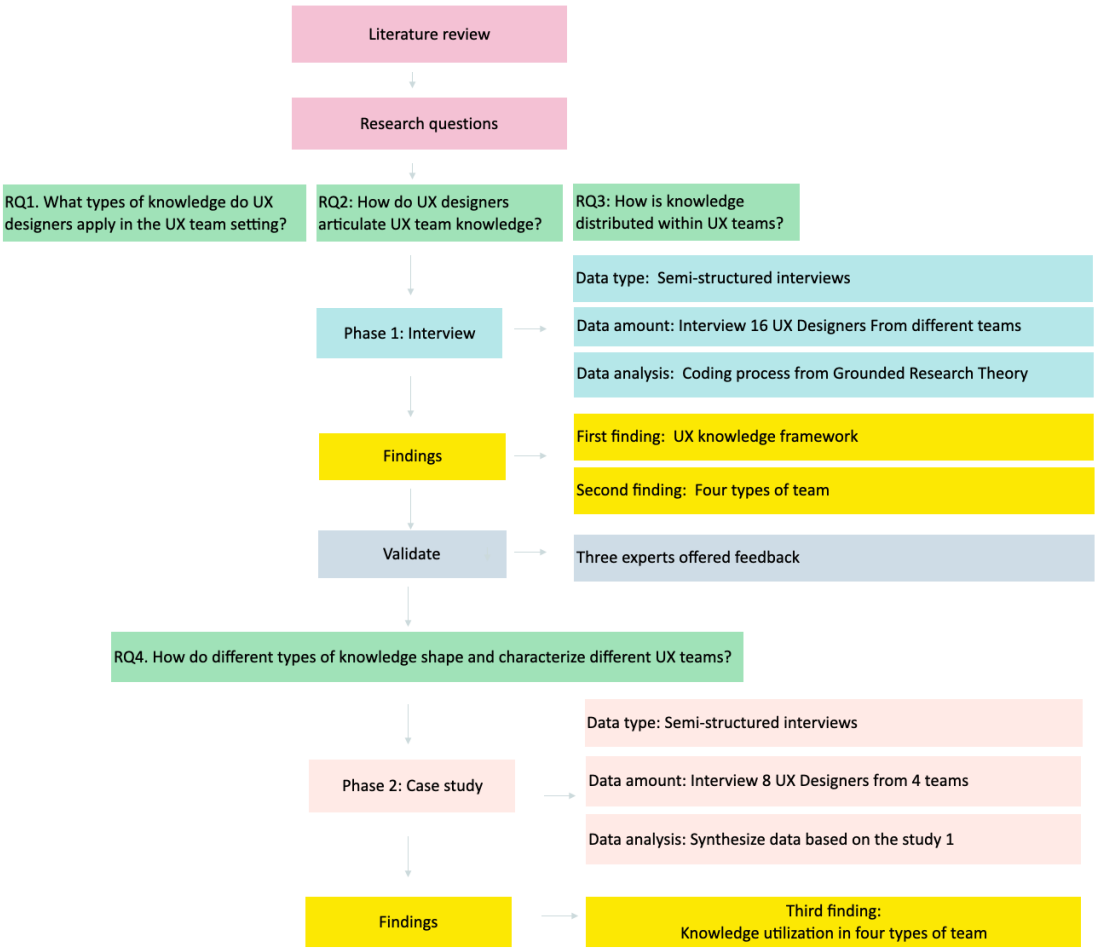
RQ4. How do different types of knowledge shape and characterize different UX teams?

3.1 Research Design

The following flowchart provides a visual representation of the research methodology in this thesis, as shown in Figure 3.1. It begins with a literature review, followed by the formulation of research questions (RQ1, RQ2, RQ3, and RQ4) that guide the study. The first phase involves semi-structured interviews with 16 UX designers from various teams, aiming to explore the types of knowledge utilized, how this knowledge is articulated, and its distribution within teams. The second phase, a case study involving interviews with 8 UX designers from four teams to understand how different types of knowledge shape and characterize UX teams.

Figure 3.1

Research Design



3.2 Qualitative Approach

Qualitative research is primarily concerned with description, interpretation, and explanation, rather than with generalizability and prevalence (Lee et al., 1999). In the context of organizational studies, qualitative research is often employed for the purposes of theory generation, theory elaboration, and theory testing (Lee et al., 1999). Even though there are various data analysis theories and techniques, the most common data analysis coding method in qualitative research is grounded theory (GT) (Lee et al., 1999). GT is suitable for organizational research when existing literature is unable to provide enough guidance to understand a phenomenon (O'Reilly et al., 2012; Glaser et al.,1967).

GT, as elucidated by Charmaz (2006), presents an inductive and systematic methodology offering flexible and heuristic guidelines for gathering, analyzing, and conceptualizing data to formulate a theory. Data sources can encompass observations, interactions with interviewees, and materials pertinent to the research topic. Researchers engage in comparative analysis, sorting, and interpretation of data through labelling and coding to identify commonalities and differences. The iterative process of theory construction or modification relies on continuous examination of participants' understandings and experiences within the research domain.

Particularly, constructivist grounded theory (CGT) possesses adaptable guidelines, permitting the researcher's creativity to flourish throughout the investigation. Inquiry questions may be open-ended or semi-structured to foster reflection and discourse aimed at comprehending the empirical study. Moreover, data collection persists until the emerging framework is refined, prioritizing the generation of fresh categories and novel insights during the iterative research process. Additionally, leveraging existing li terature reviews, frameworks, and models can provide valuable guidance to novice researchers (Nagel et al., 2015).

This study adhered to CGT, guided by the flexible principles of GT as outlined by Charmaz (2006). CGT aligns with the research aim of this study, as it underscores: a) the significance of perspectives, values, and understanding of the phenomenon under investigation; b) the inclusion of multiple perspectives, such as those of team managers and members, to comprehend the composition of knowledge and team dynamics; and c) the generation of new theories or categories through concurrent data collection and analysis while guiding research inquiries (Charmaz, 2006).

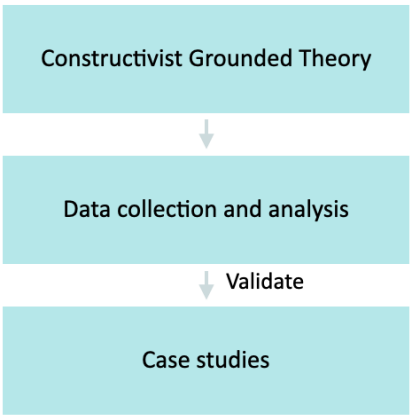
Case studies uncover complex real-life phenomena, providing a comprehensive and in-depth exploration within both social and educational contexts (Merriam, 1998). Ragin and Becker (1992) state that case studies offer concise description and reconstruction of cases. According to Yin (2018), three situations are conducive to conducting case studies: 1) when the research questions pertain to "how;" 2) when the researcher lacks control over behaviors or events; and 3) when the research focuses on contemporary rather than entirely historical occurrences. Case studies often encompass qualitative data about unique situations that extend beyond quantitative measures (Yin, 2018).

From another standpoint, Stake (2013) identifies three types of case studies:

1. Intrinsic Case Study: This type focuses on the particularity and ordinariness of the case without seeking to develop theories or generalizations.
2. Instrumental Case Study: These studies offer insights into specific issues or contribute to generalizations.
3. Collective Case Study: They comprise multiple instrumental cases to summarize general phenomena by examining a series of individual instances.

Figure 3.2

Research Methodology



In this study, case study serves as the instrumental and validated tool for illustrating and elucidating the knowledge within UX teams by identifying four distinct team types, as shown in Figure 3.2. Consequently, it is a collective case study rather than an intrinsic or instrumental one, which emphasizes focusing on particularities and specific issues. However, it is important to acknowledge the limitations inherent in case studies, such as the challenge of achieving "representativeness" (Merriam, 1998), which suggests that the researcher's subjective bias and interpretation may impact the rigor of the study. Another common concern with case studies is the difficulty in generalizing findings, emphasizing the need to extrapolate and refine theories during the analytical process (Yin, 2018).

The combination of CGT and a collective case study is deliberately chosen to ensure alignment with the research questions and objectives. CGT is well-suited to guide data collection and analysis for RQ1, RQ2, and RQ3, which explore what types of knowledge UX designers use and how that knowledge is articulated and distributed within UX teams. Its inductive, flexible, and iterative approach supports the emergence of new categories and frameworks grounded in multiple participants' firsthand experiences. For RQ4, which investigates how different types of knowledge shape and characterize UX teams, a collective case study design enables

comparisons across four UX teams, each serving as an instrumental case. This approach contributes to a broader understanding of knowledge distribution in design practice, reflecting variations in team structures, reasoning styles, and leadership style.

3.3 Ensuring Validity and Reliability

To ensure construct validity, I rigorously investigated the research questions through interviews, observation, and interpretation. Gibbert and Ruigrok (2010) propose two ways to ensure validity: triangulating different data sources and establishing an evidence chain. For triangulation, I collected relevant documents, such as archival sources, interviewed participants who work in the same team, conducted face-to-face interviews and observations, took memos during interviews, and had the research questions reviewed by peers for accuracy, see memos and transcript examples in Appendix 4 and Appendix 5.

To establish a clear evidence chain from the research questions to the final results, I provided a detailed explanation of the data collection process, participant information, and the analysis and coding process guided by the robust grounded research theory. Specifically, in the case studies, I established a clear research framework derived from Phase 1 of the study and compared the pre-observed patterns with the case study findings, thereby increasing internal validity.

Regarding reliability, Silverman (2021) proposes the principle of "low-inference descriptors," advocating for detailed data presentations without the researcher's own interpretations or summaries. Techniques such as recording the interview process, carefully transcribing recordings, and systematically coding data align with this principle. Gibbert and Ruigrok (2010) emphasize transparency and replication as critical strategies to enhance reliability, achievable through well-documented and methodically executed research procedures. In this study, I adhered to rigorous standards to ensure both reliability and validity. For instance, all

interview recordings were accurately transcribed, thoroughly read, and systematically coded to facilitate precise interpretation and analysis.

Particular, in case study, Gibbert and Ruigrok (2010) propose three strategies to ensure rigor in case studies regarding how to report findings. The first strategy emphasizes transparency by detailing specific research actions, including the methodology, decisions made, and various milestones encountered during the research process. Accordingly, I presented the case selection criteria, backgrounds of each case, interview procedures, and the emergence of categories and codes. The second strategy is to prioritize internal and construct validity. In this study, I employed data and perspective triangulation by involving both the design director and a member from each team and collecting relevant documents and archival records to improve internal validity. The third strategy involves acknowledging challenges, trade-offs, and compromises encountered during the research process and effectively utilizing resources to enhance rigor. I addressed issues related to challenge, validity, reliability, and limitations to offer a holistic understanding of the study. Overall, this study adhered to these strategies when conducting case studies. However, challenges remain in ensuring both reliability and validity.

3.4 Research Phase 1

3.4.1 Sampling Strategy

The purposeful sampling method was employed in this study to ensure the selection of suitable participants. Specifically, the study focused on UX designers operating within UX teams in high-tech industries. Sixteen UX designers who were part of in-house UX teams were chosen from high-tech sectors in China (Table 3.1). The majority of participants (13 out of 16) were located in Shenzhen, with one participant from Guangzhou and two from Hangzhou. These UX teams were primarily engaged in digital design tasks, including software, application,

and system design. Participant selection was deliberately conducted through researcher networking to ensure representation across relevant industries.

To guide data collection and analysis, an inductive grounded theory approach, as proposed by Strauss and Corbin (1998), was employed. The interview process centered on engaging participants who possessed rich knowledge and experience, aligning with the purposive sampling logic utilized in participant selection.

In Phase 1, participant selection adhered to the following criteria:

1. Participants must be actively working within UX teams.
2. Participants should possess a minimum of 3 years of experience in the field, ensuring the availability of rich and insightful information.
3. Participants must be directly involved in the entirety of the UX or design process, thereby offering comprehensive insights into their roles and experiences.

Table 3.1

Participant List

Interview stage	No.	Role	Work years	Team size	Team formation	Team compilation	Interview mode
Round 1	01	UX team leader	5+	8	5 UX designers + 3 graphic designers	The team is from a mobile phone company and responsible for designing the business system that facilitates the transformation from offline operations to online operations.	Face to face
	02	UX team leader	3+	7	3 UX designers + 1 user interface designer + 2 product managers + 1 business analyst	The team is from a financial technology company and responsible for designing the financial application for customers, which involves tasks such as interface design, function design, and interaction design.	Face to face
	03	UX team manager	5+	14	7 UX designers + 7 human factors designers	The team is from a mobile phone company and responsible for designing the UX of the phone system, including appearance and innovation of mobile phones.	Online
	04	UX leader	5+	20	5 UX designers + 5 graphic designers + 10 industrial designers	The team is from a medical equipment company and is responsible for designing the interaction, appearance, and systems of the products for customers such as nurses and patients.	Online

Interview stage	No.	Role	Work years	Team size	Team formation	Team compilation	Interview mode
	05	UX member	3+	7	3 UX designers + 4 user interface designers	The team is from a big data company and is responsible for designing the business system that improves efficiency by integrating information.	Online
	06	UX member	2+	5	3 UX designers + 1 UX researcher +1 team leader	The company offers a wide range of massage and wellness products. The team is responsible for designing the hardware products as well as the software that connects with the hardware products.	Face to face
	07	UX member	4+	20	12 UX designers + 8 graphic designers	The team works for a global tech company that focuses on creating, producing, and selling a diverse array of products such as consumer electronics, smart devices, and solar solutions for rooftops. The team is responsible for working with all departments that need UX design to update the product. The team also offers consultancy services to external clients to increase profits.	Face to face
	08	UX member	2+	20	10 UX designers + 10 user interface designers	The team is from a subscription video-on-demand over-the-top streaming service company and is responsible for designing the application.	Online
	09	UX leader	5+	10	5 UX designers + 3 user interface	The team is from a cloud computing and artificial intelligence technology company that provides cloud services and cloud enterprise applications. The team is	Online

Interview stage	No.	Role	Work years	Team size	Team formation	Team compilation	Interview mode
					designers + 2 creative designers	responsible for designing the business system accordingly.	
	10	UX member	3+	8	4 UX designers + 4 product managers	The company offers digital payment services to customers. The team is responsible for designing functions such as facial recognition and IRIS payments.	Online
Round 2	11	UX team leader	4+	6	2 UX designers + 1 product manager + 1 operations officer + 1 intern	This team is from an online game development and publishing company and is responsible for designing the functions and tools that are integrated into the game application.	Face to face in a cafe
	12	UX leader	3+	6	2 UX designers + 3 user interface designers + 1 product manager	This team is from a company that offers solutions for real estate. The team is responsible for designing smart hotel systems, including the system design, application design, and relevant hardware design.	Online
	13	UX member	3 years +	14	3 UX designers + 4 user interface designers + 6 multimedia designers	The team is from an audio sharing company and is responsible for designing the audio sharing application.	Face to face

Interview stage	No.	Role	Work years	Team size	Team formation	Team compilation	Interview mode
	14	UX manager	9+	≈90	22 UX designers + 77 graphic designers	The team is from a mobile phone company and is responsible for designing the phone systems, including the interface design, function design, and appearance design.	Face to face
	15	UX member	5+	21	14 UX designers + 4 user interface designers + 3 sound designers	The team is from a mobile company and designs the interface, mobile wallpaper, and mobile systems.	Face to face
	16	UX manager	6 years +	8	4 UX designers + 4 user interface designers	This team is from a company that provides product and technology solutions for global e-commerce companies, including website templates, marketing apps, payment, shipping, and ERP tools.	Face to face

3.4.2 Semi-Structured Interviews

In Phase 1, prior to commencing the formal data collection process, I initiated probing questions to identify suitable UX designers from online UX communities and personal networking. These questions were crafted in alignment with relevant literature on interviews and were conducted via online voice and text chats, with all information meticulously documented. Once suitable participants were identified and confirmed, a subset of these participants was selected according to the criteria to undergo pilot studies aimed at testing the interview questions. Based on the insights gained from these pilot studies, the interview questions were iteratively refined to address any identified misunderstandings or ambiguities.

For example, when inquiring about the knowledge required within UX teams, I revised the original abstract question—"Thinking about a project that has challenges and how your team solved the challenge"—to a more concrete one: "Thinking about the last project you completed, which aspect posed the greatest challenge for your team, and how did you overcome it?" This revision aimed to elicit more accurate and detailed responses from participants.

The semi-structured interview questions were formulated by analyzing relevant UX models and design knowledge frameworks. In the initial round of interviews, which involved ten participants, the aim was to gain a broad understanding of UX team knowledge. Subsequently, the findings synthesized from this round enabled following discussions with an additional six participants to scrutinize each component of the UX knowledge framework, fostering a comprehensive understanding.

Each interview session spanned 60–90 minutes, with a combination of online and offline interviews conducted according to the convenience of participants. Individual interviews were conducted, digitally recorded, and subsequently transcribed for analysis purposes. Additionally, pertinent documents such as team meeting notes, project files, and outcome

evaluation criteria were gathered to supplement data interpretation. Following data collection, three UX experts were invited to provide feedback on the findings. Their input, grounded in their extensive experience, served to validate and enhance the credibility of the findings. Their affirmation bolstered my confidence in presenting the study's outcomes.

The interview questions in Round One were as follows:

1. Does the UX team have any rules to manage the UX design process or outcomes?
2. Have there been any difficulties encountered by the team? Which knowledge, experience, and skills were crucial in successfully resolving these issues?
3. Which areas of knowledge are currently insufficient for the UX team to deliver the desired output? How does this lack of knowledge impact the output?
4. Which specific knowledge was crucial for the UX team to successfully achieve the project and aligned with the team's goals?
5. Could you categorize the different types of knowledge that the UX team possesses?
6. What new materials, knowledge, or experiences has the team gained upon completing the project? How did the team plan to capture, share, and reflect this tacit and explicit knowledge?
7. How does the accumulated knowledge within the UX team benefit collaboration and project outcomes?

Following the initial round of data analysis, four distinct types of knowledge emerged: professional knowledge, project knowledge, collaboration knowledge, and organizational knowledge. In the second round of interviews, I engaged participants in discussions aimed at obtaining detailed descriptions and deeper understandings of four knowledge circles. The major interview questions in Round Two are listed below, with a full set of detailed questions provided in Appendix 1.

1. What fundamental knowledge or skills are necessary for your team to excel in UXD? How did the team acquire this knowledge?
2. What information needs to be shared while working on a project? How is this information shared, and why?
3. How do you determine or assess the value of each project for the team or individuals? What knowledge is required for evaluation?
4. How does the team reach a consensus when working on a project?
5. Does your team have its own professional terms? Why?
6. How does the company's mission and vision facilitate the team's work?
7. Have you gained any knowledge or tools from the organization that significantly helped you in teamwork?
8. Could you identify the team type to which your team belongs and explain why?

3.4.3 Interview Procedure

The interviews were conducted between February and July 2023, spanning a duration of six months. Some interviews were conducted online via Tencent Meeting. Before each interview, participants were required to sign consent forms and information sheets. Given that the participants were located in Mainland China, Putonghua was used as the primary language during the interviews. Participants were informed at the outset that the entire interview would be recorded for subsequent analysis, with assurances that all information would be kept confidential and used solely for research purposes. Throughout the interviews, detailed memos and notes were taken to guide the interview process and aid in subsequent analysis.

3.4.4 Data Analysis of Interview

CGT advocates for the concurrent collection and analysis of data to facilitate the conceptualization of the research theme (Charmaz, 2008). Consequently, coding and memo-taking were integral components of the interview process. Building on Charmaz's theory (2008), the coding procedures encompassed both initial coding and focused coding stages.

Initial coding explores the theoretical possibilities and lays a foundation for discussion and conceptual categories in a provisional and comparative manner. Line-by-line coding could be adopted in this stage by naming each line to identify the core category of the data and preparing to collect the next data. The crucial analytical focus in this stage is to compare the data to find similarities and differences. Initial coding makes assumptions visible, enabling researchers to gain insight from participants' data.

The second phase involved focused coding, which is selective and conceptual, unlike the line-by-line approach (Glaser, 1978). The most significant codes were selected to categorize the data by considering adequacy (Charmaz, 2008). Apart from the initial coding and focused coding, axial coding was also introduced to relate categories to subcategories (Strauss, 1987; Strauss & Corbin, 1990). Axial coding resembles the data from initial coding, organized in a cohesive way (Strauss & Corbin, 1998), which establishes the relationship between data (Charmaz, 2008).

The last stage, after focused coding, is theoretical coding. Theoretical coding answers "how the substantive codes may relate to each other as hypotheses to be integrated into a theory" (Glaser, 1978, p. 72). Charmaz (2008) explained that theoretical coding explores possible relations between the data generated in the focused coding and building theory. Glaser (1978) proposed some theoretical coding series such as causes, context, conditions, consequences, dimensions, and types to indicate the category. Therefore, the goal of theoretical coding is to clarify the changes and consequences regarding the data (Charmaz, 2008).

In this study, a total of 18 hours of voice recordings were transcribed and translated into English. Additionally, the memos, notes, and drawings from the interviews were meticulously analyzed. In generating code, I carefully ensured that all the non-representative information derived from participants were carefully excluded. This comprehensive approach allowed for

a thorough examination of the data, enabling the identification of key themes and patterns pertinent to the research inquiry.

Initial Coding

Subsequent to the first phase of interviews, all the recordings were transcribed, following which two researchers analyzed the transcriptions separately to identify patterns or categories to demonstrate participants' knowledge. This was a provisional and comparative coding process in which each initial code was labelled. The initial coding captured 32 knowledge components that reflected the collective knowledge of UX designers. Table 3.2 presents examples of the initial coding, including excerpts from interviews and relevant codes.

Table 3.2

Examples of Initial Coding

Excerpt	"We need to find the novel features from similar products or different products, and internalize the concept to use in it when we need to generate divergent or creative thoughts"
Initial codes	Creative knowledge

Focused Coding

Following the second round of interviews, the most relevant and significant initial codes were selected. I read all the transcripts line by line to obtain a detailed explanation of the selected code. A total of 24 knowledge components were condensed and concluded after completion of the two-phase interview. Table 3.3 presents examples of the focused coding, including excerpts from the interviews and the relevant codes.

Table 3.3

Examples of Focused Coding

Participant	Excerpt	Focused Code
01	"Now our requirement for UX department is to either produce tools or theories/framework, tools for efficiency-oriented tasks, and theories for value/promotion/team growth requirements. This is the common understanding." "How to identify the value point when meeting the requirements from the product manager; this stage is the most difficult…"	Value identification
09	"I think the design team needs to go to defend and prove their own value; some projects require a lot of effort, but others may not see the value, or may even not understand."	
04	"We have the openness and transparency principles, which should solve 90% of the problems for the team."	Team transparency
03	"For an individual, what you may want to improve is their awareness of self-motivation or their ability, but for organizations or teams in the collective context, what you want to improve is actually regulations and norms."	Design norms and standards
14	"We have a user experience pyramid: basic experience, advanced experience, top experience. From the most basic to the top of the requirements, each layer will have its own standards. There are about a total of 10 keywords…."	
06	"If the product needs to apply some new technology, or refer to the same type of competitors, we need to have this basic desktop research ability based on the understanding of the industry."	Industry experience
07	"The whole team needs to understand why we're doing the project, and that understanding, and acceptance of the goal is probably more important than the innovation itself."	Alignment

Participant	Excerpt	Focused Code
11	“Goals are also a way to measure the success or failure of a product, which is an anchor point that serves as a simple reference. We want to achieve the goal, to solve the problem, but the degree of realization is out of our control. We are an agent team; when we reach this goal, we can feel a bit relieved, but when we are far from this goal, we need to be tense. This is a psychological cue, or to control the rhythm of tasks.”	
08	“When I first joined this team, I didn’t know the specific terms that other team members used in the meeting, so I learned it gradually, and I can communicate with them better.”	Design language
11	“UX is a general concept, and those professional terms are not difficult to understand, but some specific terms for the project need to be understood to improve efficiency and show professionalism.”	
02	”Understand the design resources, such as formal and also private resources existing in the networking, public resources is from the department and the member, these are the resources to leverage up. These resources need to exchange if you know how and what kind of information or help is needed from different teams. this is the interdepartmental resources”	Information flow
14	“Reading a lot of design website aboard, could be any kind of design website such as fashion, textile, automobile, and designers can generate insights from these resources. It is like if they see the new things from A, they can transform the insights to B, which is our products, that is an exponential improvement”	Representation operation
12	“Finding reference to solve the problems improves UX designers’ confidence by analyzing and evaluating information. Besides, good reference can show the stakeholders that the outputs is solid, not just imaginative”	

Participant	Excerpt	Focused Code
15	“UXD needs to know how to develop and build the product lifespan in the short, medium and long term, it needs to stand on the whole picture, consider the value points, insight into the users and scenarios, and then go to analyze this business module”	Product thinking
16	“Understanding of the needs of users, goals of users, preference of users are crucial to design the product, also to reach a common understand inside the team”	User perceptions
13	“We collect complaints and feedback from our users to find out what exactly is affecting their choice. How we can meet their needs, one is based on their explicit needs, and the other is to see if new insights are generated based on the feedback, then evaluate if it's suitable for them.”	

Theoretical Coding

The theoretical coding process involves using codes derived from prior theories or analytic frameworks to integrate the categories of analysis (Charmaz,2014). This approach is an exploratory to identify connections from existing codes or categories. During theoretical coding, two factors were highlighted: how the knowledge was distributed within the team and how knowledge was used to inform decisions. I borrowed from existing literature to frame these two highlights as power-centrality and reasoning style. In team research, centrality has been suggested as the most powerful dimension that generates patterns and strategies regarding the flow of knowledge (Lee et al., 2021). Centralized power refers to unequally distributed power among team managers and members, which can cause a tendency to depend on the central power person (Brass & Burkhardt, 1993). Decentralized power refers to the decision-making process as a consequence of the distribution of authority that fosters collaboration at individual and organizational levels, which leads to knowledge creation and variety (Pertusa-Ortega et al., 2010).

Regarding the application of UX knowledge, Hassenzahl (2008) introduced the "pragmatic" versus "hedonic" framework for understanding a product's character. This framework considers the attributes and relationships inherent in a particular product. Pragmatic qualities pertain to the functional aspects of a product or service, addressing practical needs and facilitating efficient task completion. These qualities are linked to usability, efficiency, and effectiveness. Conversely, hedonic attributes prioritize psychological well-being and pleasure. They encompass the experiential and emotional dimensions of a product, emphasizing the enjoyment, pleasure, and aesthetic appeal in UX. This study adapts Hasssenzahl's framework to illustrate how UX knowledge is applied. Table 3.4 presents examples of theoretical coding, including excerpts from interviews.

Table 3.4

Examples of Theoretical Coding

Participant	Excerpt	Theoretical code
15	"Leaders have three-minute enthusiasm without clear goals. They want to do a lot without analyzing and situation. Team leaders just want to help the CEO to fulfil his ideas, rather than making the decisions from the whole picture."	Power-centralized
01	"We organize fun activities that make everyone feel equal and appreciated in the team, it can be anything fun and interesting, I think the UX team needs to be active and creative working together."	Power-decentralized
13	"For us, we need to pay attention to the user data feedback since we have the key performance indicator, if a function could not have the positive data feedback, we will cease the function."	Pragmatic / instrumental
12	"Designers need to involve in the user research process to communicate with end-users, thus, they could find new insights relating to user's motivations or goals."	Hedonic/ non-instrumental

Table 3.5

Summary of Initial Codes and Final Codes

	Initial Code in the First-Round Interview	Finalized Code in the Second-Round Interview	Category Emerged
1	Knowledge of goals	Probing problems	Organization
2	Knowledge of users	Design norms and standards	Collaboration
3	Creative knowledge	Templates and modules	Project
4	Individual design skills	Leadership style	Professionalism
5	Collective design skills	Transfer of learning	Collective knowledge
6	Representation operation	Industry experience	Individual knowledge

	Initial Code in the First-Round Interview	Finalized Code in the Second-Round Interview	Category Emerged
7	Collaborative tools	Cross-department communication	Instrumental rationality
8	Work procedures	Alignment	Cognitive rationality
9	Task features	Design language	
10	Schedule knowledge	Role identification	
11	Design motivation	Information flow	
12	Design language knowledge	Team transparency	
13	Reflective skills/knowledge	Schedule	
14	Share understanding	Value identification	
15	Empathy knowledge	Task goals	
16	Decision makers intention	Multitasking	
17	Knowing the competitors	Team reflection	
18	Collaborative knowledge	User perceptions	
19	Boundary and role identification	Product thinking	
20	Information flow	Creative skills	
21	Industry experience	Representation operation	
22	Knowledge transformation	Scenario consideration	
23	Organizational design policy	Outcome criteria	
24	Decision making style	Collaborative toolkit	
25	Organizational design rules and standards		
26	Module and template		
27	Outputs measurement		
28	Evaluation and stimulation		
29	Understanding product planning		
30	Business strategy understanding		
31	information synchronization		
32	Scenario consideration		
33	Reference library		

3.5 Research Phase 2

In Phase 2, a case study approach was employed. Case study is a common approach when researching teams. Case studies are particularly well-suited for addressing "why" and "how" questions, especially in the context of contemporary events that researchers cannot control (Yin, 2011). The intention behind a single case study was to avoid making broad generalizations and offer insights that could be applied by other researchers and managers in similar contexts (Yin, 2009). Moreover, case studies enable the exploration of dynamic processes within specific settings (Eisenhardt, 1989), making them particularly suitable for addressing RQ4:

RQ4. How do different types of knowledge shape and characterize different UX teams?

3.5.1 Sampling Strategy

Four UX teams from high-tech companies were purposefully selected as case studies. Although generalization in a single case study presents challenges (Silverman & Marvasti, 2008), these limitations can be mitigated through purposive sampling, allowing researchers to select cases based on specific features and parameters of the target population while also considering time and resource constraints (Silverman, 2021). Moreover, Yin (2018) suggests that multiple case studies offer the opportunity for comparing cases, thereby enhancing the robustness of findings. In this study, the four cases were chosen based on the research objectives, focusing on UX teams within high-tech companies. Given the need for privileged access to information, the cases were purposefully selected by leveraging my industry networks. This approach ensured that the selected cases aligned closely with the research focus, enabling in-depth exploration and analysis.

To provide a comprehensive understanding of UX team knowledge, both managerial and team member roles were included in each team. Specifically, senior-level managers such as

team directors were chosen for their extensive knowledge of teamwork. The selection of teams from Shenzhen was deliberate, as Shenzhen is renowned as one of China's innovative centers. This choice aimed to ensure the representativeness of the selected cases and their relevance to the broader context of UX work in innovative environments.

The criteria for selecting UX teams as case studies included:

1. The teams must be from large high-tech firms to ensure a substantial organizational context.
2. Four teams from different companies operating in similar industries were chosen to enhance external validity and offer broader insights.
3. The selected cases needed to meet the definition of UX teams, ensuring relevance to the research focus and objectives.

The chosen cases are labelled Team 1, Team 2, Team 3, and Team 4, as shown in Table 3.6.

Table 3.6

List of Cases

Case	No.	Role	Responsibility	Team formation
UX Team 1	01	UX Designer	1. Identifying and solving usability and design challenges to create a user-friendly and effective product 2. Organizing and structuring information in a way that is intuitive for users, including designing sitemaps and navigation systems 3. Creating low-fidelity wireframes and prototypes to visualize and iterate the design concepts before moving on to high-fidelity designs 4. Continuously iterating on designs based on user feedback, testing results, and design critiques	UX designers, UI designers, animation designers, OS system designers, user researcher
	02	UX Director	1. Leading the UX team, shaping UX strategy, ensuring excellent design execution 2. Fostering collaboration across departments and advocating for the user throughout the product development process	

Case	No.	Role	Responsibility	Team formation
UX Team 2	03	UX Director	3. Lead and manage the UX teams, initiate product ideas, oversee design process from concept to final product, and oversee UX design 4. Implement UX strategies 5. Coordinate resources and integrate new methodologies and tools into the design process as appropriate	UX designers, UI designers, user researcher
	04	Senior UX Designer	1. Ensure that designs meet usability standards and accessibility requirements 2. Validate design decisions through A/B testing and analytics 3. Iterate designs based on user feedback and usability testing 4. Design wireframes, prototypes, and high-fidelity interfaces	
UX Team 3	05	UX Director	1. Provide mentorship and career development guidance to UX designers and manage the budget and timelines 2. Make decisions to ensure a cohesive and consistent experience across products 3. Define and track key UX metrics to evaluate the success of design solutions	UX designers, UI designers, animation designers, user research

Case	No.	Role	Responsibility	Team formation
	06	UX Middle-Level Manager	1. Determine the goals and key questions for research based on product objectives and user needs 2. Synthesize data from research activities to extract meaningful insights 3. Work closely with UX designers to translate research findings into actionable design and product decisions	
UX Team 4	07	Senior UX Designer	1. Develop and refine UX strategies according to user needs and business goals 2. Collaborate with product managers and engineers to communicate design ideas 3. Collaborate with developers to ensure accurate implementation of designs 4. Create and maintain design documentation	UX Designers
	08	Senior UX Designer		

3.5.2 Semi-Structured Interviews

The semi-structured interviews conducted in the case studies drew from two main sources:

1. Findings from Phase 1, which provided insights into UX team knowledge and dynamics.
2. The Evidence-based timeline retrospective (EBTR) method, initially proposed by Bjarnason and Regnell (2012) when reviewing their project experiences, thereby enhancing their work performance and process. It was later utilized by Zaina et al. (2021) to gather supplementary data on UX team collaboration and address specific concerns during the work process.

The EBTR method emphasizes observing project timelines, important events or actions, and decisions. It aims to provide objective information and encourages discussion and reflection among participants. This approach aided this study by capturing details of each team's transformation over time, aligning with the notion that a comprehensive understanding of teams necessitates consideration of contextual and temporal factors (Delice et al., 2019). Generally, teams are recognized to have a past, present, and future, and understanding their evolution is critical (McGrath et al., 2000).

To guide the interviews and subsequent data analysis, I categorized the UX team timeline into four stages: Beginning UX, Constructing UX, Realizing UX, and Promotion UX, based on the UX maturity framework proposed by Chapman and Plewes (2014). This categorization informed the development of key interview questions, which covered aspects such as the team's timeline, project characteristics, and knowledge creation and sharing. Detailed interview questions can be found in Appendix 2.

3.5.3 Interview Procedure

The case study interview protocol was organized as follows:

1. Generate questions regarding the team development timeline and how UX team knowledge has been utilized and shared
2. Gather basic information about the interviewees and their team responsibilities
3. Introduce the results from Phase 1 to the participants and explain the meaning of each team
4. Ask participants to choose the team types from a diagram
5. Confirm the target teams
6. Before the formal interview, briefly introduce the study, request participants to fill out consent forms, and ask interviewees to describe their roles within the UX teams
7. Arrange the formal interview

In total, participants from six different teams were approached, and four teams were identified as the performance team, operation team, strategy team and transformation team. Eight participants contributed through one-hour interviews. The full interview protocol is detailed in Appendix 2, while Appendix 6 contains photographs from select interviews conducted on-site at the participants' organizations.

3.5.4 Data Analysis for Case Study

According to Yin (2018), case studies commonly employ any of four data analysis strategies:

1. Data analysis based on theoretical propositions derived from the original research objectives and aligning with the study's research questions
2. Exploration of data to identify useful concepts or patterns, often observed in grounded theory approaches

3. Organization and analysis of data according to a descriptive framework established for the study
4. A combination of the aforementioned methods

As the case study served as a supplementary investigation following Phase 1, I leveraged the themes and framework derived from the initial study's results to guide the design of interview questions and inform the content analysis for Phase 2. Utilizing the second study as a means of validating the findings of the first study, the general analytic strategy employed a combination of theoretical propositions and a predefined descriptive framework. In the specific analytic process, five techniques were utilized to enhance the internal and external validity of the case study (Yin, 2018):

1. Pattern matching involved comparing the empirical findings with predicted patterns established before collecting case study data. The alignment between the empirical and predicted patterns bolstered internal validity.
2. Case explanation building
3. Time-series analysis
4. Logic models
5. Cross-case synthesis

This study used pattern matching and case explanation as the primary techniques during the analysis. The analytic procedure integrated deductive approaches (based on pre-established statements) with inductive methodologies (informed by data from the case studies), as outlined by Yin (2018). To construct explanations for each case, the analysis followed an iterative process, referencing the following iterative analytic approach in case study methodology (Yin, 2018):

1. Building the initial theoretical and predefined statement
2. Comparing the data with the statement
3. Revising the initial statement based on additional details from the case

Accordingly, the data were analyzed based on predetermined dimensions, such as the four circles of UX team knowledge (Table 3.7 and table 3.8). To thoroughly comprehend the distinctions among the four teams, I employed thematic analysis, a method that facilitates the generation of themes or patterns (Braun & Clarke, 2006). Thematic analysis is well-suited for summarizing and describing data, making it ideal for research endeavors aiming to provide a comprehensive and detailed account of a specific topic. Given the study's objective of describing and understanding the data collected from the four teams, thematic analysis was deemed appropriate.

Moreover, triangulation was employed to ensure the reliability and validity of the study's findings. This method involved utilizing internal project documents, meeting notes, and open resources from secondary research. Triangulation allowed for the validation of data collection and findings by confirming or contradicting evidence (Yin, 2009).

Table 3.7

Examples of Coding for Team Timeline

UX stage	Participant	Excerpt
Beginning UX	07	"At beginning, we didn't have UX, but we have graphic designer, or people who can draw simple wireframe, everything was technology centered."
	03	"UX team was under the industry design team to improve the usability of hardware products."

UX stage	Participant	Excerpt
Constructing UX	04	"We didn't have the UX team, but when the leaders construct the UX team, the biggest challenge is the lack of systematic process that could integrate UX teamwork into the existing work flow or information flow."
	05	"UX team need to develop the protocols such as delivery criteria, collaborative procedures and integrate user research, all these are the preparation to construct UX teams."
Realizing UX	06	"After the UX team was in position, we spend half year to plan all the project with high standard, we did co-design with all the product managers. Two years later, all projects are completed, but some of the good UX qualities were disregarded due to the time and resources pressure."
Promotion UX	05	"After all the projects are delivered, we don't have much work left to do but try to continually upgrade and adjust the work. Thus, now the propriety is to make more internal employees to realize the work that UX team did to ger recognition."
	08	"We have a number of UX team, sometimes if many teams want to in charge of one project, design proposals are required to compete with other UX teams, then product manager evaluates which proposal is the more innovative one. This is a way to make UX team be more familiar with products."

Table 3.8

Examples of Coding for UX Team Knowledge

UX stage	Participant	Excerpt
Organizational knowledge	03	"We don't particular consider about organizational knowledge, but the project manager would consider more in an organizational perspective. Instead, we need more awareness of being the project owners."

UX stage	Participant	Excerpt
	05	“Maybe only I have the knowledge in organizational knowledge circle, maybe I could sense 50% of the knowledge. I don’t think any of my subordinate have the capacity or knowledge in this circle.”
Collaboration knowledge	07	“UX designers should invest 40% of the time to export or deliver outcome, 30% of the time to collaborative and communicate with product manager, decision-maker, to make sure the design could be delivered.”
	08	“Cross department could be difficult, cause all the department are equal to contribute, to make decisions. Design plan could go further only when all the departments agreed which make the UX work is a collective outcome.”
Project knowledge	06	“Leader decides the project should focus on generating effective outcomes or invest deliberative thinking to generate satisfying outcomes.”
	04	“Before, all people in the company could express their view about UX, but now, we have standards and procedures to guide problems, solutions, priorities regarding to UX with instructions to inform who should give feedback in what time.”
Professional knowledge	08	“User research and prototype testing is compulsory before lunch new functions or UX outcomes.”

3.6 Challenges in Ensuring Reliability and Validity in This Study

There are several limitations that affect the reliability and validity of this study. In general, qualitative studies and case studies are challenging to plan systematically and execute rigorously (Denzin & Lincoln, 2011; Yin, 2009). Specifically, using the GT approach presents several problems. O'Reilly et al. (2012) proposed the following four limitations of using GT:

1. Theoretical Sampling: This method involves collecting data based on previously generated data and the researcher's data analysis. As Glaser et al. (1967) stated, "This process of data collection is controlled by the emerging theory" (p. 45). The issue arises when researchers reach saturation within a concentrated sample and cease to explore or challenge the limitations or boundaries of the coding categories.
2. Lack of Constant Comparative Method: A common pitfall occurs when the constant comparative method is not used, leading to data analysis being disconnected from coding and collection. This results in new data points being collected without incorporating insights from earlier data, which hinders the researchers' ability to track the evolving story within the data.
3. Fragmented GT Application: Researchers sometimes fail to integrate GT as a holistic approach; they use GT data analysis and coding without considering the interplay of data collection, analysis, coding, and iterative discovery.
4. Unsuitable Application of GT: GT is unsuitable for studies with well-covered literature, those testing established hypotheses, or those replicating other studies. GT is most appropriate when the relationships between concepts are weak or there is insufficient theoretical guidance in a specific field, making it well-suited for this study.

These limitations underscore the importance of carefully planning and executing GT studies to ensure robust and meaningful findings.

Apart from the inherent limitations of GT and qualitative studies, this research faced several practical constraints. Firstly, the 3-year timeframe for completing my PhD necessitated compromises in the research methodology. For example, conducting workshops to discuss the UX team knowledge framework in a group setting could have enhanced the study's validity. Additionally, integrating quantitative approaches, such as questionnaires, could have helped validate the components of UX team knowledge and examined the relationship

between the UX knowledge framework and team performance. Secondly, while including more participants or teams could have increased data saturation, resource limitations constrained this aspect of the study. Fortunately, my experience in the high-tech industry and strong network with UX designers and managers facilitated participant recruitment and data collection. Thirdly, elucidating the essence of knowledge, particularly tacit knowledge, posed challenges. This study's interviews included questions regarding participants' former projects, thus requiring retrospective information, which might have led to inaccuracies or incomplete data.

Another challenge in this study relates to its focus on team-based knowledge. While the study aims to capture how individual UX designers' insights and knowledge are utilized in team collaboration, it acknowledges that these unique contributions may not always be fully reflected in the UX knowledge framework. The study recognizes the valuable contributions of individual UX designers and strives to respect and integrate their insights within the team context, fostering more effective collaboration. Ultimately, the individual designer serves as the foundation of the team's collective success.

Overall, these constraints introduced trade-offs affecting the study's validity and reliability. However, the inclusion of four case studies added significant value, validating the results and providing deeper explanations.

3.7 Ethical Considerations

Ethical considerations were rigorously ensured throughout the study to ensure the protection and respect of all participants involved. Prior to data collection, information sheets were distributed to each participant, clearly outlining the research questions, objectives, data processing and storage procedures, confidentiality measures, and the contact details of the researcher for any inquiries. These information sheets provided participants with a

comprehensive understanding of the study, allowing them to make decisions about their participation. Informed consent was obtained from all participants, who signed a form indicating their voluntary agreement to participate in the study. The form emphasized that participation was voluntary and that participants could withdraw at any time without facing any negative consequences.

To protect participant confidentiality, all data were anonymized before analysis. Pseudonyms were assigned to participants and any identifying information was removed from transcripts and other data records. Data were securely stored in encrypted files, accessible only to the researcher and authorized personnel involved in the study. The confidentiality of the participants was further safeguarded by ensuring that the research findings were reported in a manner that did not allow for the identification of individual participants. Participant safety was a paramount concern throughout the study. The study design included measures to minimize any potential risks to participants, both physical and psychological. Participants were informed that they could decline to answer any questions that made them uncomfortable, and they were assured that their well-being was prioritized at all times during the research process.

This study received full approval from the Ethics Committee of The Hong Kong Polytechnic University. The ethics review process involved a thorough evaluation of the study's methodology, data management plan, and procedures for obtaining informed consent, ensuring that the research complied with all ethical standards. The approval of the ethics committee confirms that the study adheres to the ethical standards.

In summary, the ethical considerations in this study were carefully addressed to ensure the confidentiality, informed consent, and safety of all participants, with the study receiving formal approval from the relevant ethics committee. Further details of form and information sheet are demonstrated in Appendix 3.

3.8 Section Summary

This chapter presented the detailed research design, including the interviews in Phase 1 and the case studies in Phase 2, following the GT approach. In Phase 1, the UX team knowledge types, elements, and team types were identified through the coding process. In Phase 2, a useful pattern was identified to explain the case by integrating pre-established statements and data from the case study. The key points are listed in Table 3.9 to inform the results, discussion, and conclusion in the subsequent chapters.

Table 3.9

Research Methods Summary

Research Phase	Research Questions	Key Points
Phase 1: Interview	RQ1. What types of knowledge do UX designers apply in the UX team setting?	After the coding process, four types of knowledge were identified by categorizing and interpreting 24 elements in UX team knowledge: professional, project, collaboration, and organizational.
	RQ2. How do UX designers articulate UX team knowledge?	Twenty-four elements were pinpointed as the UX team knowledge composition that reflects the tacit and explicit nature of design knowledge.
	RQ3. How is knowledge distributed within UX teams?	The knowledge distribution is primarily determined by two pairs of dimensions identified during the theoretical coding process. Power-centralized and power-decentralized were used to address leadership style, while pragmatic and hedonic features were stated as reasoning styles to indicate how UX knowledge is applied. These two pairs of dimensions revealed four types of teams: performance team, operation team, strategy team, and transformation team. Each team exhibits different knowledge distribution and utilization.

Research Phase	Research Questions	Key Points
Phase 2: Case Studies	RQ4. How do different types of knowledge shape and characterize different UX teams?	Case study analysis was conducted mainly based on three dimensions: UX phases and team timeline; the utilization and transformation of project, collaboration, project, and professional knowledge; and knowledge sharing and reflection.

Chapter 4: Results

This chapter presents the findings derived from the interviews and case studies. In Phase 1, the knowledge within UX teams is conceptualized as comprising four distinct circles: professional, project, collaboration, and organizational knowledge. Each circle encompasses various knowledge components, which will be described in detail. The distribution of knowledge is analyzed across four specific team types—performance, operation, strategy, and transformative—based on two pairs of dimensions. In Phase 2, the case studies are summarized by discussing each case through the lenses of team timeline, knowledge transformation, and knowledge sharing.

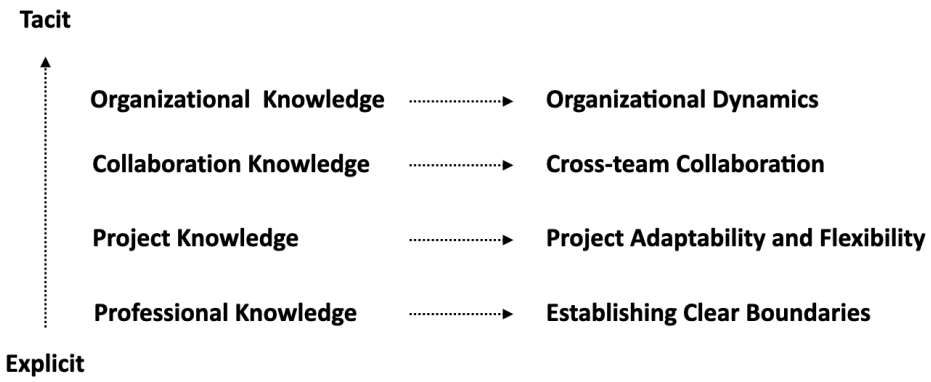
4.1 Research Phase 1: Interview Findings

4.1.1 UX Team Knowledge

The empirical data identifies four distinct types of knowledge (Figure 4.1) that address RQ1: What types of knowledge do UX designers apply in the UX team setting? These categories—professional, project, collaboration, and organizational knowledge—reflect the multifaceted expertise within UX teams. Each type plays a unique role in supporting UX teams, ranging from foundational design skills to adaptive knowledge for cross-functional collaboration.

Figure 4.1

Four Types of Knowledge



1. Professional Knowledge

Professional knowledge is the foundational expertise and specialized skills unique to UX teams. It encompasses essential competencies in UX tools, design principles, and methodologies. This knowledge defines the UX team's role within an organization, distinguishing its contributions and reinforcing its value in driving user-centered design. Key aspects of professional knowledge include clearly defined roles within the UX team, leveraging the collective expertise of team members, and ensuring tasks are completed effectively and efficiently.

As N5 stated:

> I believe our team differs significantly from other departments, such as engineering. Our way of thinking is unique. For the UX team, the basic professional knowledge is focusing on user-centered design and considering problems from the user's perspective.

N6 noted:

> Our team needs to demonstrate professionalism, which includes managing overall project phases, guiding the project at critical points, conducting user research, analyzing and synthesizing information, and having a sensitivity to data. These are essential.

N7 emphasized:

> The greatest advantage or capability of the UX team is having a solid professional foundation and understanding of relevant design methodologies.

2. Project Knowledge

Project knowledge represents the UX team's adaptable understanding of project-specific requirements, enabling members to tailor their approach based on each project's unique

demands. Although often temporary and specific to each project, project knowledge builds on patterns and insights that contribute to continuous improvement in project management and collaboration within the UX team.

As N2 shared:

> Project-related knowledge is essential, especially for evaluating requirements and understanding the business context.

N8 mentioned:

> When I first joined the team, I didn't have a deep understanding of the projects. I relied on my adaptability to quickly learn and grasp more in-depth information, which required a significant time investment.

N7 added:

> Team members collaborate more seamlessly on projects now, as if we've developed a kind of team intuition. We can recognize which requirements are the most important without much discussion. This intuition can be seen as a shared language within the UX team, understood only among us as part of our professional skill set.

3. Collaboration Knowledge

Collaboration knowledge is the UX team's capability to establish and sustain effective communication both within the team and with cross-functional collaborators. This knowledge facilitates seamless collaboration across departments, supports problem-solving, and promotes consistent, goal-aligned design efforts throughout the organization.

As N4 stated:

> Collaboration experience is important. We need to promote design concepts from multiple perspectives and help different departments understand the value of design.

N3 observed:

> Sometimes, I discuss with friends how the boundaries between UX designers, visual designers, and even service designers are very blurred. It's challenging to fully separate these roles from product managers or user researchers, and sometimes even the marketing team. UX and product teams might have conflicts due to overlapping responsibilities from excessive specialization. Cross-team collaboration requires understanding these differences while ensuring everyone is aligned on common goals.

4. Organizational Knowledge

Organizational knowledge, which is largely tacit, refers to the UX team's understanding of the company's structure, culture, and dynamics, including management styles, decision-making processes, and resource allocation. This knowledge enables the UX team to align their work with organizational goals, adapt to leadership preferences, and facilitate effective knowledge-sharing practices across the company.

As N3 mentioned:

> It's essential to understand the organizational context, especially leadership styles. No matter how valuable a UX idea is, it can be dismissed at higher levels if a business leader, for instance, doesn't appreciate the design value. Understanding the company's policies and culture helps the team grasp the reasoning behind decisions.

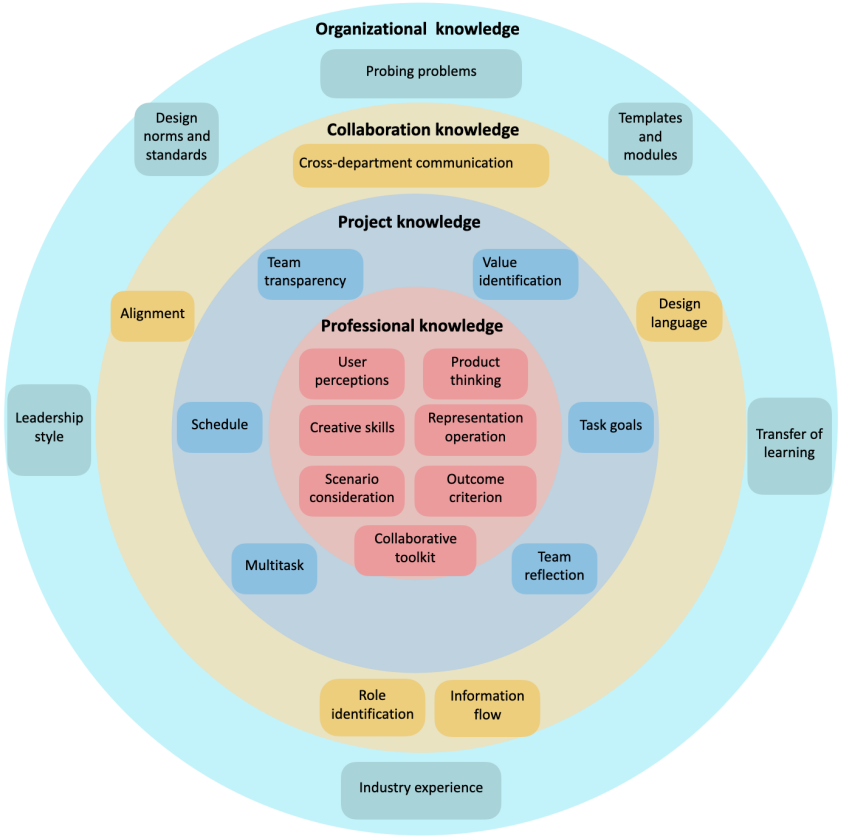
The degree of tacit understanding increases from professional to organizational knowledge. Professional knowledge is more explicit and transferable, as it focuses on specific techniques or skills that can often be documented and taught. In contrast, organizational knowledge is more tacit in nature and requires contextual awareness and experiential learning. Unlike professional knowledge, organizational knowledge is embedded in shared experience, relationships, and interactions across the organization.

4.1.2 UX Team Knowledge Framework

I synthesized a framework for UX team knowledge based on the four types of knowledge and relevant empirical data (Figure 4.2). This framework is illustrated as overlapping circles, ranging from professional knowledge (smaller circles) to organizational knowledge (larger circles). The larger circles represent the collective knowledge of the entire UX team. The boundaries between these circles may blur, as team members often utilize multiple types of knowledge simultaneously. Altogether, the framework includes 24 components across the four circles of knowledge.

Figure 4.2

UX Team Knowledge



Professional Knowledge Circle

Professional knowledge within the UX teams encompasses a wide range of specialized skills and expertise, such as user perceptions, product thinking, creative skills, representations

operation, scenario consideration, outcome criterion and collaborative toolkit. The elements in the professional knowledge circle were the compulsory and most fundamental components shown by the UX teams and distinguish them from other professionals. They established the unique value proposition of the UX team and clarified their role in driving user-centered design initiatives. By leveraging their professional knowledge, the UX team established themselves as trusted advisors and experts, earning the respect and collaboration of other teams and stakeholders.

The professional knowledge of the UX team ensured that tasks and objectives could be achieved effectively and efficiently. It provided the necessary skills, methodologies, and best practices to successfully execute UX design projects from commencement to delivery. Whether conducting user research, creating wireframes and prototypes, or performing usability testing, the collective professional knowledge of the UX team ensured that tasks were completed to a high standard and met user needs and business goals. The professional knowledge could also represent explicit or embodied knowledge that should be articulated and transformed clearly to team members.

Project Knowledge Circle

Project knowledge within the UX team involves the team transparency, value identification, schedule, task goals, multitask, and team reflection. This collective understanding enabled the UX team to effectively plan, execute, and manage projects from initiation to completion, ensuring alignment with project goals and objectives.

For example, one initiated project aimed to update account register procedures by collaborating with the product manager, whereas another project emphasized redesigning the recommendation system by working with the IT department. Although each project differed, team members demonstrated flexibility in their ability to navigate different project contexts and collaborate with diverse stakeholders by equipping themselves with relevant

project knowledge. Moreover, project knowledge includes internalized patterns and insights gained from previous project experiences. Through team reflection and learning, temporary project knowledge could be internalized as patterns that enable team members to respond quickly to similar future projects. This pattern recognition and learning contributed to the continuous improvement of project management practices, methodologies, and approaches within the UX team.

Collaboration Knowledge Circle

Collaboration knowledge includes the establishment and adoption of a common design language within the UX team. It involves defining and standardizing design terminology, principles, and patterns that facilitate effective communication and understanding among team members. A common design language promotes consistency in design approaches, enhances collaboration, and reduces misunderstandings or misinterpretations during design discussions and reviews.

Moreover, collaboration knowledge encompasses the ability to communicate effectively across different departments and functional areas within the organization, such as bridging communication gaps, translating technical terms into user-friendly language, and aligning design objectives with business goals. UX teams developed cross-departmental communication skills to collaborate with stakeholders such as product managers, engineers, marketers, and executives, ensuring that design decisions are informed by diverse perspectives and requirements.

Collaboration knowledge also involves role identification and clarity within the UX team and across project teams. It includes understanding the roles and responsibilities of team members, stakeholders, and project leaders and ensuring that everyone understands their contributions to the project's success. Clear role identification promotes accountability, fosters teamwork, and enhances project efficiency by minimizing duplication of efforts and

facilitating effective task allocation and coordination. Notably, managers within the UX team play a critical role in fostering collaboration knowledge among team members. They are equipped with knowledge from the collaboration circle to make members feel empowered to share ideas, collaborate on projects, and collectively drive UX design initiatives forward.

Organizational Knowledge Circle

Organizational knowledge includes probing problems, templates and modules, design norms and standards, leadership style, transfer of learning, and industry experience. In contrast to professional knowledge, organizational knowledge required more experience for team members to master. For example, a CEO might prefer data-driven presentations with measurable impact, while a product director might be more interested in the creative aspects of a design. Understanding these preferences allows the UX team to tailor their approach, increasing the likelihood of stakeholders' endorsement. Moreover, when a project is challenging, a UX team with organizational knowledge may understand who to approach for an efficient resolution. For example, they might know to involve customer service in discussions if the issue affects user satisfaction or consult with IT if the challenge is technical.

4.1.3 UX Team Knowledge Description

The detailed descriptions of each component of team knowledge are listed in Table 4.1 to answer RQ2: How do UX designers articulate UX team knowledge?

This table outlines the specific components that UX designers recognize and communicate as essential to their team knowledge, providing insights into how they convey their expertise, share information, and collaborate effectively within the team.

Table 4.1

Description of Team Knowledge

Circles	Components	Description
Organizational knowledge	Probing problems	The tacit knowledge regarding identifying and proposing problems related to the project/product where the UX could be improved.
	Design norms and standards	1. Familiarize oneself with design norms and standards accumulated within the company to ensure that design outcomes meet the required criteria. 2. Encourage and enhance performance by utilizing norms to measure and evaluate work, fostering reflection on daily tasks.
	Templates and modules	Master the templates, modules, and methodologies used within the company to enhance efficiency.
	Leadership style	Identify the leadership style as either a top-down or bottom-up approach.
	Transfer of learning	1. Summarize and systematize knowledge into theories, frameworks, and methodologies for conceptualization and generalization, enabling repeated use.

		2. Conduct workshops and seminars to transfer learning to other team members and collect feedback for team and individual growth.
	Industry experience	Accumulate industry experience from previous projects, whether successful or failed, for a unique advantage to leverage in the future.
Collaboration knowledge	Cross-department communication	1. Show professionalism to gain recognition and respect from other departments by understanding the goals, concerns, and motivations of both upstream and downstream colleagues. 2. Empathize with colleagues, adopt different perspectives when encountering disagreements, and work towards reaching an agreement.
	Alignment	1. Align personal goals with team, company, and business goals. 2. Identify self-growth opportunities along with achieving team goals.
	Design language	1. Using common language and terms within and across teams enhances communication efficiency. 2. Build a common ground understanding for collaboration.

	Role identification	Be aware of the clear boundaries and assigned responsibilities to differentiate one team from another, thus ensuring clarity and accountability.
	Information flow	Understand the flow of information between teams.
Project knowledge (Temporary)	Team transparency	1. Clarify roles and tasks within and between teams.
	Schedule	2. After being assigned a specific role or responsibility, deliver the project according to the schedule. 3. Assess one's own time requirements for project completion.
	Value identification	1. Identify whether the project requires basic performance or has the potential to bring high levels of recognition to the team. 2. Identify the value of the project at both the collective and individual levels by categorizing it as technology oriented, product oriented, or design oriented.
	Task goals	1. Make correct decisions when the choices are similar, in alignment with the goals. 2. Foster shared understanding within and between teams to build cohesion. 3. Evaluate individual outcomes based on the goals.
	Multitasking	1. Prioritize tasks based on project importance or urgency.

		2. Differentiate between long-term and short-term work within the project. 3. Process and evaluate information from various projects to streamline daily work.
	Team reflection	Summarize the team's experience and knowledge upon project completion to establish shared understanding and mental models that enhance project effectiveness.
Professional knowledge (compulsory and basic)	User perceptions	1. Understand user needs and expectations by analyzing data and user feedback and conducting interviews or observations. 2. Reach a balance between business needs and user needs. 3. Internalize user perceptions to inform daily work.
	Product thinking	1. Determine the profit model and business goals of the product, categorizing it as product oriented, data oriented, or user oriented. 2. Understand the purpose of each task rather than solely focusing on its completion.
	Creative skills	1. Identify key factors that contribute to creative ideas. 2. Stay informed about competitors' and other industries' innovations and apply relevant insights to teamwork. 3. Generate ideas or solutions by envisioning extreme user scenarios to achieve UX outputs.

	Representation operation	1. Generate visual representations from reference materials and use them as inspiration for generating diverse design concepts. 2. Utilize different visual representations to communicate ideas effectively. 3. Enhance UX by creating personas, journey maps, service blueprints, and affinity diagrams.
	Scenario consideration	1. Empathize with the user's scenario to gain a holistic understanding of their needs, expectations, and decision-making process. 2. Generate design concepts based on the identified user scenario.
	Outcome criteria	1. Familiarize with different outcome criteria for various tasks to determine the degree of success or effectiveness of the endeavor. 2. The outcome should be well designed, adhering to standard colors, patterns, and guidelines assigned by the criterion.
	Collaborative toolkit	1. Establish a common and explicit understanding of utilizing collaborative tools to access task history and share project progress and outcomes. 2. Create team’s own collaborative tools according to characterized work features.

4.1.4 Knowledge Distribution in Four Team Types

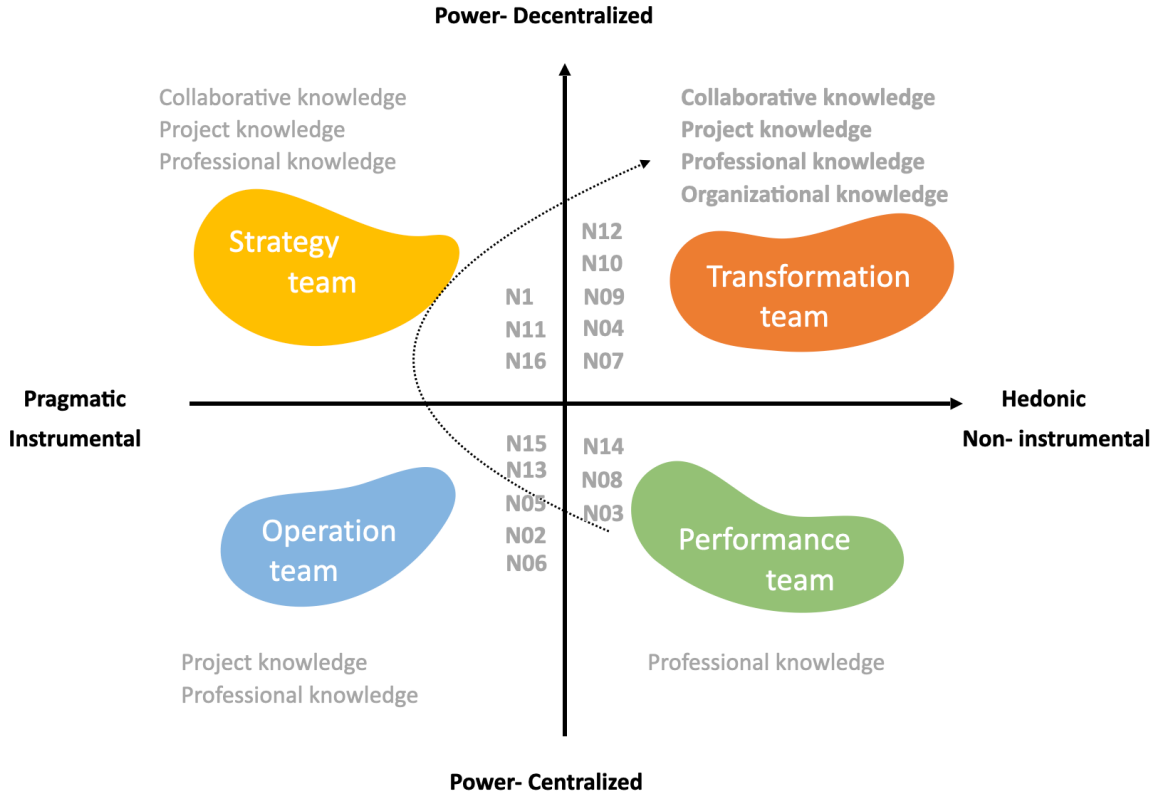
To answer RQ3 —How is knowledge distributed within UX teams? — this study developed a typology based on theoretical coding and analysis of interview data. Two key dimensions emerged from the coding process:

1. Power Centralization: Whether leadership and decision-making are concentrated in a few individuals (centralized) or distributed across the team (decentralized);
2. Reasoning Style: Whether team decisions are guided by pragmatic/instrumental reasoning (focused on efficiency and outcomes) or hedonic/non-instrumental reasoning (focused on psychological well-being and user satisfaction).

These two dimensions formed the basis for classifying UX teams into four distinct types, each representing a unique logic of knowledge distribution. This classification is illustrated in Figure 4.3.

Figure 4.3

UX Teams' Knowledge Distribution



Note. Performance team: PT; Operation team: OT; Strategy team: ST; Transformation team: TT

Performance Team

Participants N14, N08, and N03 belonged to PT, which relies on team leaders to make decisions. Leaders are usually equipped with rich industry experience and devoted to maximizing the value of the UX team, especially in the preliminary stages of a new project or portfolio. The advantage of PT is that decisions can be made quickly when there are controversial opinions. As N14 mentioned:

> I have more than 9 years of industry experience; whenever there is a controversial design direction, I can make the right decision. Even I'm trying to engage team members in the decision-making process. However, I'm the one to decide eventually.

There was powerful resistance from other departments, as improving user experiences was a long-term effort with an implicit value that is difficult to measure and transfer into accountable revenue. In the worst scenario, UX design added an extra burden to other departments, such as the marketing or customer service department, affecting or even jeopardizing their goals. As N03 stated, "The value of good UX takes a long time to prove, which causes resistance from other departments, cause the good UX may cause extra workload and troublesome for them."

The team's knowledge composition was mainly constituted at the professional level to ensure that the outputs were guaranteed while fulfilling the value statement from leaders. As N08 stated, "The standards of UX outcome evaluation depend on the director's preference. We don't have any formal standards to evaluate the outcomes. "

Nevertheless, team members were positive about proposing design concepts and redefining ill-defined problems. Ultimately, team leaders made the decisions. It was evident that upper management highly supported the team to make changes and fulfill the design value. However, it was challenging to implement this in practice, as resources were limited, and the awareness of the importance of user experience mostly existed within the UX team.

Operation Team

Participants N15, N13, N05, N02, and N06 fell under OT. Professional and project-level knowledge is the critical dimension for OT, as the team works closely with various projects. OT prioritized projects or tasks once the leader arranged or other departments made the requests, as seen in the quote from N05:

> We need a deep understanding of the stakeholders, especially the customers who are paying for this product. There is also the need to understand the needs of the top management team and try to fulfill their requests as much as possible because they know the market better.

N06 also stated, “CEO puts a lot of his understanding of the market and product to influence us through the authority of his power.” As a result, teams preferred to generate a satisfying solution for the leaders rather than an optimized one, as the merit was irrelevant to the outcome quality. As stated by N15:

> I don’t feel fair that how leaders evaluate our work by categorizing the performance into ABCD through considering our overwork duration instead of the work performance, it all just depends on the leader’s subjective impression and evaluation; they don’t even consider how other departments evaluate our performance. In addition, it is difficult to promote an idea as there are many hierarchies.

Due to this mindset, the team was treated as an outsourced one with minimum performance, lacking team cohesion and long-term goals. The working styles led to low recognition from other teams, who viewed the UX team mainly as a “toolkit” that facilitated design requests, where following new technological developments was crucial for UX teams to accomplish basic execution work. Regarding knowledge usage and design strategies, the team leaders’ preference was given importance instead of user needs or product features. However, the team leaders’ experience was inconsistent, sometimes leading to effective decisions and at other times deterring innovative ideas. Under the circumstances, OT fostered compliance rather than genuine commitment, where suggestions and comments from members were more likely to be denied.

Strategy Team

Three UX teams associated with ST, which pursued efficiency to broaden its business scope rather than prioritizing innovation or UX. The focus was on narrowing the disparity with competitors by completing each task effectively and quickly. As N16 mentioned:

> We are pursuing the efficiency of the project to hurry up the complementation and promotion. In fact, we don't have UX designers to do creative or valuable work during the process. The most urgent need for the UX team is to shorten the gap with competitors.

Team leaders frequently emphasized the shared vision and goal to improve team cohesion. They appreciated members' knowledge regarding collaboration to build strong connections with other upstream and downstream teams, thus avoiding conflicts. In addition, team leaders respected and appreciated members' opinions and trusted them to make contributions with a diligent and positive attitude. As explained by N11, "My team members are relatively equally contributing to the project, I give my team members more flexibility regarding their goal and schedule, even though the goal set by my leader is not adjustable."

Decentralized leadership ensured that members could manage their schedules or make decisions together if the actions fit the goals. However, UX was constrained by the business goals and the company's vision. The UX team did not need to work proactively to generate creative and enjoyable interactions or experiences for users but were driven by the competitive market. Overall, ST adopted an agile development process where collecting feedback and validation of the final output was rarely considered but the iteration speed was emphasized. Consequently, members questioned the meaning of their work and felt the lack of achievement feelings.

Transformative Team

Participants N12, N10, N09, N04, N07 connected with TT. The ideal UX team was motivated by pursuing the value of UX in scaling up the business by providing users with a satisfactory experience when using the product. All team members were equally involved in the decision-making process, proposing problems and making decisions collectively to introduce new products or improve UX performance and effectiveness. The team worked collaboratively on design brief reporting, arranging responsibilities, schedule planning, and taking turns being the project owner. N07's stated, "We will have a project owner when we get a new project. Each designer needs to take the rule alternatively."

The value of each project could be perceived clearly from both collective and individual perspectives. AS N04 emphasized, "As a team leader, I need to find the common interest between the company's goals and individual goals, build a win-win situation, which encourages members to maximize their performance."

If a task only had collective value, it could affect individual commitment. Fairness was a top consideration when assigning tasks to avoid competing resources and to keep members united. Moreover, a growth mindset was cultivated to promote active knowledge sharing and transfer among team members. Members were encouraged to write reflective reports summarizing their strengths and weaknesses after a project was completed, which built strong integrated capacities and enabled them to work independently on any project. Moreover, the team collected feedback on the output of each project and received specific comments to determine how to optimize the design in the future, which was positive reinforcement that stimulated members' motivation and encouraged them to optimize their work.

4.1.5 Summary of Phase 1

In the Phase 1, the UX team knowledge framework was generated, and each element and type of UX teams were described by interviewing 16 UX designers.

For the UX team knowledge framework, I summarized four circles of knowledge. Professional knowledge serves as the foundation for successful collaboration and guided the entire design process, from user research and ideation to prototyping and implementation. It ensures that design decisions are informed by best practices, industry standards, and user-centered principles. Project knowledge enables UX teams to adapt to specific project requirements, timelines, and goals. It facilitates efficient project management, collaboration with cross-functional teams, and alignment with project objectives. It also enables the UX team to effectively plan, execute, and manage projects, ensuring alignment with project goals and objectives while fostering continuous improvement and innovation in project management practices. Collaboration knowledge fosters effective teamwork, communication, and coordination within and between UX teams and other departments. It facilitates cross-functional collaboration, sharing of ideas, and alignment of design efforts with business goals. Organizational knowledge provides insights into the broader organizational context, including management practices regarding common problems and leadership styles. It guides decision-making, prioritizes projects, and aligns design efforts with organizational goals.

Additionally, two pairs of dimensions emerged during theoretical coding and situational analysis: power-centralized vs. power-decentralized and pragmatic/instrumental vs. hedonic/non-instrumental reasoning. These dimensions helped categorize four distinct types of UX teams:

1. Performance Team (PT)
2. Operation Team (OT)
3. Strategy Team (ST)

4. Transformative Team (TT)

PT and OT exhibit power-centralized leadership, focusing on efficiency and meeting project requirements. In contrast, ST and TT adopt power-decentralized leadership styles, emphasizing collaboration, innovation, and user satisfaction. PT and OT rely heavily on leader preferences for the design process, while ST and TT promote collective decision-making.

4.2 Research Phase 2: Case Study Findings

The data collected from the case studies answered RQ4. How do different types of knowledge shape and characterize different UX teams? All case analyses constituted the team background, team projects, team timeline, team knowledge, and team knowledge sharing and reflection. The descriptive data of four UX teams were based on the data from interviews, documents, meeting notes, and open resources. Detailed case information is listed in Table 4.2.

Table 4.2

Case Description

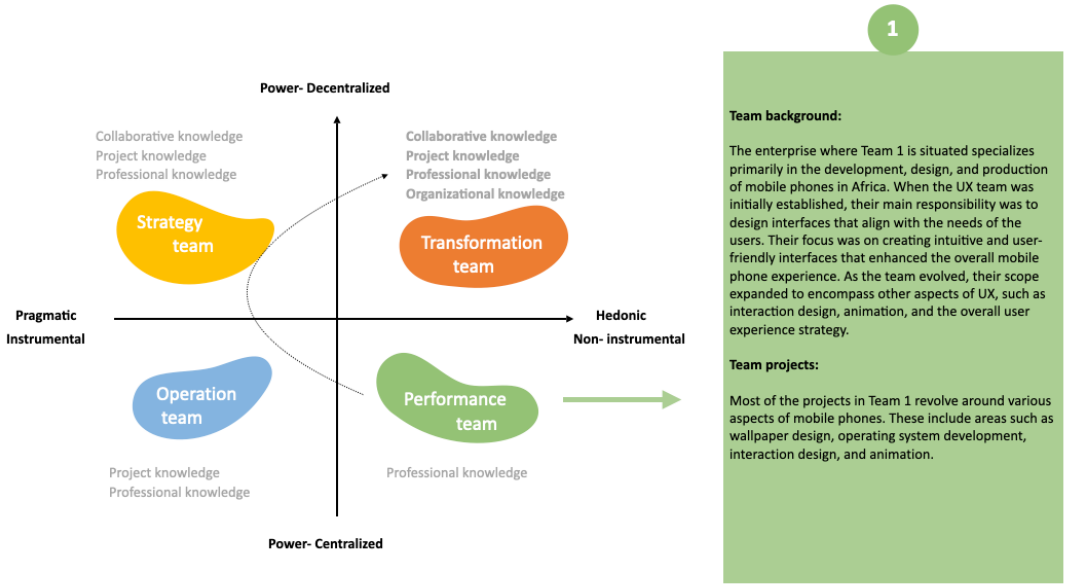
Case Number	Type	Team Industry	Team Introduction	Team Size	Location
Case 1	Performance team	Mobile phones	Team 1 operates within a telecommunications firm and assumes the responsibility for conceptualizing phone systems, encompassing interface, functionality, and aesthetic design aspects.	90+	Shenzhen
Case 2	Operation team	Smart wireless health products	Ensuring that the end-user's interaction with the company's products or services is as effective, pleasant, and intuitive as possible	7+	Shenzhen
Case 3	Strategy team	Electronic products (mobile phones, headphones, smart watches)	Designing the business system for internal employees	30+	Shenzhen
Case 4	Transformation team	Telecommunications equipment, consumer electronics, smart devices, and rooftop solar products	The team works internally with other departments to update the product UX while also offering consultancy services to external clients.	20+	Shenzhen

4.2.1 Case 1 Results

The background and project of Case 1 are demonstrated in Figure 4.4.

Figure 4.4

Case 1 Demonstration



4.2.1.1 Team 1 Timeline

Beginning UX

UX Team 1 was initially formed by merging three separate teams and gradually expanded to approximately 100 people. The teams were merged because the individual output of these teams was not satisfactory; however, their combined results were well-received by the leader. Therefore, the decision was made to merge these departments and focus on the high-end market. This action also aligned with the company's strategic planning for transitioning to high-end products.

Regarding the establishment of UX goals, particularly in 2010, the concept of UX was only beginning to emerge. During that time, UX designers often held dual roles as product

designers. N2 explained, “The unclear boundary between UX designers and product managers in the initial stages resulted in a situation where the primary goal for UX designers was to rapidly respond to market requirements and deliver to the target audience.”

As a result, UX designers had to undertake multiple tasks, blurring the lines of their occupational roles. This ambiguity led to competition rather than collaboration between product managers and UX designers, ultimately resulting in conflicts of responsibility in their daily work. Consequently, some individuals chose to resign due to these challenges. Immediately after the merger, both the team and the company faced various challenges, including adjusting to the leader's preferred style and setting team goals and KPIs. These aspects required some modifications. A subsequent change in leadership resulted in further changes to the established style and goals. Consequently, UX design approach needed to adapt accordingly. As N2 stated:

> Two leaders had different approaches. The previous leader focused more on innovation, while the current leader pursues steady and achieves short-term goals, but the long-term ones are not as clear. It had an impact on the work of UX. With the previous leader, we had more freedom and took bigger steps. There was more room for imagination, even though the innovation goals may have been unrealistic. However, the current leader prioritized the implementation of short-term goals.

In general, after incorporating other departments, the UX team faced the main challenge of seeking stability and retaining employees. Even after the merger, the UX team was simply an interaction design team with a few interaction and UI designers, lacking anyone who worked on dynamic effects. At that time, its main responsibility was function-oriented, focusing on localized designs for different markets. The company did not have a complete product eco-system in the beginning UX.

However, the UX team did not have highly specialized roles, so they mainly relied on UX designers. Once they understood what the users wanted, they would create interfaces based on local case studies in the domestic market. The development team would then implement them and finally integrate them into the mobile system for market release. At that time, Team 1 maintained a dominant position in the African market and could quickly gain cooperation from different manufacturers to respond to the demands of the end-user market. This position thus established the advantage of their product. N1 mentioned:

> In Africa, FM radio was a commonly used medium for entertainment and information. However, many people faced financial constraints and couldn't afford to buy a separate radio. In order to address this issue, we conducted thorough user research to understand the needs and preferences of the local population. Based on our findings, we decided to integrate the FM function into the phone system.
>
> During a business trip to India, we received feedback from our clients. They mentioned a market demand and expressed the desire to have it introduced to the market within three months. As the UX team, it was imperative for us to meet this requirement.

N1 mentioned, “We were in a Blue Ocean market, there was not many competitions. As long as we could keep the product affordable with unique and attractive point to satisfy users’ needs.”

However, many old methods are no longer applicable now. Customers have more entertainment options beyond FM radios. Therefore, the key lies in how to ensure the fundamental quality of the product.

Constructing UX

The global market underwent a significant transformation, leading Team 1 to shift its focus from the African market, which had relatively low competition. However, as the company expanded its business scope within the domestic market, it became imperative for Team 1 to develop more competitive features in order to differentiate itself from other domestic brands. N1 mentioned, "To compete with other brands with an advantage in terms of product pricing, we need to invest in software for our mobile devices. At the very least, our efforts should not lag significantly behind those of other companies."

As a result, a mobile operating system (OS) team was established. The process of forming this team also involved restructuring the UX team and adjusting their responsibilities. Consequently, each function within the UX team became more specialized and finely divided, with the aim to develop high-end strategic products. Hence, this period marked a transition from the low-end market to the mid-to-high-end market segment. The change in market strategy led to a restructuring of the internal UX team, with the introduction of visual designers, motion designers, and user researchers. However, the increased specialization and division of responsibilities within the UX team caused conflicts. N1 articulated:

> Previously, UX designers had the autonomy to make decisions independently. However, the current circumstances require them to involve others in the decision-making process, collaborate with other departments, and even got delegated tasks directly from other teams. As a result, their freedom has decreased, and their sense of accomplishment has reduced. They may perceive themselves merely as a way to graphic outputs, lacking the same level of autonomy and fulfillment they once had.

This change led to the resignation of some personnel within the organization. N1 explained: “Due to strategic adjustments and changes in leadership, many UX designers have struggled to adapt, resulting in a significant portion of them choosing to resign.”

During this period, the focus was not only on stabilizing the UX team but also on defining the boundaries of responsibilities within the team and streamlining the collaborative processes. Existing employees needed to transition from their roles and integrate into the reformed team. Additionally, the UX team began recruiting talented employees. N2 highlighted, "We need to bring in industry experts or collaborate with external design houses."

The company faced intense competitive pressure as it shifted from a blue ocean market to a red ocean market. Therefore, aligning with competitors in terms of UX became essential. Another change was the shift from rapid feature development in the early stages of UX to a slower pace of major updates, typically occurring only two or three times a year. This change allowed for broader coverage across various device models as opposed to immediate feature additions.

Realizing UX

As the division of responsibilities becomes increasingly refined, collaboration within and without the UX team becomes tighter. For example, during the project planning phase, the product department included the UX department in the planning process and conducted workshops with product and operations personnel for co-design.

However, the UX team requires further enhancement of the specialized skills. For Team 1, the design of mobile wallpapers, 3D modeling techniques, and post-production animation effects have strict requirements and standards. Due to the team's involvement in numerous projects, there is currently a lack of manpower to meticulously refine this aspect. Therefore, Team 1 needs specialized talent or collaboration with international design companies to achieve their objectives in this area.

Promotion UX

Standardization capability is currently a major obstacle to further advancing UX work, as mentioned by N2: “Emphasizes platform standardization could ensure overall design consistency and uniformity, going beyond simple system design.”

To address this deficiency, Team 1 has started working on innovative systems, quality management systems, and collaboration systems. These three systems ensure the completion of designs with quality control standards established by the UX team. In the future, this area of design will also be a key focus for Team 1.

In comparison to similar-sized companies in the industry, the firm has multiple personnel dedicated to platform consistency design, while Team 1 only has one or two individuals supporting this work. The current workload of the UX team is already saturated, and one person cannot possibly manage all the planning aspects. Simultaneously, there is a need to enhance designers' understanding of AI technology to improve the efficiency of the UX team. In summary, according to N2, the current goal of UX is clear: to excel in visual design, particularly regarding representative and high-end products, to align with competitors. There is also an emphasis on recruiting more high-end talent specialized in key products to further demonstrate the value of UX.

4.2.1.2 Knowledge Transformation

Lack of Organizational Knowledge

During the early stages of Team 1, there was a lack of organizational knowledge. After understanding user needs and generating localized insights, the team would directly deliver the functionality, and the process would end, even if the functionality was poor. There would be no further optimization or iteration. N1 expressed:

> In a short time, we build a spaceship. If it succeeds, it succeeds. If it fails, it's likely to be ignored. Many of the small spaceships we built before gradually disappeared because personnel changed, and people didn't understand why we did those things, so eventually, they were removed, and we stopped doing and continue those projects.

This was a prominent phenomenon during the initial stage, particularly at the organizational level. Hence, in the early stages, Team 1 operated more like a temporary team.

This rapid and hasty delivery of functionalities also led to another phenomenon. N1 stated:

> For example, designers may also be involved to develop design language. One apparent issue is that when a new designer or leader joins the team, they may introduce their own version of the design language based on their preferences as a new design lead. However, it is often realized later that the differences are minimal. Consequently, subsequent newcomers may overturn their work and develop anew.

The design language or design rules within the UX team have been constantly changing, yet the perceived quality of the products remains unsatisfactory.

Establish UX Pyramid

Team 1 has established a UX pyramid with hierarchical levels ranging from foundational requirements to the highest level of expectations. Each level within the pyramid has its own set of standards, comprising approximately 10 key terms distributed across different tiers of the pyramid. These standards serve to regulate the fundamental requirements, ensuring that the design outputs produced by the UX team meet these criteria. N2 stated:

> This took a significant amount of time to accomplish. We conducted meetings with team leaders from various levels, leveraging their knowledge and experience to brainstorm and identify numerous requirements and corresponding vocabulary

related to the UX experience. We selected the most crucial ones to form the final version of the standards.

Deliver Functionality

To acquire user requirements, Team 1 relies primarily on the sales team to collect feedback from the market. Sometimes, even the CEO and senior executives inspect the market and understand user needs, identify gaps compared to competitors, and determine potential breakthroughs. Once the UX team receives the requirements, they swiftly execute and launch the function. This cultural approach is referred to as the "backpack culture," as mentioned by N2.

Interdepartmental collaboration is mainly facilitated by dedicated project managers who assume the role of coordinators, ensuring timely delivery from different departments. The UX team is involved throughout the entire project process, from product planning to product delivery. As N1 mentioned:

> During the product definition phase, the UX team needs to articulate the requirements for product data. In the second phase, they focus on practical themes such as boundaryless design. In the third phase, the UX team engages in fine-tuning and polishing the product.

The UX team's responsibility is to understand the requirements determined by the product department, obtain insights into the desired functionalities from the user's perspective, and produce research reports based on user insights. This process includes aspects such as users' aesthetic preferences and prevailing design trends. The most crucial knowledge requirement for the UX team is the ability to rapidly respond to the market, swiftly identify user needs, set objectives, achieve implementation, and promptly observe market feedback. The primary

focus of the team is to deliver functionality, while other duties are predominantly determined by managers and executives who possess greater collaboration and organizational knowledge.

N2 added:

> UX team needs increasing the specialization. Previously, a UX designer could use multiple design software, but now the focus is on ensuring that designers can deliver their assigned modules effectively and produce high-quality outputs. Generalists or general knowledge and experience are not suitable for our company's stage of development.

4.2.1.3 Knowledge Sharing and Reflection Within the Team.

To foster knowledge sharing and reflection within the UX team, Team 1 implements several initiatives. Firstly, the team organizes regular monthly seminars dedicated to sharing project experiences. During these seminars, team members present and discuss their daily work, highlighting challenges faced, innovative approaches taken, and lessons learned. This forum allows for sharing ideas, promotes collaboration, and encourages knowledge exchange among team members.

Additionally, formal meetings are conducted on a yearly basis to reflect upon the projects completed in the previous year. These meetings encourage in-depth discussions, where team members critically analyze successful and failed projects. Through constructive feedback and open dialogue, the team identifies areas for improvement and derives valuable insights to enhance future project outcomes.

Workshops are also a common practice within Team 1, aimed at generating new ideas and fostering creativity. These workshops provide a collaborative environment for brainstorming user needs, competitive functional features, innovative concepts, and problem-solving

concepts. By engaging in interactive activities and group exercises, the UX team cultivates a culture of innovation and continuous improvement.

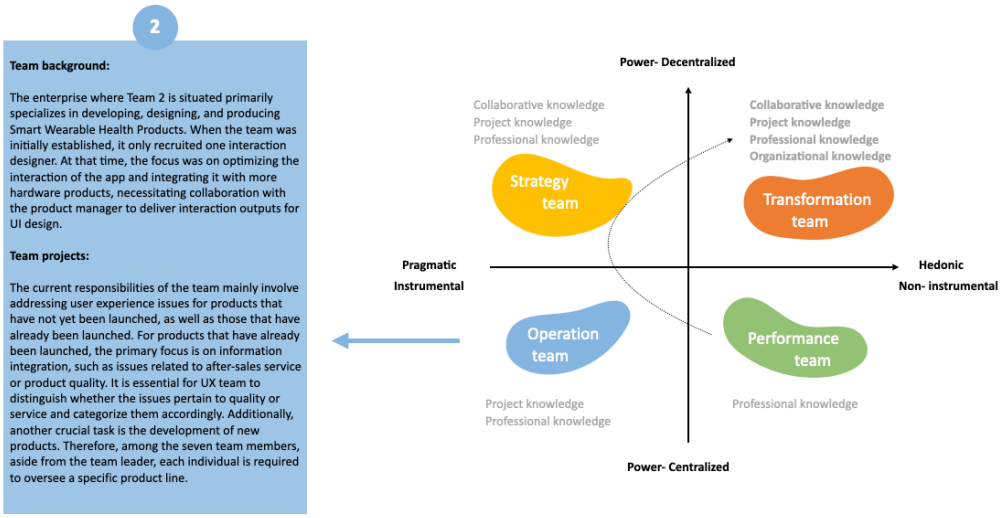
However, even with multiple knowledge-sharing initiatives, Team 1 faced a heavy workload, and leaders made relevant decisions, resulting in lowered team motivation to share and reflect on the project experience.

4.2.2 Case 2 Results

The background and project of Case 2 are demonstrated in Figure 4.5.

Figure 4.5

Case 2 Demonstration



4.2.2.1 Team 2 Timeline Construction

Beginning UX

Initially, the company focused on producing small household appliances such as rice cookers and smart kettles. These products did not necessitate consideration of wearability, interaction design, or ergonomics. However, as the company expanded, it ventured into wearable technology, which demanded higher levels of interaction design. Consequently,

interaction designers were introduced to address UX issues more effectively. This shift in business direction marked a significant milestone in driving UX within the enterprise's development.

Specifically, the company initially developed a mobile application that required UX optimization to enhance the design. The UX team was under the application design team, a subunit of the technology research and development center. Subsequently, the application needed to integrate with hardware products to enhance their intelligence and provide users with varied experiences. Thus, more interaction designers were required.

Constructing UX

The company embarked on exploring and developing digital health services while integrating them with its existing hardware products. However, the massage products the company primarily focused on were not suitable for continuous wear, and a new digital healthcare department was established to expand into new business areas such as smartwatches and other medical devices. During this transition, the workload of the UX team surged compared to the initial tasks of device connectivity and control within the application. With the introduction of the new smartwatch business and the addition of medical functionalities such as blood pressure and blood glucose monitoring—requiring specialized medical knowledge—UI designers were also hired.

During this period, the distinction between UI and UX was not always clear, with UI designers sometimes taking on UX tasks and even assuming roles similar to product managers, prioritizing and executing user requirements. Consequently, the responsibilities and complexity of tasks for the UX professionals increased, prompting the gradual integration of UX work with other departments.

Although the digital healthcare department was primarily exploratory and not focused on profit indicators, its dissolution occurred due to significant cognitive biases about software products within a hardware-focused company. However, throughout this exploratory process, UX garnered recognition and secured a significant position within the company.

Realizing UX

Six months after the dissolution of the healthcare department, the UX team was integrated into the customer growth center, which comprises four small teams: the user experience team, the customer service team, the user research team, and the user operations team. The customer growth center was established due to the desire to enhance user growth by improving repeat purchases, conversion rates, or user loyalty. A separate department aimed at integration was created to achieve tangible results, although such outcomes have yet to materialize.

Among the four small departments, only the UX team is involved in the entire product lifecycle, from conducting technical rehearsals and collecting market feedback after the product is launched to adjusting any issues that arise. The user research team primarily focuses on the early stages of product development, while the customer service team focuses on post-launch, handling customer complaints and feedback.

Promotion UX

The pivotal transformation for the UX department occurred when its scope of responsibilities expanded. Initially, the team primarily focused on addressing issues with products already in the market. However, revising experiential issues with existing products proved challenging, and the focus of UX shifted toward proactively managing the overall product experience before launch or at various stages of product development, rather than intervening solely during later stages. Additionally, the UX team was initially confined to designing mobile applications but later expanded to include aspects such as confirming product aesthetics and

ensuring usability issues at the project initiation stage. This transformation elevated the importance of UX work and broadened its scope significantly.

4.2.2.2 Knowledge Transformation

Professional and project knowledge constitute Team 2's expertise. The company recognized the need to diversify its product portfolio and identified smartwatches as a promising opportunity. Consequently, the significance of UX work increased, evolving from a supportive role to a major team that was responsible for addressing complex design challenges. However, deficiencies in collaboration and organizational knowledge became apparent during the formation of UX teams. Key elements such as design norms, standards, information flow, and role identification were absent, resulting in a general lack of flow in collaboration processes.

One of the primary responsibilities of the UX team was to identify and address UX-related problems. However, the scope of these issues often surpassed the team's capabilities, leading to resistance from other departments and a tendency to underestimate the value of UX contributions. Notably, at the company's early stages, projects proceeded without the presence of a dedicated UX team. Hence, following the establishment of the UX team, when the UX team raised questions or suggestions regarding products, other departments often dismissed them instead of considering them valuable feedback. As expressed by N4, the questions included "Why can't the UX team simplify the project?" and "The UX team needs to standardize the process of raising questions or evaluating UX, making it recognizable to other teams."

Many of the other teams were inclined to adhere to previous project process, ignoring the input from the UX team. N3 highlighted this issue:

> Other departments are unsure of the role of the UX team. It's crucial to establish collaboration and organizational standards to support the daily work of UX,

particularly by integrating UX decision-making into the overall project process to enhance its influence within the company.

The success of Team 2's development depended on the timing of UX involvement, the quality of insights provided, and the role it played throughout project development. These factors needed to be actionable and manageable to effectively persuade stakeholders or other departments of the team's significance.

Professional Knowledge

Professional knowledge varied about whether the UX team should engage with the post-sales department for support and feedback on products. This feedback included identifying issues stemming from logistics, product design, or UX problems in various scenarios. Ultimately, responsibilities related to interaction and UX were delegated to the UX team for resolution. A question arose regarding whether the UX team should prioritize involvement in the early stages of product development rather than handling feedback from users after product launch. As N3 expressed, "Post-sales support might be more effective in addressing user feedback about the products."

In addition to positional considerations, extra key knowledge regarding the profession was outlined by N3 and N4 in a pyramid structure:

a) At the highest level, a referenceable UX framework includes various dimensions such as tactile sensation, usability, weight perception, convenience, detachability, and repairability. Establishing these UX dimensions allows every team member's output to be accommodated within the framework, making issues more specific and enabling the UX team to provide precise solutions. This framework prevents user bias and categorizes post-sales feedback.

b) In the intermediate layer, efforts are made to identify potential UX issues throughout the entire product usage journey, including pre-experience, usage, and post-use stages. These issues need to be standardized. For example, consistent interaction logic across different hardware products is crucial, along with establishing norms for interactions, such as feedback mechanisms for sound and button presses.

c) Empathy plays a vital role in understanding users' feelings and experiences while using the product. It involves reflecting on how UX work can aid users and considering the logical flow of product usage from the user's perspective.

d) At the foundational level, the comprehensive understanding of user data, such as ergonomic data, serves as the foundation for effective UX design processes.

Overall, Team 2 possesses solid professional knowledge and treated interaction design as a major part of its duties. Interaction design standards served as benchmarks for the UX team to achieve. In contrast, the UX strategy often evaluated products from the user's viewpoint. The former was focused internally, while the latter was assessed externally. Establishing UX standards and strategies were not a singular occurrence but an ongoing iterative process. Developing interaction design standards or a UX strategy enabled UX designers to become proficient in design language, adept at articulating issues using UX-specific terminology, and capable of fostering a unified design language within the enterprise.

Project Knowledge

The boundary between project and collaborative knowledge was blurred. Both circles emphasized collaboration, focusing on maximizing the role of the UX team within the enterprise and ensuring smooth cooperation from every department and individual to achieve common objectives more effectively. Moreover, organizational knowledge was not heavily emphasized because projects were primarily handled on a case-by-case basis. Consequently, there was less need to consider or involve knowledge at the organizational

level. Project managers typically take the responsibility for such knowledge in this regard, as N3 stated, "Maybe only the CEO or top management team are equipped with organizational knowledge."

Regarding project knowledge within the UX team, the current emphasis lies on strengthening ownership. The team leader believes that if members exhibit a strong sense of ownership over their respective projects, it will ensure the thorough execution of their assigned tasks.

4.2.2.3 Knowledge Sharing and Reflection Within the Team.

The UX team served as the most deeply ingrained repository of knowledge within the entire company. Operating as an advisory council, Team 2 offered strategic insights to other departments or products, adapting different mindsets across various project teams. Knowledge sharing within Team 2 primarily followed the process from product development to launch. For instance, the team needed to understand specific target demographics, usage scenarios, and core selling points, evaluating experiential risks before launch to shift from reactive to proactive measures.

As the team accumulated knowledge and experience, the complexity of products increased, which cultivated the complexity of skills, knowledge, and experience. When the number of products increased, Team 2 required more comprehensive and sophisticated capabilities to coordinate and manage increasingly complex projects. The team became more specialized through project and knowledge accumulation. Moreover, specialization became increasingly important as the company's emphasis on the UX department grew. Thus, standards and schemes became more robust, and the influence of UX continued to expand internally within the team and the company, with team members sharing insights gained from project experiences and exchanging UX knowledge and expertise with other teams.

Although experience and resources for new products were insufficient, the team continuously learned to explore new products through desktop research such as literature or research evidence. N3 claimed, "We will establish a knowledge base to consolidate UX-related knowledge, materials, and retrospective documents for each project as experiential accumulation."

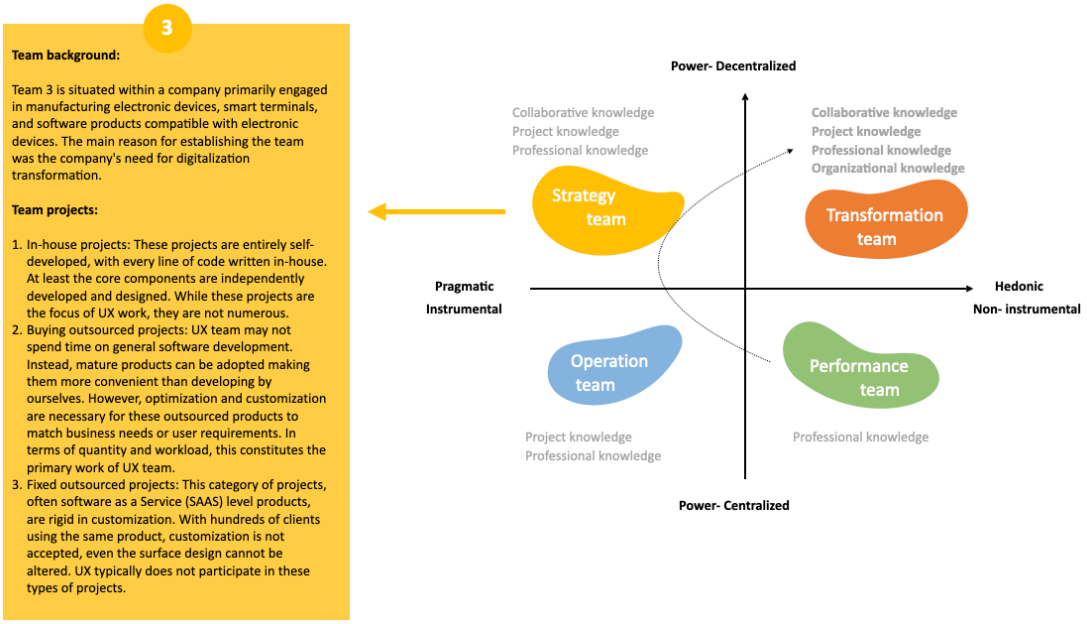
While UX designers often worked independently, encountering significant UX challenges encouraged team members to engage in discussions and share project experiences. Team members were invited to share their UX projects and perspectives during meetings or as guest speakers within the company.

4.2.3 Case 3 Results

Case 3's background and project are demonstrated in Figure 4.6.

Figure 4.6

Case 3 Demonstration



4.2.3.1 Team Timeline Construction

Beginning UX

The initial interest in UX within the enterprise stemmed from the ambition to undergo digital transformation, aiming to transition offline business operations to online platforms. The company had previously invested in various commercial management software solutions but encountered difficulties with interoperability between these systems, which hindered precise accounting of manufacturing and personnel costs. For instance, when the company received a mobile phone order from Europe, the lack of a digital management system made it impossible to accurately calculate manufacturing costs. Employees resorted to manual calculations using calculators and Excel. As the company expanded its operations globally, there arose a need for precise operational management, seamless data integration, and the development of missing systems.

N5 mentioned, "Each department operates in isolation without communication between them," illustrating the disconnect between operations, where departments functioned independently, relying on manual transmission of data and business-related information.
At the time, the company's digitalization efforts were at a relatively early stage compared to other enterprises such as Huawei or traditional home appliance manufacturers. However, the company's development scale and market share had reached a point where digitalization was imperative. Moreover, the leadership's understanding and appreciation of UX directly determined whether this department could be established and recognized. This reasoning was the primary reason for the UX engagement.

Three tasks or concerns in the beginning stage were highlighted by N5 and N6:

a) Recruitment criteria and roles, such as the user researcher role, being crucial.

b) UX was nonexistent in the company before, so establishing ground rules was necessary, such as building protocols on how UX integrates into different types of projects and workflows regarding input and output in UX work. Notably, UX methodology also needed to be confirmed. All these regulations required to be effective and practical.

c) The management style and culture needed to be confirmed. Team 3 allowed teams and members to choose the projects they wanted to engage in or were interested in. A fair culture was encouraged whether the team members were in-house designers or outsourced designers. Team 3 was united by the common goal to fulfill the digitalization mission.

Even in its beginning stage, Team 3 endeavored to make a meaningful impact. It undertook tasks beyond expectations and assisted other departments in problem-solving. For example, when product managers proposed numerous features resulting in increased complexity and redundancy, the UX team offered fresh perspectives to streamline and address the issue effectively.

Constructing UX

The company targeted the end-user market, which emphasized aesthetics and UX. This positioning embraced the construction of a UX team to facilitate the internal business system through digitalization. After establishing ground rules, the crucial task in the construction of the UX team was to systematize all procedures by documenting them in PowerPoint, testing them, and promoting them to other departments. During the construction stage, there were 30 in-house designers and 20 outsourced members.

Seven business operations needed to be integrated into the online digitalization platform. Thus, the digitalization mission was divided into executive tasks from a general goal. Specifically, different business operations required customized visual styles, modules, and

interaction processes, which motivated the UX team to build standard operations across different projects, such as UX methodology and UX tools, which could be used universally. Therefore, the company highly valued UX teamwork as it improved efficiency and reduced business cost.

Realizing UX

This stage was the busiest after the construction of the UX team. The foundational principles of previous UX collaborative procedures, methodologies, and input or output standards needed to be leveraged to guarantee successful digitalization. Design schemes, user interfaces, interaction flows, and web designs were all confirmed and readied for execution. The UX team expanded to approximately 80 members, working on multiple projects simultaneously. As N5 stated, "That was the most exciting stage; the team was highly united to complete projects."

Apart from the UX work itself, efficient collaboration with other teams was required, where the UX solutions were customized upon request. UX collaboration protocols and methodologies were consolidated during this stage. The number of members working on some marginalized projects were reduced to focus more resources on valuable projects.

Promotion

All projects were delivered to internal employees to streamline operations and improve efficiency. Simultaneously, duplicating the digitalization platform to other business operations in various countries was urgent and part of the UX team's mission. In addition, continuously optimizing system performance was necessary. However, some roles in the UX team became unnecessary as some systems became fully operational and began updating automatically. Thus, the team reduced its size to approximately 20 members, and the importance of UX decreased. A significant change in UX emphasis was the need to promote

and publicize the digitalization outcomes contributed by the UX team to ensure internal employees recognized the value of the UX team.

4.2.3.2 Knowledge Transformation

Initially, interaction designer, visualization designer, and UX designer were the major rules in UX team. Gradually, branding design and user research team became part of the UX team. Branding design facilitates the continuity and texture between different systems, whereas user research teams explore user's needs and preferences. As Team 3 encompassed one sector in a large company, the knowledge transformation was evident by following the project strategies and stages. There were general guidelines to handle projects, as N6 stated:

> Our team demonstrates a strong overall sense of rhythm, with macro-level rules driving daily projects, and micro-level rules are applied to handle different projects. Even for some buying outsource products, UX can participate in the bidding stage to review and serve as a reference point.

> UX must always prioritize the user experience. It cannot be treated as a mere processing of materials. Even for something as simple as a poster, it is essential to analyze who will see it, when, and under what circumstances. It's not about copying previous work blindly; it requires thoughtful consideration.

Professional Knowledge

Professional knowledge served as the foundation for quickly delivering output while working in an agile process. However, N5 claimed:

> Professional knowledge was the weakness point in our team. The profession and industry developed so fast that there was not enough time for designers to have a

solid foundation but needed to adopt fast and generate output fast. Thus, designers learned the relevant skills and experience through practice.

Similarly, N6 commented, "There was often little additional time available to prioritize the optimization of UX with the construction of products and systems, alongside an increasing number of demands and tasks."

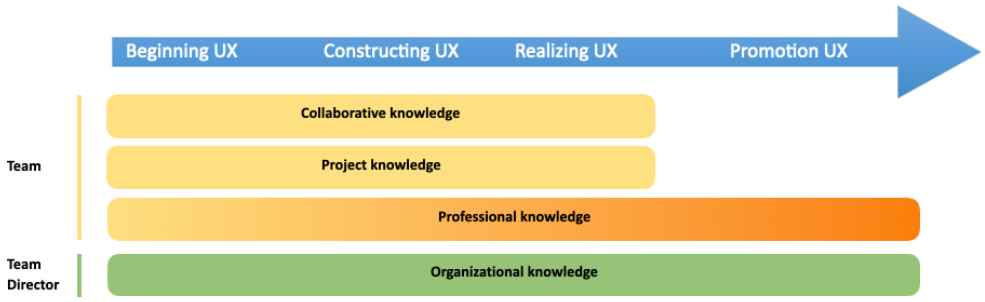
If professional knowledge included an understanding of the industry, the question became how deeply the UX team could be involved in the business process of generating UX strategy. The goal of the UX team was to build products that worked more efficiently with product managers. For example, initially, Team 3 focused on the color of different systems, then shifted to efficiency and usability, which were the foundation of the system. Notably, Team 3 mainly handled internal business projects where improving collaborative efficiency was a common goal.

N6 claimed, "Whether a project aimed to improve efficiency or improve UX involved resource budgets, thus the emphasis was decided by leaders."

In different stages, the requirements for professional knowledge varied (Figure 4.7). In the beginning, the core knowledge comprised project, collaborative, and professional knowledge. Professional knowledge was the main component to perform tasks in the fourth stage. However, collaborative and project knowledge were insignificant in the promotion stage, as the main tasks involved achieving basic daily tasks.

Figure 4.7

Case 3 Timeline



Among all the knowledge features, the distinct one from Team 3 was user perception being different. As N6 stated:

> One major challenge faced by B2B products is the inherent separation between our team and the business users who utilize these products. This disconnect makes it difficult for us to approach design from a user experience perspective, as the internal employees who make demands are often the same ones using the product. Whether about marketing or financial systems, the individuals requesting features are also the end users themselves. Therefore, as designers, it's challenging to step back and say, 'I'll represent what you want,' unless we have a profound understanding of their needs. In contrast, business stakeholders and product managers often have closer communication and a clearer understanding of the underlying logic. Despite our efforts to understand the business, there may still be a knowledge gap between us and the users who operate the business.

The lack of understanding between designers and actual users led to a strategic shift in the core task and challenge during the promotion stage, resulting in two transformations of professional knowledge.

First, Team 3 aimed to promote digital operations, akin to a marketing department. This promotion primarily involved disseminating digital content through short videos or visual materials to serve the business, primarily targeting internal personnel. Given the challenges associated with the implementation of digitalization, substantial budgets were allocated annually. However, the business performance in this regard remained unimpressive and undervalued. There was thus a pressing need to enhance awareness and understanding among business personnel. Despite the considerable time and effort invested in digitalization efforts, personnel seemed to lack recognition of its value. Therefore, it was imperative to undertake promotional activities to highlight the significance of these initiatives.

Second, Team 3 needed to gain recognition and positive feedback, such as comments about the digital system being helpful and efficient, which could be a huge encouragement to motivate team members. However, unfortunately, as N5 expressed, “Now most comments we get are negative feedback; we need to change the situation to show more of the good side of the digital platform and reduce the negative view.”

This was a new problem for the team, which required a new solution—the team’s knowledge needed to evolve. For example, N5 addressed the problem:

> Drafting lengthy articles might not attract much attention, especially when considering the prevalent consumption of short videos among individuals nowadays. Additionally, within the company, there exists a knowledge-sharing platform. Leveraging the popularity of short video formats, we can repackage lengthy articles into more digestible content, presenting them in a format that is easier for business personnel to comprehend.

This approach allowed Team 3 to effectively communicate the value of digitalization and address current challenges. Additionally, showcasing the results of the large-scale system

construction efforts to business personnel was essential. It was also necessary to demonstrate progress gradually throughout the iterative process of daily operations.

While this UX propaganda did not immediately resolve the misunderstanding between business personnel and designers, it represents a step in the right direction with a series of gradual experimentation. If Team 3 fails to undertake new efforts to publicize the digitalization, the potential successes of digitalization in the future may not be attributed to UX department. However, in the chance of failure, the UX team would face downsizing. The team's greatest contribution included designing standards, tools, and components that are beneficial to the entire company. Considering the potential implications after completion of digital transformation, there may not be as many people needed to complete the tasks that were originally required. The remaining 20 team members may face the possibility of downsizing, with only half of the team tasked with handling promotional activities.

Therefore, from the perspective of both the department and the company, it is imperative that Team 3 take action to guide the business personnel to realize the value of digitalization.

Project Knowledge

The project knowledge within Team 3 was primarily aligned with the responsibilities of different UX subgroups. For example, a particular subgroup excelled in project knowledge, demonstrating proficiency in multitasking and schedule management, including daily operations and achieving project goals. They typically handled high-pressure tasks. However, the subgroup's pursuit of design excellence or depth was insufficient, merely prioritizing task completion. While they achieved quantity, the quality was often lacking, which was circumstanced by routine work. However, some other subgroups mastered user research. They knew that UX needed to understand what kind of users it was targeting and truly comprehend their needs rather than striving for simplicity or sophistication. It was essential to tailor the UX approach to specific demographics and address their unique requirements

rather than applying a one-size-fits-all standard to all demands. Moreover, another subgroup explored UX strategy by conducting field research to find design opportunity, but they lacked project management skills such as schedule or time management.

Collaboration Knowledge

When beginning digitalization, the UX team collaborated with product teams to plan and identify design issues within existing systems. Meanwhile, product managers focused on uncovering underlying logical, data-related, and functional issues. Some teams may have required in-depth user needs exploration during this phase. Hence, Collaboration with other departments was essential during this period, employing co-design principles and leveraging industry knowledge together to ensure that the UX design output could be implemented effectively.

Generally, team members who held collaborative or project knowledge faced downsizing when most of the projects were completed. With fewer ongoing projects and limited cross-department collaboration, there was less demand for their expertise. After project delivery, team members' schedules became less structured, sometimes requiring only minimal tasks such as drawing a single image unrelated to core projects. P5 explained, “When project and collaborative knowledge became insignificant, designers needed to transform themselves with more professional knowledge that could assist basic performance work.”

Organizational Knowledge

Organizational knowledge required a higher dimension of thinking that relied on judgment of the macro environment. N5 stated:

> Team members rarely have time to think about issues from an organizational perspective. No matter how significant the problem is, leaders can take full responsibility.

> Even as the design director of the entire UX team, I may be the only one who has 50% of organizational knowledge.

Organizational knowledge included the capacity to identify problems derived from empathizing with users, contextualized ability, and identifying the central point in complexity. However, the largest capacity for the UX team was solving a problem rather than identifying it. N5 clarified, “The prerequisite for problem-solving ability lies in the capacity to identify the problem. Once the problem is accurately identified, it is already 70% solved.”

Nevertheless, when addressing business challenges, each department had its own starting point. While the technical department employed technical approaches, the UX team listened to user feedback, distilled user ideas, and transformed them into a solution, finalizing it in the design. Even if UX teams could not solve problems unrelated to design, the attempt was still worthwhile.

Modules were established and combined into one holistic module for the UX team to employ. In addition, four customized modules were created for marketing, mobile systems, data platforms, and financial operations. However, the disadvantage of these modules was that they limited the designers' proactive behavior in generating creative outputs. Therefore, specific rules were implemented to guide innovation and create surprises for users through small elements while still adhering to the basic design standards.

4.2.3.3 Knowledge Sharing and Reflection Within the Team.

Every week, short standing meetings were compulsory for team members to share project progress and tasks. Knowledge was mainly shared through verbal communication during these regular meetings. The team attempted study groups to encourage knowledge sharing,

but these efforts were not successful as they required significant effort to organize and prepare, and the shared knowledge was seldom used in projects.

PowerPoint presentations were used to summarize project process information, including project planning, industry materials, competitor analysis, industry trends, specific objectives, target audience, user personas, journey maps, and post-launch inspection tools. Team members selected a project they worked on and shared the successes or shortcomings of the project, allowing other members to learn how relevant knowledge was applied in projects. Although the team did not have dedicated knowledge management tools, they utilized PowerPoint presentations to transfer learning to other team members.

However, understanding PowerPoint often required accompanying verbal explanations. Moreover, the company lacked systematic organization of the considerable number of presentations and failed to extract information from these documents. When new employees joined, they could access past files, but there was no structured knowledge transfer process in place. Instead, the firm relied mainly on verbal explanations from senior employees. Moreover, new employees typically had only a week to familiarize themselves with past projects before diving into their tasks, leaving little time for them to absorb previous experiences. N5 explained:

> Salaries are tied to performance. Knowledge management doesn't benefit those involved in it or contribute to performance evaluations. From my perspective, it doesn't result in salary increases or better performance reviews. Knowledge transfer and management is crucial, but it requires significant time and effort. Once a project is completed, there's no time for thorough reflection.

Despite the team's recognition of the importance of knowledge management, the focus was more on individual promotion rather than collective efforts. Individuals aspiring for

promotion had to participate in the team's promotion channel mid-year. Projects undertaken by these individuals were reviewed and assessed by the evaluation panels, comprising leaders from different departments. This process necessitated reviewing past documents to foster personal growth and reflection. If past documents were not preserved, individuals being evaluated have to rely on their memories to create new documentation, which could result in misinformation. Hence, preserving documentation showing the process or stage-wise progress is helpful.

However, considering the team as a whole, not much effort was invested in systematically documenting and reviewing past projects. N5 added:

> It also depended on the leadership's preferred style. If the leader leaned towards a pragmatic and business-oriented approach, they might have perceived knowledge management as not being sufficiently demanding.

Knowledge management could have yielded long-term benefits. If a team had been well-nurtured, three to five years down the line, everyone's knowledge base would have been extensive and robust. However, a designer's curiosity would have been more crucial, as they could access any historical documents if they wished. If an individual had a thirst for knowledge, they could always find historical files. However, if an individual lacked curiosity, they might have felt that their knowledge and experience were sufficient, especially since everyone had their own areas of expertise. If, at that point, designers were forced to organize their work and conduct periodic reviews, it could have been done. But after completing it, questions would have arisen about who they reported to, what actions followed, and whether it led to promotion and salary increases. These were all issues that needed to be addressed.
Generally, senior employees needed to share their knowledge and experience with new employees. As N6 commented:

For colleagues with limited knowledge and experience, we needed to share our knowledge and experience with them using summary templates, modules, tangible frameworks, such as standardized structures in PowerPoint presentations, covering background, products, planning, and project design concepts. Extracting commonalities from past projects and organizing them into templates. The key was to reuse knowledge and experience in other projects and learn through the project execution process.

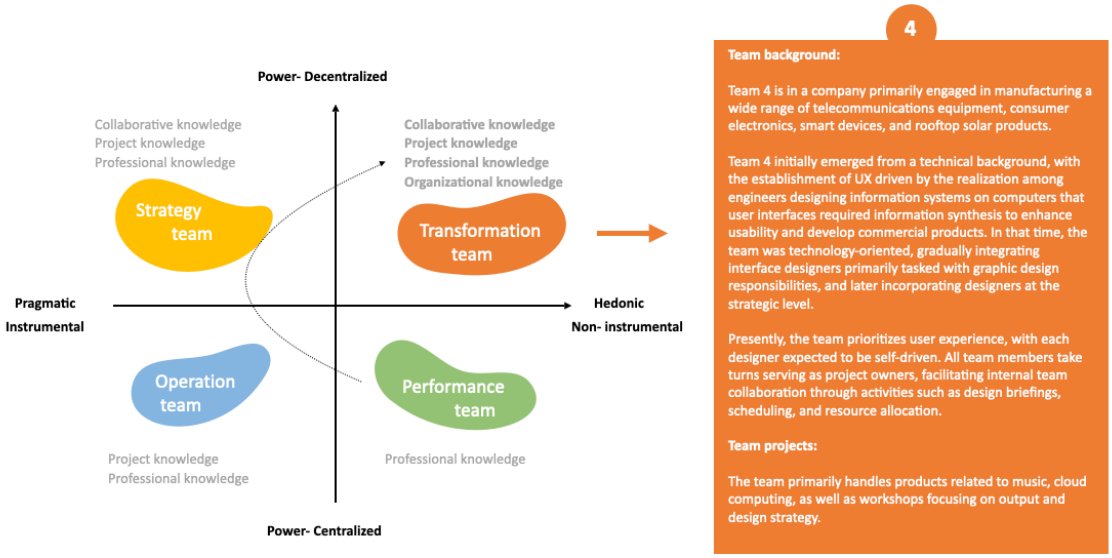
Overall, Team 3 summarized past projects into methodologies, including detailed dimensions that each project needed to address.

4.2.4 Case 4 Results

Case 4's background and project are demonstrated in Figure 4.8.

Figure 4.8

Case 4 Demonstration



4.2.4.1 Team Timeline Construction

Beginning UX

In the beginning, the UX team operated as a department within the corporation. However, changes in the company financial structure occasioned its transformation into an independent team responsible for its own profits and losses. Consequently, UX designers functioned more like production line workers, delivering outputs such as prototypes, wireframes, and design evaluations based on requests from other departments. The team had to demonstrate its value to the company by meeting business or performance goals set internally or by the company. Sometimes, UX designers were outsourced to other departments to assist with their work. Profits for the UX team were calculated based on how many designers were allocated to different teams or projects. However, working in other departments or on multiple projects did not necessarily bring new opportunities or challenges; it often resembled working on an assembly line.

The UX team dynamic did not prioritize learning activities. Instead, learning new knowledge and gaining experiences relied mainly on self-exploration, as the company did not provide an environment for team members to acquire new knowledge. As P7 explained, “UX team was primarily viewed as a ‘toolbox,’ with each designer functioning like a tool with different functions, cooperating with the work of different teams.”

In this initial stage, the priority was to complete design tasks rather than to fulfill the strategic value of UX. Therefore, professional knowledge was the major dimension in this stage.

Constructing UX—Design Innovation

The UX team has begun seeking breakthroughs by collaborating with design companies and research institutes in Europe. The concepts of design principles and design stories were established to understand how good designs are created and operated through such

collaborations. Hence, Team 4 began attempting reforms, focusing not only on basic solutions but also on innovation to gain recognition and further expand the team. During this period, using these innovative projects as benchmarks within the company, the team received some design awards. Moreover, during this period, project knowledge emerged.

Realizing UX—Resource Support

Relevant supportive teams were also established when the UX team grew. For example, the user research team collaborates with the UX team to produce user research reports as needed. Similarly, the team responsible for design guidelines and components provides resources that the UX team can access at any time. Consequently, the UX team receives sufficient resource support to engage in more innovative projects, create UX design protocol and methodology, and share good design practices. During this stage, collaborative knowledge became significant.

Promoting UX—Empower

The UX team empowered various product lines to innovate by guiding product development through design rather than allowing product positioning to dictate design. Additionally, it used design to gain insights into user needs and assess their commercial potential to drive profitability. To achieve this, a UX strategy had to be established to make other departments aware of and value the importance of UX before proceeding with product and specific function development. This approach ensured that user-centric design principles were at the forefront of decision-making, ultimately leading to more successful and impactful products.

4.2.4.2 Knowledge Transformation

Professional Knowledge

Team 4 was primarily centered around technology, with design playing a supportive role in the early stages. Therefore, designers were mainly responsible for basic execution work. Professional knowledge served as the foundation to meet the most basic output

requirements. However, due to the repetitive nature of tasks, team members began to question their self-worth. As N7 remarked, "Every day is like working as ants, you know? We need to keep drawing."

Since the team had high expectations for UX outputs, solid professional skills were needed to achieve them. For example, design solutions at the testing stage had to reach a level where users could interact with them before gathering feedback through user research to determine the final output solution. Nevertheless, the UX team's importance and influence were relatively weak during this period. Gradually, the team gained more recognition and established professional credibility by supporting other departments.

Project Knowledge

The accumulated project experience needed to be reused in other projects. Thus, the team developed the concept of "design reuse," transferring designs horizontally from one project to another. According to the main insight generated by Team 4 during project development, reusing well-designed elements could spark inspiration, improve products, and enhance efficiency. Moreover, meticulous control and execution were necessary for all the UX projects. These accumulations strengthened the competitiveness of the UX team.

Collaboration Knowledge

As an independent design department, Team 4 had to collaborate with specialized programming, testing, or operations departments, making cross-departmental cooperation essential to complete tasks. However, the premise of this collaboration was that each department was equal, and everyone had an equal opinion in the design process. Designs were approved only when all the departments involved in a project found the proposed solution feasible. If one department, such as testing or programming, rejected the design proposal, it could be overturned. Hence, design proposals were the result of collective decision-making, and Team 4 was responsible for each step. As N8 explained:

> Within or between teams, there was no concept of hierarchy, and the voice of each department was equal. The core purpose of this approach was to ensure that everyone took responsibility for the product and had a sense of accountability. However, the downside was that project timelines could be extended.

Each requirement was not solely the responsibility of the UX department but was tied to different product lines and aimed for mutual benefits with other teams. Therefore, alignment with the goals of other departments was necessary.

N7 mentioned:

> The designers in the UX team spend 40% of their time on completing tasks. However, 30% of their time is spent on communication and collaborating with various departments. Another 30% of their time is dedicated to guarantee the implementation. Even with the best solutions, if the execution or delivery deviates from the design plan, only 10% of the design's potential can be realized. This does not make for a good UX team.

Among the stakeholders, those who proposed the project requirements or identified problems were the most critical, as their interests were the closest and strongest. Additionally, regular communication and reporting with the decision-makers who evaluated design capabilities were necessary since understanding and assessing role identification were essential prerequisites for effective work.

Notably, the UX team secured projects by competing with other UX teams within the company. When one UX team determined that a project was promising and offered potential, they needed to develop a design strategy and concrete plan to compete with the other UX teams.

N8 revealed one criterion for identifying a promising project: "If a product could be presented at a launch event, it indicated that the project was important."

The product department would evaluate which UX team's proposal aligned better with their expectations. Therefore, the UX team needed to understand the expectations of the product management team where collaborative knowledge were required. As N7 commented, "The product department already had some concepts regarding the UX. If the output direction of the UX team was consistent with the product department's expectations or provided some concepts that exceeded expectations, they might adopt it."

Many UX teams aimed to be recognized as innovative teams. For example, AI was quite popular at the time, and everyone wanted to innovate in the AI domain. This process created a positive competitive atmosphere because the company provided resources for everyone to explore, giving them the opportunity to find better innovative solutions.'

Organizational Knowledge

The team was highly valued and influential within the organization. The members guided product development through design and encouraged a user-centric approach, leading to knowledge generation at the organizational level. However, with the company's growth, many basic product functionalities were already established, and the focus shifted to improving UX. This shift was an opportunity for the UX team to take the initiative. For example, Net Promoter Score was defined as a metric for product or service quality, and product managers relied on the UX team to improve user satisfaction. The UX team, being the most familiar with users, approached problem-solving from the user's perspective.

Another important aspect of organizational knowledge was upward management. This aspect involved demonstrating to other departments or leaders the value that the UX team added, such as improvements in data and receiving thank-you notes or commendations, all of which

contributed to the team's achievements and key performance assessment. In addition, organizational knowledge was tightly regulated, especially concerning design standards and criteria. As N8 mentioned, “These UX standards were like a “fish net” that couldn't be easily disrupted and breaking them required layers of review and approval.”

4.2.4.3 Knowledge Sharing and Reflection Within the Team.

The company has a regularly updated design sharing platform where designers write articles, such as explanations of design concepts. Design sharing sessions are held at least once every 1–2 weeks, with designers sharing their project experiences and participating in online forums to answer questions. This sharing indirectly expands the influence of the UX team; hence, the team encourages it and incorporates it into the performance assessment of team members. Summarizing project experiences essentially involves accumulating intellectual assets, so the UX team also has a platform for archiving, where final research reports, design proposals, and user validation results are uploaded.

There is also a dedicated tool management team, where the UX team can adjust the style of the desired modules or files online before using them. Essentially, it is knowledge about the component or modules library. However, when there is conflict with the ideas of the product team, the team members prioritize their "political intelligence." Some team members may even create two sets of solutions, as N8 added, "One set is for internal reporting, and the other set is for product department/external department reporting."

Hence, the internal solution was a conceptual and visually appealing design. However, on the external side, it was a highly practical concept. This way of resolving conflicts mainly depended on the evaluation criteria for the results. N8 stated, "The main purpose of doing two set of solutions is to make the leadership feel that the team's work was very impressive and then achieve a high-performance rating."

Because the management style within the group was to promote step by step rather than suddenly appointing a leader, when team members became leaders, there was more reflection within the team. The different solutions aiming at internal and external presentation was mitigated. The management focus shifted to actual results and user feedback rather than team members' flashy concepts when determining performance ratings.

4.2.5 Summary of Phase 2

The second study revealed that each UX team type has unique advantages during different stages of a company's development. This phase verified the results from Phase 1 by contextualizing the findings through interviews with UX managers and team members. The case studies highlighted how companies prepare and balance their resources according to their development stages and requirements in maximizing UX value. In addition, the case studies also described how the UX practitioners update or reconstrue their knowledge to cope with changes and challenges.

Furthermore, the case studies provided insights into how UX teams are characterized based on leadership and reasoning styles. They offered a real-life context for high-tech companies to understand and improve their UX practices, showing how different types of UX teams contribute uniquely to the organization at various stages of its growth.

The importance of different types of knowledge varies depending on the stage of a project. However, an individual UX designer needs to transform the knowledge as needed to remain competitive.

4.2.5.1 Team 1 Represents the Performance Team.

Team 1 faces fierce competition in the market, prompting them to shift their approach in UX experience and knowledge from task completion to a more intricate and tailored method to meet market demands. One strategy employed to update their UX knowledge was the

recruitment of experts in the field. While professional knowledge remained central in Team 1, there was a need to increase UX knowledge in the project and collaboration dimensions to develop innovative functionalities.

Currently, there is a significant emphasis on innovation within Team 1 and throughout the organization. There is a collective expectation for the UX team to pioneer new forms of interaction akin to Apple's design team. This trend suggests a future for the UX team that involves high specialization to lead the market. As the company currently plays a catch-up role, it necessitates the recruitment of design talent capable of making a notable impact in specific areas. Functionality was repeatedly mentioned in conversations with Team 1 participants, underscoring the importance of professional knowledge as the bedrock for meeting immediate functionality demands.

However, power-centralized leadership results in knowledge centralization and a reliance on practical knowledge to achieve functionality. This hierarchical structure facilitated swift and efficient team movement but introduced potential drawbacks, as highlighted by N1 and N2. Changes in leadership caused shifts in priorities, with past leaders prioritizing innovation and current leadership emphasizing short-term goals over long-term vision. These changes impacted the team's autonomy and sense of accomplishment. Despite establishing a UX pyramid with hierarchical standards, Team 1 encountered challenges such as inconsistent design rules and personnel turnover due to frequent leadership and organizational changes.

Nevertheless, Team 1 emphasizes interdepartmental collaboration and innovation, leveraging regular seminars, meetings, and workshops to foster knowledge sharing and reflection. These initiatives serve as platforms for team members to exchange ideas, address challenges, and collectively enhance their understanding of UX principles and practices.

4.2.5.2 Team 2 Represents the Operation Team.

Team 2 demonstrates the transformative journey of a company as it navigates an evolving product portfolio and market demands. Initially focused on traditional household appliances, the company recognized the potential of wearable technology and embarked on a strategic shift toward incorporating smartwatches and digital health services into its product portfolio. This shift marked a significant milestone in the company's trajectory, prompting the emergence of UX design as a critical component in product innovation.

As the company ventured into new business areas, the role of UX evolved from a supportive function to a central pillar driving product strategies and outcomes. The integration of interaction designers and the establishment of a dedicated UX team underscored the growing importance of user-centric design principles in shaping the company's offerings. Despite organizational biases and the lack of collaboration protocols, the UX team established itself as a key influencer within the organizational structure.

Moreover, insights from Team 2 highlighted the relationship between UX design and organizational strategies. The UX team was formed and changed along with the adjustment of the product portfolio. By integrating UX in the overall product experience, the company was able to leverage the collective expertise of the UX team to drive innovation and deliver exceptional products and services that resonate with users.

4.2.5.3 Team 3 Refers to the Strategy Team.

Case Study 3 illustrates the journey of an strategy team, transitioning to the company's digital transformation in a more user-centric approach. The company recognized the importance of UX as it expanded globally and ventured into digitalization, driven by the need for precise operational management and seamless data integration. The establishment of a UX team to streamline operations and improve efficiency through digital platforms marked a pivotal moment in the company's evolution. The construction of the UX team involved systematizing

procedures, breaking down the digitalization mission into executable tasks, and integrating UX methodologies across various projects. Team 3 expanded rapidly with a focus on internal employees and business systems by undertaking multiple projects simultaneously and collaborating with different departments to ensure successful digitalization outcomes.

However, as digitalization progressed, the emphasis on UX diminished, leading to downsizing within the team. This shift prompted the team to prioritize promotional activities to highlight the value of digitalization and obtain recognition from internal stakeholders. The evolution of professional knowledge within the team reflected the changing demands of the stakeholders after the completion of major projects.

Knowledge sharing and reflection within the team were essential for collective learning and growth, although efforts in knowledge management were primarily driven by individual aspirations for promotion rather than improvement. Despite challenges in documenting and reviewing past projects, the team recognized the long-term benefits of knowledge management in fostering a culture of self-motivated learning and improvement.

Overall, Team 3 demonstrates ST features. The leadership in Team 3 was able to provide a clear vision and direction for the organization's digitalization efforts and make strategic decisions regarding the formation and structure of the UX team accordingly. In addition, leaders empowered the UX team by granting autonomy in project selection and decision making. Team members were allowed to choose projects based on their interests and contribute to the digitalization mission, fostering a sense of ownership and commitment. Leadership demonstrated adaptability and flexibility in responding to evolving needs and challenges. For instance, as some digitalization projects reached completion, leadership shifted the focus of the UX team to promotional activities to highlight the value of digital outcomes, showing an ability to pivot strategies based on outcomes and feedback.

4.2.5.4 Team 4 Refers to the Transformative Team.

Team 4 transitioned from a mere department within the corporate hierarchy to an independent entity with its own profit and loss accountability. This transformation signifies a strategic realignment toward prioritizing innovation and achieving UX excellence. Initially, the UX team operated within the corporate structure, primarily focusing on delivering design outputs such as prototypes, wireframes, and evaluations as per requests from other departments. The team functioned as assembly-line workers, with profits determined by the number of designers allocated to various projects. As the UX team developed, it sought breakthroughs by collaborating with external design firms and research institutes, embracing design principles and narratives from Europe. This shift toward innovation led to the development of novel concepts and projects, earning the team recognition within the organization.

With the team's growth, specialized subgroups were established, providing invaluable resource support and empowering the UX team to engage in innovative projects. The team positioned itself as a key driver of business success by aligning with the goals of other departments and demonstrating the strategic value of UX. Team 4 cultivated professional, project, collaboration, and organizational knowledge, fostering a culture of knowledge sharing and reflection. This well-developed knowledge benefits knowledge transformation inside and outside the team. In addition, the team’s possession of more types of knowledge and experience signifies and increase in UX priority.

Overall, Case Study 4 exemplifies the evolution of the UX team from a functional department to a strategic powerhouse, driving innovation and excellence across the organization.

4.3 The Applicability of The Results

While this study centers on UX teams within the Chinese high-tech industry, its findings are particularly applicable to mid- to large-sized enterprises that possess relatively mature UX infrastructures. The applicability may be limited in smaller firms, early-stage startups, or traditional manufacturing sectors where UX practices are less developed or loosely integrated. Although the research encompasses various sectors within the high-tech classification, the case study phase primarily focuses on the electronic product manufacturing segment.

The findings are deeply embedded in the specific characteristics of China's high-tech industry. Fast-paced product iteration, multi-stakeholder environments, and a strong emphasis on innovation and intellectual property all directly shape how UX teams are structured, how knowledge is generated and disseminated, and how interdisciplinary collaboration is enacted. These contextual factors contribute to a distinctive pattern of UX team knowledge development that may not be directly transferable to industries with lower technological intensity or slower innovation cycles.

4.4 Section Summary for the Two Phases

The key points from Phase 1 and Phase 2 of the study have been summarized in Table 4.3. This table serves as a comprehensive overview, capturing the critical findings and insights gathered during the research.

Table 4.3

Key Points in Phase 1 and Phase 2

Study Phase	Results	Category	Content
Phase 1	Team knowledge types	Professional knowledge	User perceptions; product thinking; creative skills; representation operation; scenario consideration; outcome criteria; collaborative toolkit
		Project knowledge	Team transparency; schedule; value identification; task goals; multitasking; team reflection
		Collaboration knowledge	Cross-department communication; alignment; design language; role identification; information flow
		Organizational knowledge	Probing problems; design norms and standard; templates and modules; leadership style; transfer of learning; industry experience;
	Two pair dimensions	Power-centralized and power-decentralized	Leadership style (how the UX knowledge is distributed)
		Pragmatic / instrumental and hedonic / non-instrumental reason	Reasoning style (how the UX knowledge is applied)
		Performance team	Professional knowledge

Study Phase	Results	Category	Content
	Team types	Operation team	Project and professional knowledge
		Strategy team	Project, professional, collaboration knowledge
		Transformation team	Project, professional, collaboration, and organizational knowledge
Phase 2	Case study 1	Performance team	Each team possessed distinct features that benefit the company at various stages, from beginning to maturity stage. Transformative team was perceived as the advanced team, characterized by decentralized leadership and a priority for hedonic design.
	Case study 2	Operation team	
	Case study 3	Strategy team	
	Case study 4	Transformation team	

Chapter 5: Discussion

This chapter discusses the answers to each research question in relation to the literature review and relevant studies. For the UX team knowledge framework, the discussion covers relevant study areas such as desired skills for UX practitioners, the features of explicit and tacit knowledge, T-shaped UX expertise, knowledge in different UX stages, and the nature of design knowledge.

Moreover, each case study is discussed by highlighting its distinct features. The transformative team is emphasized in relation to team creativity, coopetition, and power-decentralized leadership. Team agility and leadership transformation are the main aspects reflected in the performance team, while communication and collaboration are significant in the operation team. The strategy team is discussed by addressing the underestimated and devalued issues inside the organization. Apart from the distinct features in each team, their commonalities are also discussed, such as the importance of collaboration, sharedness, and team alignment. Finally, based on this discussion, a reflection on UX knowledge transformation is offered.

5.1 UX Team Knowledge Framework

To address RQ1: “What types of knowledge do UX designers apply in the UX team setting?” and RQ2: “How do UX designers articulate UX team knowledge?” this study developed the UX team knowledge framework to describe the understanding of UX designers regarding the knowledge required for UX team collaboration. This study established four knowledge circles with 24 components to represent the knowledge features and characteristics that exist in UX teams: professional, project, collaboration, and organizational.

There is a multifaceted and complex interplay between these four circles of knowledge. As stated by Ployhart (2004), transferring individual attributes such as knowledge, experience,

and skills to team knowledge is the goal. I observed that the knowledge components in the collaboration and organizational circles are more tacit and abstract, making them difficult to articulate and transfer clearly. In contrast, elementary-level UX designers could perform better in the project and professional circles. Particularly, professional knowledge refers to the individual knowledge of the UX designer, which is the foundation and precondition for teamwork.

This study proposed a UX team knowledge framework with four circles in high-tech industries by interviewing 16 team members and managers. However, Rose et al. (2020) proposed three desired skill sets for UX work by interviewing 64 UX practitioners: technical skills(UX standard), human skills(interpersonal matters) and disposition skills(internal motication).The difference between this study and Rose et al. (2020) lies in the respective focuses and methodologies.

While Rose et al. concentrated on identifying and categorizing desired skills for individual UX practitioners, this study synthesized a framework for understanding knowledge within UX teams. Unlike Rose et al., who primarily focused on individual skills, this study visualized different types of knowledge within UX teams as circles, illustrating their relationships with one another and with the broader team context. By mapping these connections, this study provides a comprehensive framework for understanding UX knowledge in a collective setting. Both studies contribute valuable insights to the field of UX design. Rose et al. offer detailed insights into the specific skills desired for individual practitioners, addressing subjective and individualistic dimensions. This study complements Rose et al.'s research by providing a broader framework that elucidates the collective knowledge dynamics within UX teams.

Furthermore, when UX designers work within teams, they are expected to possess a diverse range of knowledge spanning various dimensions, including profession, project, collaboration, and organization. However, articulating all the components within each dimension can be challenging, particularly when considering tacit knowledge, which is inherent in design work.

This knowledge poses two main challenges: acquiring and leveraging tacit knowledge from users, and reusing team members' tacit knowledge to generate new insights (Sun et al., 2024).

There are techniques for tacit knowledge acquisition in product design, such as the repertory grid technique, which involves collecting tacit knowledge based on different evaluations of the same subject and interviews, thus capturing tacit knowledge through storytelling (Sun et al., 2024). Through these techniques, UX teams can effectively acquire and leverage tacit knowledge to enhance their design processes and outcomes. Sun et al. (2024) provided practical strategies for addressing the challenges associated with tacit knowledge in UX design, complementing the theoretical framework developed in this study.

Notably, Rose et al. (2020) highlighted the importance of T-shape expertise, which indicates UX practitioners' broad knowledge in different fields as well as their profound experience in a specific area. Rose et al. also highlighted tacit knowing and personality characteristics as the fundamental attributes for career success and are difficult to teach. Other skills such as user research and sketching are easier to articulate and share. These findings align with this study, as the UX team knowledge is an interdisciplinary approach. Together, these results could help new graduates or individuals who want to enter the UX field work as a team player.

Regarding the particular stages in projects, Hokkanen et al. (2016) proposed a minimum viable user experience framework aimed at ensuring a positive user experience in the early versions of products, focusing on specific criteria within the product's user experience. The main elements of this framework include attractiveness, approachability, professionalism, and conveying the product idea effectively. This UX knowledge framework could serve as a reference for incorporating these elements into products through teamwork. However, while their study targeted small startups, this study focused on large high-tech companies.

Regarding the UX team knowledge circles, Dziobczenski and Person (2017) summarized the key skills for user interface designers, which include three categories: competence areas (digital design, film, and animation); knowledge and skills (process management, presentation, conceptual design, technical design, and software skills); and personal characteristics (self-driven, acumen, and design passion). As I could not find relevant studies that define the skill sets or knowledge of UX designers, I assume that knowledge varies in the teamwork context, where personal characteristics may not emerge as an apparent component that influences teamwork.

Nevertheless, Minder and Lassen (2018) discovered six dimensions about how designers work as facilitators in multidisciplinary innovation projects: a) designers are involved in project management; b) they engage non-designers in the decision-making process; c) they provide up-to-date information; d) they promote open innovation approach and accept new ideas; e) they introduce creative ideas; f) they have visual competence; g) they support co-creation and inclusion. Among these factors, new information, creativity, and visual competence are related to professional knowledge circles, which highlights the foundation requirements for UX designers or team. However, in this study, creativity mainly refers to generated creative ideas or outputs, while Minder and Lassen related creativity to how designers generate excitement and energy, and assist non-designers in generating ideas.

The UX knowledge framework raises the question of whether a unique concept of UX design knowledge exists. Cross (1982) proposed a "designerly" way of knowing that involves the process and product of design, with design knowledge inherent in artifacts that generate different types of knowledge. Conversely, Herriott (2023) argued that “what designers know is the same as finding out any other person’s way of knowing,” which concludes that the body of design knowledge is not exclusive to designers but accessible to anyone. More specifically, Herriott specified that designers’ linguistic communication and ways of knowing are not unique features of their minds. Even tools and methods could be entirely interchangeable in

the design discipline. Wang and Ilhan (2009) argued that design knowledge should not be isolated but should draw from common cultural knowledge to foster creativity. Similarly, Dziobczenski and Person (2016) stated that formal education might not be a precondition for becoming a graphic designer, but teamwork, project planning, creativity, and aesthetic skills are more crucial. In addition, designers are expected to use tools in various phases of a project by purposefully combining or selecting different tools to persuade relevant stakeholders (Tassoul, 2005).

Gray (2014) identified a few core design competencies for UX practice in a longitudinal study: multitasking, common vocabulary, design leadership, self-learning, understanding organizational culture, and adaptability. Among these competences, understanding organizational culture is the precondition to creating effective outputs within the bureaucracy. To some degree, this study is consistent with these findings; for example, multitasking and design language are crucial in the project and collaboration knowledge circles. Gray concluded that UX competence is fluid and contextually dependent. It is shaped by personal factors, organizational influences, and the collaborative efforts of individual designers. Similarly, UX team knowledge is also context dependent and influenced by the organizational culture, leadership, and reasoning style.

Overall, whether “there is a designerly way of knowing” or “there is no such thing as the designerly way of knowing” is debatable. However, this study has found that only a few knowledge components are exclusive to UX, such as representations, scenario considerations, and design languages. Other compositions, such as knowing the users, alignment, transfer of learning, and cross-department communication, may also apply to other professions. This finding may inform future UX knowledge evaluation for pedagogy and practice.

5.2 Knowledge Distribution in Four Team Types

After discussing the circles and descriptions of knowledge, four UX team types were identified using two dimensions: power centralized / decentralized and pragmatic (instrumental) / hedonic (non-instrumental). This classification addresses RQ3: How is knowledge distributed within UX teams? To clarify knowledge distribution, Power centralization refers to leadership style, which creates a unique power dynamic in each team regarding knowledge distribution. Meanwhile, the pragmatic and hedonic concept highlights product features by considering the distinctive attributes and user relations with a certain product.

Each circle of knowledge plays a unique role in influencing UX teamwork and guiding the design process. Professional knowledge provides the skills and expertise for designing user-centered solutions, while project knowledge enables adaptation to specific project requirements. Collaboration knowledge fosters effective teamwork and communication, while organizational knowledge offers general design guidelines and makes the design knowledge more sustainable by transfer of learning. Together, these four circles of knowledge form the foundation for successful UX teamwork and the delivery of impactful user experiences.

The knowledge composition for each type of team, their responsibilities, and their position in companies are highlighted. PT and OT exhibit power-centralized leadership styles, where decisions are primarily made by experienced team leaders. PT operates with a pragmatic and instrumental reasoning style, emphasizing value fulfilment of projects, especially in project initiation stages. However, PT may encounter resistance from other departments due to the long-term nature of UX improvements and the lack of user-centered design awareness inside the company. In contrast, decision-making in OT is influenced by stakeholder and top management needs, reflecting a pragmatic approach to meeting project requirements over

optimizing design outcomes, leading to low recognition and appreciation of UX teams from other teams.

On the other hand, ST and TT adopt power-decentralized leadership styles. ST focuses on efficiency and competition, aiming to narrow the gap with competitors through agile development processes. This approach, while fast-paced, may raise questions about the meaningfulness of work and achievements among team members. In contrast, TT operates in a hedonic and non-instrumental reasoning style, driven by user satisfaction and business growth. TT emphasizes collaboration and active knowledge sharing, promoting innovative solutions and strong team commitment.

In terms of design process rules, PT and OT rely heavily on leader preferences and minimal team member involvement. PT emphasizes professional knowledge to ensure guaranteed outputs, while OT focuses on project and professional knowledge. However, their design strategies are dictated by leader preferences, leading to minimal input from team members. In comparison, ST allows for decentralized leadership, offering flexibility in goal setting and decision-making, driven by business objectives. TT stands out due to collective decision-making, promoting fairness and commitment among team members.

Each UX team type showcases distinct leadership and reasoning styles, influencing their approach to UX work and the design process. While PT and OT prioritize efficiency and meeting project requirements, ST and TT focus on collaboration, innovation, and user satisfaction, shaping their unique contributions to the UX design landscape in organizations.

In relevant studies about knowledge distribution, Zaina et al. (2021) demonstrated the UX information distribution in agile teams, with the interactions between members of the team, project owners, and user interface/UX designers on three levels to explain information flow: the “how” level indicates information identified in the artifacts; the “what” level refers to user

stories and verbal communications between team members to articulate the technical and business information instead of considering users' needs; and the "why" level is seldom presented in artifacts but mainly mentioned in oral communications. In the current study, I focused more on the components of the UX team knowledge than on how knowledge flows in the team; however, team communication was significantly highlighted in both studies. Similarly, Leinonen and Roto (2023) emphasized the pivotal role of communication in transferring knowledge from the service design team to the UX design team. They highlighted the amount and quality of communication as a crucial medium for knowledge transfer, depending on the direct interaction among teams, shared task information, and team autonomy in decision-making. The current study aligns with this research, as cross-departmental communication is one of the core components of collaborative knowledge in UX teams.

However, Zaina et al. (2021) found that agile team members tend to be passive receivers of information instead of actively playing a role in its creation, particularly regarding information related to user needs or goals, which are undervalued by members. This study indicates that user perceptions are crucial components in setting common ground for effective UX outcomes and that team members are obligated to contribute to understanding users.

Leadership style influences team efficiency, creativity, and performance (Giffen Cheng & Wang, 2017; Gong et al., 2009; Javed et al., 2021; Wu et al., 2022). More specifically, knowledge generation and application increase by giving more autonomy to staff in the decision-making process (Pertusa-Ortega et al., 2010). Lee et al. (2021) suggest that knowledge centralization negatively affects R&D team performance by hindering knowledge sharing, development, and accurate knowledge evaluation, as members are unable to access crucial knowledge and distribute it in the decision-making process. However, the current study supports that a lower level of power centralization may motivate UX designers to contribute to teamwork by proceeding with ideas, proposals, design problems, and

experiments. I argue that a UX team with a power-decentralized leadership would be the ideal team type for knowledge performance or distribution. However, I also admit that each team type functions differently, and the company's development stage and goals may affect the structure of team knowledge.

In brief, the design management literature covers managing design teams, collaborative processes, design methods, and promoting design at the organizational level (Kramoliš & Staňková, 2017). Among them, how teams learn and reflect their knowledge facilitates the co-creation of team knowledge (Tan et al., 2023). This study can help UX practitioners in selecting, mobilizing, and integrating into suitable teams and their knowledge by presenting how teams articulate and distribute their knowledge. It also identifies the composition of UX knowledge and how the transformation of teams can be applied both inside and outside of China.

5.3 Distinct Features in the Four Case Studies

Following the Phase 1 study, I use four case studies to validate the results and provide further explanation to address RQ4: How do different types of knowledge shape and characterize different UX teams? In Phase 2, I presented four case studies, each illustrating a distinct UX team type.

I have systematically discussed each team by extracting their unique features and knowledge characteristics. Each team is dedicated to addressing different challenges and strengths in various company development stages. Choma et al. (2022) examined UX factors in Brazilian software startups on a broad scale, summarizing four dimensions influencing UX work—business and market, UX work and teams, product and process, customers and users. Comparatively, this thesis focused more specifically on team knowledge and collaboration.

This focus allowed for a deeper understanding to guide UX practices and management within the high-tech industry.

The evidence suggests that the most advanced UX team is the transformative team, as it maximizes team creativity, which is defined as a collection of new and useful ideas generated at the team level. It surpasses a simple aggregation of individual ideas to encompass innovative outcomes resulting from collective decision-making, considering various perspectives (Dong et al., 2017). Team creativity serves as the source of team value contribution and is crucial for addressing multiple uncertain problems, thus playing a fundamental role in venture success (Kratzer & Mrożewski, 2021; Rong & Liu, 2022). Learning orientation is the crucial aspect in improving team creativity by supporting intrinsic motivation (Khedhaouria et al., 2017). When team members possess intrinsic motivation, they are more likely to view time pressure as a positive incentive or challenge; however, when the time pressure is too high, team members view it as an obstacle (Khedhaouria et al., 2017). A suitable amount of time pressure could motivate members to fulfil their work in a short period, which could nourish achievement motivation, which is a supporting variable in generating more creative outcomes (Wu et al., 2022).

The accumulation of knowledge across the four circles facilitates the combination and transformation of knowledge, thereby fostering team creativity. This process is particularly effective under power-decentralized leadership and a hedonic approach.

5.3.1 Performance Team

In Team 1 (performance-oriented team), agility plays a crucial role in navigating the competitive global market, particularly in the early stages of the firm's development. Team agility refers to how quickly a team can respond to market changes, seize opportunities, and meet customer demands by leveraging its advantages (Breu et al., 2002; Christopher, 2000; Swafford et al., 2006). Agility enhances a firm's competitiveness by facilitating the

achievement of strategic goals, reducing costs, and improving responsiveness (Swafford et al., 2006). Time pressure can enhance team agility; however, it may lead to decreased product quality if not managed effectively. One approach to enhancing team agility is by increasing team empowerment through intrinsic work motivation, self-determination, and competence (Kirkman et al., 2004). Strong empowerment fosters cognitive flexibility and enables creative responses to urgent issues (Lashley, 1999; Swenson, 1997), leading to confidence, decisiveness, and greater independence in decision-making among team members rather than relying on team leaders (Yang & Choi, 2009).

In Team 1, leaders were determined to encourage swift responses in team members. However, they did not provide sufficient psychological empowerment, which is crucial for fostering team agility. Psychological empowerment involves methods that make team members believe in their capabilities, creativity, and ability to make the right decisions. Empowerment has been shown to be positively correlated with team agility, as it encourages proactive behaviors such as adaptability, resilience, and flexibility (Thomas & Velthouse, 1990). Empowerment is thus essential for enhancing team agility, particularly in companies at the early stage of UX development. Moreover, team empowerment enhances overall team performance by motivating members to execute daily tasks effectively and on schedule (Biron & Bamberger, 2010; Mathieu et al., 2006). However, Team 1 faces a challenge as it pursues innovation, which requires long-term investment rather than moving in an agile way.

In pursuit of UX expertise to differentiate itself from competitors, Team 1 must transform its leadership from a power-centered approach to a transformational one. Transformational leaders inspire and motivate their followers by creating a shared vision, fostering a sense of belonging and commitment, and encouraging innovation and creativity (Charbonnier-Voirin et al., 2010; Liu et al., 2015; Pieterse et al., 2010). Management should prioritize a culture of empowering team members by involving them in significant decision-making processes and providing recognition, power, and rewards (Liu et al., 2015). While restructuring the culture

of empowerment may be challenging for the firm, it is essential for improving team performance and agility significantly. Encouraging members to learn from each other, providing timely constructive feedback, empowering them with authority over their work, fostering healthy competition, and trusting their decisions are all crucial steps in this process.

5.3.2 Operation Team

The operation team in Case Study 2 encountered challenges related to integration and collaboration with other teams. Consequently, the team sought to enhance collaboration by engaging in the early stages of product development, collaborating closely with product managers and the engineering department. This approach resonates with findings from previous UX research, such as Kashfi et al. (2017), which highlight communication and collaboration as key challenges for UX practitioners working alongside non-UX teams. By involving themselves early in projects, UX teams can bridge knowledge gaps between different roles and negotiate trade-offs between technical constraints and design concepts. However, this proactive involvement can also lead to power struggles, as different teams may have varying motivations, decision-making preferences, and constraints within their respective responsibilities.

5.3.3 Strategy Team

Team 3 was primarily responsible for internal business products, and its main challenge involved proving the value of UX following the implementation of major projects. This struggle resonates with the findings of Kashfi et al. (2017), who highlighted a prevalent issue in UX: Stakeholders often underestimate its value. This study summarizes the challenge as a "lack of consensus on the value of UX." Further elaboration reveals that in market-driven products, factors such as appearance, branding, and emotional appeal are paramount to end-users, thus emphasizing the importance of UX. However, in functionality-focused scenarios, it becomes more challenging to articulate the value of UX. Choma et al. (2022) noted a similar lack of consensus on UX value in startup environments. These findings underscore a common

theme across various contexts: Regardless of company size, the lack of consensus on the value of UX remains a significant issue.

Team 3 also demonstrates that UX teams can be flexible in their roles. Digitalization and publicizing UX outputs inspire team members to plan in the long term to demonstrate UX value. Especially for business-to-business UX team, encourage users to utilize the system after completion of project is crucial for the UX contribution significance.

5.3.4 Transformative Team

Team 4 operated within a large high-tech company that fostered competition among UX teams. This competitive environment required teams to pitch design proposals to project managers, who then decided which team would be assigned to the project. However, If a company emphasizes only competition, it becomes challenging for individuals to perceive common goals and collective interests. This emphasis may hinder the chance or motivation for team members to share their knowledge and resources. Moreover, competition is inherently focused on achieving victory and surpassing others. When team members perceive that achieving their goals conflicts with those of other teams, it can detract from overall team operations in the long term. This is especially true when team members regard each other as rivals, leading to behaviors such as concealing information and ideas (Deutsch, 1992; Johnson & Johnson, 1989).

Excessive competition reduces team performance when cooperation is absent in the organization; however, a controlled level of competition with cooperation could have positive effects in team performance (Liu et al., 2015). Moreover, coopetition positively affects innovative performance in digital industries by encouraging resource sharing and promoting common goals among and between teams (Liu et al., 2015) . In digital ventures, especially, coopetition influences innovation and agility performance (Guo et al., 2023). The leadership in Team 4's company is more power-decentralized, which promotes cooperation and fosters

team belonging and a sense of achievement through autonomy. Coopetition encourages knowledge sharing, communication, and supportiveness in a coordinated way to achieve team goals by improving team strengths (Johnson et al., 1981). Coopetition requires effort to build up as it does not show simultaneously with competition.

5.3.5 Comparison of four cases

Team 4 seems to be the ideal version of UX teams and stands out from the other teams with its decentralized leadership and emphasis on hedonic design. Unlike the other teams, which initially operated within a corporate hierarchy, Team 4 transitioned to an independent entity, granting it more autonomy and decision-making authority. This decentralization of power enabled Team 4 to focus on fostering creativity, enjoyment, and aesthetic appeal in their design processes. In addition, Team 4 was the only case that could collaborate with external firms to leverage UX strengths, ultimately helping those firms improve efficiency and user satisfaction. This method scales UX knowledge beyond internal influence and monetizes UX as an intellectual property, thus increasing profits.

In contrast, the other teams exhibited varying degrees of centralized power and pragmatic approaches to UX. Team 1, for example, highlighted a team operating within a hierarchical corporate structure, where UX was initially viewed as a functional unit. Meanwhile, Team 2 depicted a team striving to broaden its responsibility scope within the organization, balancing the need for collaboration with other departments and meeting the expectations of product development. Similarly, Team 3 showcased a team navigating the challenges of digital transformation within a company, focusing on operational efficiency and integration rather than creativity and encountered downsizing. Notably, Team 3 and Team 4 both need to demonstrate their value. Team 3 needs to prove its digitalization outcomes and value to internal employees by encouraging them to use the digital system, whereas Team 4 needs to demonstrate its value both inside the firm and to external clients to increase profit.

Overall, Team 4 represents transformation team with decentralized power leadership and emphasis on hedonic design set it apart from the other teams, representing a shift towards a more innovative and user-centric approach to UX within the organization. Although each team faced unique challenges and priorities, Team 4's evolution toward greater autonomy and creativity suggests a potential model for fostering a more dynamic and impactful UX practice.

Based on the four case studies, the evidence suggests different types of knowledge, UX strategy, and tendencies are required in different project stages. In particular, apart from the knowledge heterogeneity difference, the inherent differences between different teams are highlighted.

5.4 Different Roles in Each Stage

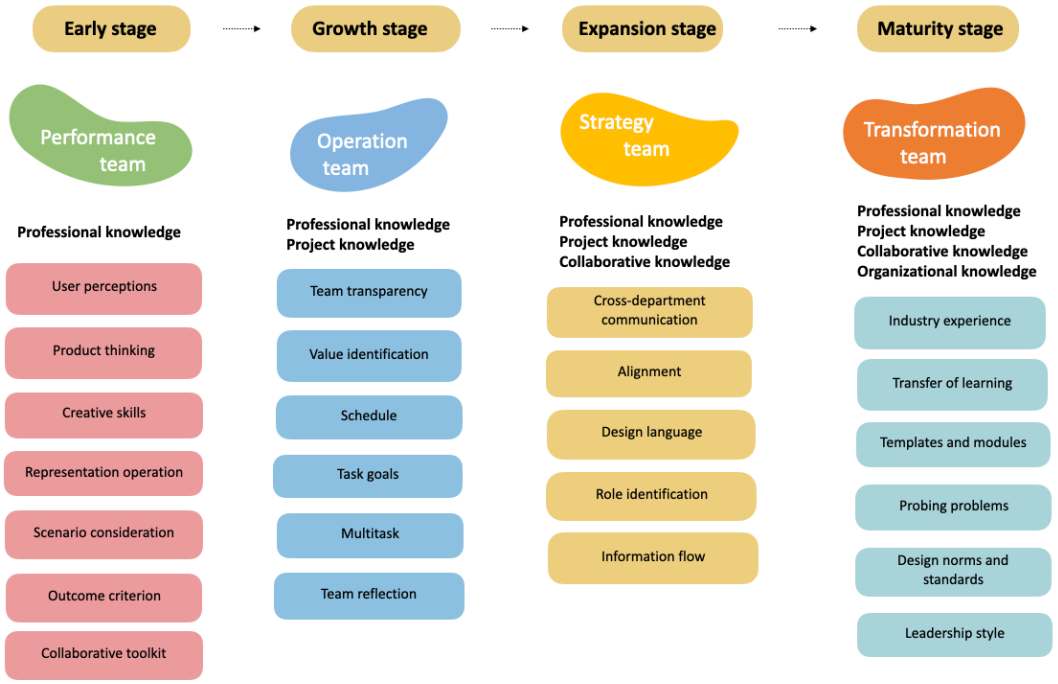
The four UX teams analysed in this study represent different developmental stages of company growth, based on their structural characteristics, leadership styles, and knowledge practices (Figure 5.1). This section draws connections between the team types (PT, OT, ST, TT) and typical company growth stages—early, growth, expansion, and maturity—to provide a conceptual lens for understanding how UX teams evolve alongside organizational development.

To ensure analytical validity, the selected teams were drawn from large-scale enterprises within the Chinese high-tech industry—specifically, from sectors such as electronic product manufacturing, software development, and communication technologies. These companies share similar industrial characteristics, such as rapid iteration cycles, cross-functional collaboration, and a strong emphasis on innovation. All case studies involved both UX designers and team managers to capture a broader spectrum of internal dynamics and ensure internal reliability of the data. While interviews did not include top-level executives, the team

managers provided valuable insights into how UX work is positioned within the company strategy and operations.

Figure 5.1

Team Roles



Early Stage

In the early stages of company development, a PT may be beneficial for quickly establishing a strong UX foundation to help the company increase its competitiveness. PTs can efficiently navigate the initial challenges of product and UX with power-centralized leadership, where team members' opinions are less involved. Leaders focus on rapidly iterating designs and make quick decisions to ensure the product meets user needs and market demands.

Growth Stage

As the company enters the growth stage, an OT may become more relevant, especially when there is a need to scale operations and manage multiple projects simultaneously. With power-

centralized leadership and a pragmatic reasoning style, OTs prioritize meeting project requirements and efficiently delivering results. They adapt to changing market dynamics and stakeholder needs, ensuring the smooth execution of UX initiatives across various projects. However, when the company expands into new markets, OTs may face challenges in adapting to diverse customer needs and cultural contexts. Their pragmatic reasoning style may prioritize efficiency over empathy, resulting in decreased customer satisfaction.

Expansion Stage

STs are well-suited to navigate the complexities of scaling the business by reorganizing the business system. STs align UX efforts with strategic business goals, utilize power-decentralized leadership, and focus on improving operations efficiency. STs foster collaboration across teams and departments, leveraging UX insights to gain a competitive edge in the market. However, STs may struggle to transform their capacity from efficiency-driven approaches to meet end-users' needs and preferences.

Maturity Stage

In this stage, TTs emerge as a key driver of long-term success and sustainability, with power-decentralized leadership and a hedonic reasoning style focused on user satisfaction and business growth. TTs make initiatives to enhance the overall user experience and drive business growth by dedicating to user-centered design. Moreover, TTs prioritize collaboration, innovation, and continuous improvement, positioning the company for continued growth and success in the long run.

In summary, while the four teams differed in size and internal structures, they operated within comparable industrial and organizational environments. The alignment of UX team types with company development stages is not meant to suggest a rigid progression model, but rather to offer a heuristic for understanding how different forms of UX team knowledge and collaboration become more or less effective depending on the company's developmental

needs. Understanding these dynamics can help organizations proactively identify potential challenges and reconfigure UX team structures to better support evolving business goals.

5.5 Commonality Between the Four Teams

In high-tech industries, Kilduff et al. (2010) observed a prevalent phenomenon: competition within teams despite apparent collaboration and knowledge sharing. Similarly, this study has found that all four teams experience internal competition to some extent, primarily due to reward systems and key performance indicators evaluating UX designers' outputs.

Regarding collaboration, Kashfi et al. (2017) state that UX practitioners often become involved in the later stages of project development in software development. In this study, all the teams are involved in the early stages of projects, where UX designers initiate ideas by collecting demands from users or market departments. This shift could be attributed to the belief that early involvement of UX in large high-tech companies facilitates more effective changes in UX. Nonetheless, even with early involvement assured, UX teams may become disconnected from projects in later phases. Therefore, active involvement throughout the project is essential to ensure the visibility of UX designers. However, this visibility may result in power struggles with other teams due to opinion conflicts, differing motivations, and ownership of decision-making (Kashfi et al., 2017). While previous studies report UX challenges and usability issues, this study indicates that UX knowledge is evolving to address these challenges. Different teams have different concerns and struggles with relevant knowledge regarding collaboration, communication, and promotion. However, these concerns or struggles are situational rather than general, with this study providing additional insights to Kashfi et al.'s (2017) emphasis on UX challenges in general.

In this study, all UX teams exhibited a high level of maturity but operated within different company phases or with varying UX requirements. Performance teams, possessing

professional knowledge, could benefit the firm's early stages, while operational teams, with project expertise, contribute to a broader project portfolio. During expansion, strategy teams align with changing business goals, while transformative teams, equipped with diverse knowledge, foster innovation. As companies grow, interdisciplinary capacity becomes crucial for UX teams, reflecting the evolving demands across different development stages.

Regardless of the development stage, team alignment emerges as a critical factor in shaping shared mental models. Alignment is the process of reconciling diverse perspectives within a project team to collectively undertake actions aimed at achieving outputs (O'Leary & Williams, 2013). There are several ways to foster alignment in project work (Van der Hoorn & Whitty, 2017): 1) Pay attention to stakeholders' personal motivations or interests to cultivate strong interpersonal connections through informal interactions such as coffee breaks, attending birthdays, or sharing humor; 2) present ideas and offer guidance to team members; 3) and provide space for stakeholders to propose solutions or insights. Through these actions, shared mental models can be enhanced. As proposed by Cannon-Bowers et al. (1993), shared mental models facilitate coordination by aligning task and team-related knowledge among team members. Shared mental models have been emphasized in design research for effectively utilizing distributed and shared knowledge (Bierhals et al., 2007). Three major factors affect the outcome or quality of team shared mental models: sharedness, accuracy, and importance (Badke-Schaub et al., 2007).

Sharedness encompasses both overlapping and divided knowledge. In some situations, overlapping knowledge proves more relevant in solving design problems, while in others, specialized knowledge becomes necessary, especially in heterogeneous teams. Excessive common or distributed knowledge can hinder team performance by hindering creativity or divergent thinking. Therefore, achieving a balance of sharedness is imperative and requires evaluation of factors such as the team's environment, task features, and team maturity.

The accuracy of a mental model is paramount for its quality, regardless of whether all team members share it. Team agreement on a mental model does not guarantee its accuracy. Moreover, accuracy and sharedness are intertwined: accurate mental models must be shared among team members. However, they are distinct concepts, both influencing team performance. In structured tasks, accuracy can be measured by comparing individual mental models to expert models. On the other hand, in ill-structured problems, where no clear solution exists, it is more difficult to assess accuracy. In such cases, researchers recognize the potential existence of multiple accurate models. In contexts with multiple effective approaches, similarity among team members' mental models may outweigh accuracy.

Alignment in the collaboration knowledge and task goals in the project knowledge from this study underscore the importance of shared mental models, as they significantly impact team performance quality, particularly in fostering alignment, having common goals, cross-departmental communication, and value identification within project and collaboration knowledge circles. Moreover, Kou and Gray (2018) emphasize the necessity for UX professionals to gain recognition both internally and externally within the organization. The findings of this study echo this statement, highlighting recognition as a pivotal factor for the team's success, extending beyond the mere outcomes of UX endeavors.

5.6 Knowledge Sharing and Reflection in UX Teams in a High-Tech Industry

Knowledge sharing and reflection are crucial for team collaboration and innovation within UX teams. Various factors influence how teams share knowledge. For instance, Caglar et al. (2022) identified the following contextual factors in UX work: task, temporal, social, technical, and physical. Additionally, Saad et al. (2021) argued that key skills for UX work include collecting knowledge, interpreting user feedback, and analyzing user information.

Leinonen and Roto (2023) summarized four knowledge transfer problems from service design to agile UX that are relevant to this study:

1. Lack of incentives to transfer knowledge in the implementation stage due to communication barriers among teams.
2. Customer needs and UX experiences are explicit and difficult to transfer.
3. Communication is not inspiring, especially when the information context is unclear.
4. Communication errors occur when there is low applicability of information for the senders and receivers.

In this study, four circles of knowledge—professional, project, collaboration, and organizational—were shared and transferred mainly through project collaboration and completion. Meetings, procedures, criteria, and standards were applied, allowing team members to share common knowledge and learn from each other. However, traditional methods such as presentations, meetings, articles, documents, and workshops are predominantly used for UX team knowledge sharing. None of the participants in this study reported using a specific design knowledge management system for sharing or archiving documents.

One explanation for this is that UX knowledge is embodied in people with specific context. During knowledge sharing or transfer, knowledge richness can diminish, as second-hand information is less motivational than first-hand information (Leinonen & Roto, 2023). Context and first-hand experience are crucial for knowledge sharing and reflection. For instance, in the case study, Team 1 encouraged employees and top managers to conduct field research to collect user needs and observe the context. This first-hand experience made the information more sustainable and motivational for later-stage idea implementation. Another explanation is that UX knowledge is inherently explicit and difficult to articulate, as demonstrated in some design knowledge models.

The unified model of design knowledge categorizes knowledge into four levels (Thoring et al., 2022): artifact knowledge, design intuition, design language, and design theories. These levels can be transformed from one to another, determined by four knowledge qualities: situatedness, expertise, diffusion, and content. This model emphasizes the hierarchical layers of knowledge, highlighting the progression from basic to advanced understanding. However, tangible artifacts are concrete and easily perceived, whereas abstract theories and intuition depend on the member's expertise and are difficult to share. Both Leinonen and Roto (2023) and Thoring et al. (2022) underscore the importance of context or situatedness for effective knowledge transfer and sharing.

In this study, the UX team knowledge framework was created, focusing on different knowledge areas needed within UX teams and stressing the importance of professional, project, collaboration, and organizational knowledge for effective UX work. While the unified model of design knowledge provides a high-level view to understand the progression and diffusion of knowledge, the UX team knowledge framework offers a practical approach addressing specific knowledge needs and interactions within UX teams.

In a broader scope, the fifth order of design knowledge suggests that design has evolved from focusing merely on things to emphasizing relationships and creating conversations between different groups (Mortati, 2022). Buchanan (2001) previously addressed that design could shape social structures. Neely and Mages (2024) proposed the concepts of "entrainment" and "super unit" to emphasize the unity in human collaboration. Gray and Kou (2019) summarized how UX knowledge is extended and strengthened on social media sites by breaking disciplinary boundaries toward flexibility, helping UX practitioners incorporate this knowledge into project practice. To some degree, knowledge sharing on social media represents the co-creation of UX knowledge. In this study, UX practitioners share relevant knowledge not only within teams but also openly, boosting occupational development.

This study agrees with Mortati (2022) that delivering outputs is not the most relevant aspect of design; problem-seeking is a new knowledge area. Additionally, new methods and tools are crucial agents in the design process. This observation aligns with the scope of UX team knowledge, where problem-solving is only one part. Probing problems from a broader perspective that benefits stakeholders or society is a major responsibility requiring competence through integrating new tools and methods.

By analyzing and reflecting on this study's results, a means of restructuring UX team knowledge emerges. Developing design involves restructuring knowledge to make the design process more inclusive and participatory rather than centered solely on UX designers. Balancing information from different perspectives is challenging but crucial for design leadership (Quint et al., 2022).

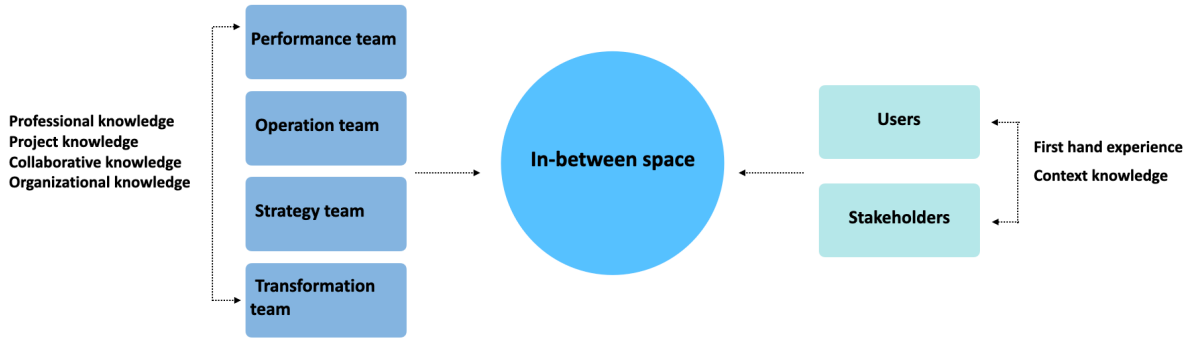
The four circles of knowledge and team development indicate that knowledge sharing, and reflection should involve users more in the design and decision-making process, offering holistic user stories rather than relying on second-hand information. Manzini (2015) emphasized the significance of collaboration and co-creation in the design process, encouraging designers to work closely with users and stakeholders to ensure effective and sustainable designs. Collecting first-hand experience and context-rich information helps team members understand user needs and each other better, making knowledge sharing and transfer easier with a common contextual ground.

Moreover, Salmi and Mattelmäki (2019) suggested an "in-between space" where co-design is experimented within the organizational context, bringing co-design facilitators and organizational practitioners together in workshops to create new collaboration methods that shape innovation. Thus, knowledge related to co-design and its meaning may become a crucial component for UX teams, as it facilitates the co-initiation and co-creation of new design problems and solutions. Figure 5.2 presents a visual map showing the "in-between

space" for knowledge sharing and collaboration in UX teams. It connects different types of UX teams on the left with users and stakeholders on the right. The "in-between space" in the center appears to act as a bridge for interactions, facilitating the exchange of different types of knowledge, including professional, project, collaboration, organizational, context knowledge and first-hand experience.

Figure 5.2

In-between Space for Future Knowledge Sharing



In summary, some actions can be used for better knowledge sharing and transfer in UX teams: promote open communication and co-creation with users; encourage team members to collect first-hand UX information; and highlight the importance of context and situatedness in different project stages. Ultimately, the goal of knowledge sharing and reflection is to help UX teams to navigate the complexities of design leadership and drive innovation in the high-tech industry.

5.7 Artificial Intelligence in UX Teams in the High-Tech Industry

Integrating artificial intelligence agents in UX teams was mentioned frequently in the four case studies as an opportunity for problem solving and performance improvement. However, the concern is that although AI could be effective in solving task-specialized problems,

humans are still required to cope with complexity (Jarrahi, 2018). Therefore, team members can equip with the relevant knowledge to use AI as a complementary method.

Demir et al. (2018) examined the difference between teams with AI and without AI and found that teams equipped with AI had more agility in an evolving situation. Although AI integration could benefit team performance in the same way as cooperation or transformation leadership, it is unclear how the assistive AI will affect team agility in problem-solving processes. Previous evidence has shown that AI assistance in teams exhibits significantly more agility than human-only team in terms of response speed and quality of solution, specifically during changes (Song et al., 2022). The reasons that AI-assisted teams increase agility are (Song et al., 2022):

1. AI agents help designers consider more options by reallocating designers' effort from generating more design solutions to cognitive activities such as discussing the solution with stakeholders.
2. Communication quality in AI assisted teams is superior due to team members handling information more carefully. Moreover, swift coordination improves agility and team performance.
3. AI-assisted teams entail more solution space and greater cognitive flexibility by eliminating design fixation.

Particularly, AI increases the initial performance in low-performance teams but deter high-performance teams (Zhang et al., 2021). AI may cause high-performance teams to become too lazy to explore solutions by over-evaluating their successes in achieving design tasks, which ultimately results in inferior performance.

In this study, most designers mentioned that AI can take over some low-effort tasks, but the core knowledge that UX designers possess, such as understanding users, markets, industries, and stakeholders, is beyond AI's capability. As Polanyi (1966) stated, tacit knowledge, which includes intuition, insights, instincts, and procedural skills or memories, is difficult to articulate and express. In design, capturing and verbalizing tacit knowledge is particularly challenging. This study acknowledges that the two phases of data collection may not be fully able to capture the tacit knowledge within UX teams. However, this tacit knowledge is what makes each individual competitive and shapes different team dynamics.

Given the fast-paced and rapidly evolving nature of technology, it is imperative to investigate how emerging technologies such as AI and generative AI influence UX team knowledge sharing, collaboration, decision-making, and project outcomes. Understanding the implications of these technologies for UX management is essential for maintaining awareness of industry trends and best practices. Consequently, UX professionals in high-tech companies must stay updated with latest industry advancements, emerging technologies, and best practices in UX design.

In future UX education and practice, the integration of AI into UX teams may have both short-term benefits and long-term implications. The integration of AI into UX teams has the potential to enhance problem-solving processes, improve team agility, and foster innovation. However, careful attention must be paid to the balance between human and AI capabilities, the quality of communication and collaboration within AI-assisted teams, and the long-term effects of AI integration on team performance. These factors require further investigation and consideration in future UX education and practice.

Chapter 6: Conclusion

6.1 Summary of Research Findings

This study was based on relevant models and theories in UX knowledge sharing and creation, UX designers and teams, and design knowledge. While most studies address UX management within an organizational scope or UX designer competence within an individual scope, there is a lack of inquiry into UX team knowledge research. In particular, in design projects, a project is delivered by the team's effort, and the knowledge or competence required within the team may vary from the knowledge required by an individual designer. Additionally, the team is the critical unit for collaboration and management. Nonetheless, there is a lack of research focus on UX teams that could properly indicate the relevant UX knowledge in a collective setting. Thus, the key question emerged: “What constitutes UX team knowledge?” Based on this question, four research questions were proposed to bridge the gap by presenting detailed descriptions of UX knowledge and its utilization in teamwork. The study also elaborated on how knowledge is distributed and utilized within UX teams.

A two-phase study was conducted to answer the research questions. In Phase 1, 16 UX designers were interviewed to generate the UX team knowledge framework and create the four quadrants to represent four types of teams with various types of knowledge. In Phase 2, four in-depth case studies were conducted to verify and explain the UX team knowledge in a real-world setting by interviewing 4 UX members and 4 UX leaders. The detailed answers to each research question are as follows.

RQ1. What types of knowledge do UX designers apply in the UX team setting?

The UX team framework developed to answer this question consists of four circles—professional, project, collaborative, and organizational—each representing different components of knowledge. Professional knowledge serves as the foundation, providing the expertise necessary for minimum performance. Project knowledge enables teams to adapt to

project-specific requirements. Collaboration knowledge fosters effective teamwork and communication, while organizational knowledge provides insights into the broader context, guiding decision-making and aligning design efforts with organizational goals. Together, these four circles of knowledge form the foundation for impactful UX, ensuring that design decisions are informed by best practices, industry standards, and user-centered principles, ultimately leading to successful project outcomes and continuous innovation in UX practices. The framework offers a fresh perspective for UX practitioners to reflect on their knowledge and presents a novel approach for enhancing collaboration within UX teams.

RQ2: How do UX designers articulate UX team knowledge?

After four major circles of knowledge and relevant components were revealed, the detailed description for each circle and component was listed. In total, there are 24 components:

1. Professional knowledge: user perceptions; product thinking; creative skills; representation operation; scenario consideration; outcome criterion; collaborative toolkit
2. Project knowledge: team transparency; value identification; schedule; task goals; multitask; team reflection
3. Collaborative knowledge: cross-department communication; alignment; design language; role identification; information flow
4. Organizational knowledge: industry experience; transfer of learning; probing problems; design norms and standards; templates and modules; leadership style

This finding provides insights into the various components of UX teams, highlighting the importance of each in contributing to successful collaboration and project outcomes.

RQ3: How is knowledge distributed within UX teams?

After the coding process, four team types were identified to indicate the knowledge distribution according to two pairs of dimensions: power-centralized vs. power-decentralized and pragmatic/ instrumental vs. hedonic/ non-instrumental. Four types of UX teams—performance team, operation team, strategy team, and transformative team—have explained the diverse leadership styles, knowledge distribution methods, and reasoning processes that influence their approach to UX practice and organizational dynamics. Both power-centralized and power-decentralized leadership styles exhibit unique strengths and weaknesses about knowledge sharing and creation, shaping their contributions to the UX design in organizations. Contextualizing these findings within different stages of company development—early stage, growth stage, expansion stage, and maturity stage—provided actionable insights for companies to optimize the UX team settings and navigate the challenges and opportunities inherent in each stage.

RQ4: How do different types of knowledge shape and characterize different UX teams?

Four case studies were conducted to answer this question and offer valuable insights into the challenges and dynamics faced by UX teams operating within different organizational contexts. Each case study highlighted unique aspects of leadership, collaboration, empowerment, and the perception of UX value.

Team 1, representing PT, operated within a hierarchical corporate structure, emphasizing hedonic features but facing the challenge to innovate and differentiate itself in a competitive market. The team's evolution involved recruiting experts and fostering interdepartmental collaboration to meet market demands. PT emphasized team agility and the importance of quickly responding to market changes and customer demands. However, the lack of psychological empowerment hindered the team's ability to fully leverage its agility. This case underscores the significance of empowering team members to foster creativity and adaptability, ultimately enhancing team performance and agility.

Team 2, corresponding to OT, underwent a transformative shift toward user-centric design principles amid the company's strategic expansion into new business areas. Team 2 highlights the challenges of integration and collaboration within cross-functional teams. Early involvement in projects was identified as crucial for overcoming knowledge gaps and negotiating trade-offs between technical limitations and design concepts. This case supports the importance of effective communication and collaboration among teams to achieve successful project outcomes.

Team 3, embodying characteristics of ST, navigated the complexities of digital transformation within the company, with UX evolving from a supportive role to a central focus in streamlining operations and improving efficiency. Team 3 delineated the team's struggle to prove the value of UX within the organization, a common challenge highlighted in previous research. The lack of consensus on the value of UX underscores the need for organizations to recognize and prioritize UX as a strategic asset. This case emphasizes the importance of aligning UX goals with broader organizational objectives to gain recognition and support.

Finally, Team 4, representing TT, demonstrated an ideal model of UX team evolution, transitioning from a functional department to a strategic powerhouse driving innovation and excellence. Team 4 illustrated the benefits of fostering a culture of cooperation and competition, or "coopetition," within UX teams. While competition can drive individual performance, cooperation fosters knowledge sharing, communication, and supportiveness, ultimately enhancing team effectiveness. This case highlights the importance of balancing competition with cooperation to promote innovation and agility within UX teams.

The case studies of the four UX teams provided real-world examples that align with the identified team types (performance, operation, strategy, and transformative team) and UX knowledge framework outlined in Phase 1. Each team's characteristics, challenges, and

strategic priorities reflect aspects of the team types and the various dimensions of UX knowledge outlined in the framework.

6.2 Summary of Discussion

Based on the results, I compared the UX team knowledge framework with individual UX knowledge or competence and discussed the explicit and tacit features integrated into design knowledge. Unlike previous studies, this study offers a collective perspective on team knowledge, emphasizing the complexity and tacit nature of certain knowledge areas. The results agree with an ongoing debate about the nature of design knowledge; while certain aspects are unique to UX design, many components are applicable across various professions. Furthermore, this study is in accordance with previous studies that highlight the significance of communication, leadership styles, and knowledge distribution in improving team performance and UX outcomes.

The study reveals the critical role of knowledge characteristics in defining team dynamics, challenges, and strengths by analyzing four distinct case studies. Unlike broader studies on UX factors, such as those by Choma et al. (2022), this research focused on the specifics of team knowledge and collaboration within high-tech industries, offering actionable insights for enhancing UX practices and management. Apart from each team's distinct features, some common themes emerged across the four case studies. Firstly, internal competition is common among UX teams, driven by reward systems and key performance indicators.

However, while competition can drive performance, it must be balanced with cooperation to encourage knowledge sharing. Secondly, the early and sustained involvement of UX teams in project development is crucial. This shift from traditional late-stage involvement to early engagement facilitates more effective UX changes and ensures that UX considerations are

integrated throughout the project lifecycle. Thirdly, the study emphasizes the importance of alignment in shaping shared mental models within teams.

Two key themes emerged that are critical for UX knowledge development. AI integration in UX teams could enhance the problem-solving process, but human interventions are required for navigating complex situations. AI-assisted teams demonstrate greater agility, improved communication, and enhanced cognitive flexibility. However, AI could potentially foster complacency in high-performing teams. UX knowledge development also emphasizes inclusivity and participatory practices in the design process by involving users and relevant stakeholders to cultivate the co-creation approach.

6.3 limitations

This study has several limitations. First, the data were collected mainly through interviews, which introduces the risk of researcher bias. The reliability of the data could be improved through longitudinal approaches, such as conducting repeated interviews with the same participants over time to observe changes in UX team knowledge sharing, exchange, and application during different stages of project development. Furthermore, future research could adopt a quantitative approach—for example, using questionnaires—to further examine the relationship between UX team knowledge distribution, team collaboration, and design performance.

Second, although the study focuses on the Chinese high-tech industry, participants were primarily recruited from companies based in the Shenzhen area. As such, the findings may reflect regional characteristics and may not fully represent UX practices across other regions of China or international contexts. A cross-contextual comparative study could explore how cultural, organizational, and industrial conditions shape the development of UX team knowledge in different environments.

Finally, the high-tech industry itself encompasses a wide range of sectors. Although this study references the official classification of high-tech industries in China, the selected cases predominantly represent electronic products, communication products, and software development. As such, the findings may not be fully generalizable to other high-tech sectors—such as pharmaceuticals, aerospace, or biotechnology—where UX design plays a different role due to longer product development cycles, higher regulatory requirements, or different types of user engagement. The specialized nature of the sectors involved in this research should therefore be taken into account when applying the UX team knowledge framework to other domains.

In future research, the UX team knowledge framework can be compared with other UX teams in different fields such as those in design consultancy. Moreover, future studies should investigate the role of leadership in cultivating and shaping knowledge within UX teams by examining how different leadership styles and approaches influence team knowledge. Practically, how this study can empower UX managers to design team knowledge structures and personnel arrangements could be explored further.

6.4 Contributions

Theoretically, this study benefits existing studies in three ways. Firstly, compared to the conventional method of focusing on UX tools, methods, or process, this study presents a novel way to understand UX knowledge in a team context to support UX practice. This approach could contribute to UX management study. According to McKeown (2019) and Hinderks et al. (2022), UX management includes three key aspects: UX goals, UX strategy, and UX resources. By analyzing the intricate dynamics of UX team knowledge composition and its implications for organizational success across various stages of company development, this study offers valuable insights into the UX goals, strategy, and resources in shaping the design landscape within organizations.

In general, the structure of UX team knowledge composition and categorization presented in the study serves as a reference for other fields such as user interface design or product design teams. By adapting and tailoring the framework to suit their specific contexts, researchers in these fields can also benefit from a structured approach to knowledge management and skill development.

In education, the study highlights the importance of developing competencies across various knowledge domains within UX teams in pedagogy. The UX team knowledge framework could be leveraged to identify specific competencies and learning outcomes for UX education programs. By aligning curriculum content with the framework, educators can ensure that students acquire the necessary skills and expertise to excel as UX professionals. This competency-based approach to education promotes a more holistic and practical understanding of UX work, preparing students for real-world challenges in the field.

Practically, the UX team knowledge framework provides a comprehensive understanding of the diverse knowledge domains within UX teams. Firstly, this framework serves as a guiding tool for both managers and practitioners, allowing them to navigate the complex scope of UX management effectively. By delineating the four circles of knowledge—professional, project, collaboration, and organizational—the framework offers a structured approach to skill development among UX professionals. Practitioners can leverage this framework to identify areas for improvement and focus on acquiring the necessary competencies to excel in their roles.

Secondly, the study provides managers with valuable insights for identifying their current team types and aligning them with their business goals by determining the characteristics of the four types of UX teams and their corresponding leadership and reasoning styles. This understanding allows for strategic decision-making in team management and enables teams

to optimize their performance by leveraging their strengths and addressing their weaknesses. Importantly, understanding how different types of teams use and transform their knowledge in different stages of UX development among various company could offer insights to newly established firms. In addition, the four case studies provide valuable insights into the complexities of UX team dynamics and organizational challenges. From the importance of psychological empowerment and early project involvement to the struggle to prove UX value and the benefits of coopetition, these case studies offer valuable lessons for organizations seeking to optimize their UX practices. By addressing these challenges and leveraging opportunities for collaboration and empowerment, organizations can enhance the effectiveness and impact of their UX teams in delivering exceptional user experiences. Managers can use the study as a reference and leverage the different types of UX teams as the situation demands.

Thirdly, the study highlights the different leadership and reasoning styles among UX teams, prompting companies to reflect on their design management practices proactively. By recognizing the impact of leadership on team dynamics and outcomes, organizations can cultivate a supportive and conducive environment for innovation and collaboration within UX teams.

Lastly, the study emphasizes the importance of developing a tailored knowledge management system for UX teams, which can enhance team resilience and learning orientation. By making knowledge more explicit, transferable, and sustainable, organizations can foster a culture of continuous improvement and knowledge sharing within UX teams, thereby driving innovation and excellence in design practices.

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Appendix 1: Interview Protocol for Phase 1

After conducting the first-round interviews, in the second round of interviews in Phase 1, the interview questions focused on professional, project, collaboration, and organizational knowledge.

Professional circle:

1. What user-related tasks did the team undertake in the recent or ongoing project? Which knowledge and experience were instrumental in resolving encountered challenges?
2. What fundamental knowledge or skills are necessary for your team to excel in UX? How did the team acquire this knowledge?
3. What specific UX expertise and experience are essential when producing creative outputs? Which ones are considered the most important?
4. How is knowledge distributed among team members?

Project circle:

1. What project-related information must team members fully understand?
2. What information needs to be shared while working on a project? How is this information shared, and why?
3. What knowledge do you consider important for teamwork but is rarely used in practice?
4. Is there a specific knowledge gap that team members suddenly realize while working on a project?
5. How do you determine or assess the value of each project for the team or individuals? What knowledge is required for evaluation?
6. When faced with multiple projects, what knowledge and experience does the team utilize to manage them effectively?

Collaboration circle:

1. How does the team reach a consensus when working on a project?
2. How does the team reach a consensus with other teams involved in the project?
3. How does your team communicate across departments? What knowledge or skills are necessary for smooth communication?
4. When you receive a requirement, how do you understand the underlying motivation or driving force behind it?
5. Does your team have its own professional terms? Why?
6. What are your thoughts on the importance of "empathy" between coworkers?

Organizational circles:

4. How does the company’s mission and vision facilitate the team's work?
5. What design criteria does your team follow for projects?
6. Does the organization provide incentives for team members? If so, what are they, and how do they impact teamwork?
7. Have you gained any knowledge or tools from the organization that significantly helped you in teamwork?
8. How is knowledge distributed within your teams? How are decisions typically made?
9. Could you identify the team type to which your team belongs and explain why?

Appendix 2: Interview Protocol for Case Studies

Before the formal interview, the researcher would ask the interviewee's background information such as their responsibilities and team size.

The interviewee's background.

1. How many years have you worked at this company?
2. How long have you worked on the UX team?
3. What are your approximate job responsibilities?
4. how many people are on the UX team?
5. What are the roles? What are the main tasks of the current UX team?

The interview questions that focus on the team's knowledge transformation, actions or decisions are following:

1. How does the UX team transform from beginning stage to the presence? (timelines, actions, events, decisions)

- What were the goals of the UX team when it was first created? What is the goal now? How has that goal changed?
- Do you think the UX team is constantly changing? How is it changing? Why does it need to keep changing?
- If you were to delineate several important periods in the evolution of the UX team, how would you do it?
- What important decisions were made during each of these periods? What were the important actions? Or were there any important events?
- What challenges were encountered during the transformation of the UX team? How were they overcome?

2. What knowledge is required for a successful transformation?

- What is the distribution of team member roles over time?
- How has the leadership, or cooperation, or communication style required of team members changed over time?
- If these are four knowledge types (professional, project, collaboration, organizational) make up a team, how do you think the knowledge of team members has changed over time?
- How do you understand the impact of these four types of knowledge in the team development process?
- How does this knowledge help to transform or achieve goals?
- How have these four types of knowledge changed along with the evolution of the team?
- How do you see the team changing in the future? What kind of knowledge or experience is needed to face the challenges of the future?
- What do you see as the main issues facing the current UX team?

Appendix 3: Consent Form

INFORMATION SHEET

User Experience Team Knowledge in China's High-Tech Industry

You are invited to participate in the above project conducted by Xiuxiu Wu, supervised by Prof Kin Wai Michael SIU, a staff member of the School of Design in The Hong Kong Polytechnic University.

This study aims to explore and demonstrate UX team knowledge in China's high-tech industry by providing a comprehensive understanding of its composition, characteristics, distribution, and utilization.

You are invited to participate in one interview. It will take about 60 mins or less. The interview should not result in any undue discomfort. All the information you mentioned will be kept for analysis.

Any research data from which you can be identified is known as personal data. Personal data does not include data where the identity has been removed (anonymous data). We will minimize our use of personal data in the study as much as possible. The researcher and his team will have access to personal data and research data for the purposes of the study. Responsible members of The Hong Kong Polytechnic University may be given access for monitoring and/or audit of the research.

All information related to you will remain confidential and will be identifiable by codes only known to the researchers. The information collected will be kept until a year after project the public release of research results. The Hong Kong Polytechnic University takes reasonable precautions to prevent the loss, misappropriation, unauthorized access or destruction of the information you provide.

You have every right to withdraw from the study before or during the measurement without penalty of any kind.

If you have any questions, you may ask our helpers now or later, even after the study has started.

You may contact the researcher for the following situations:

a. if you have any other questions in relation to the study;
b. if, under very rare conditions, you become injured as a result of your participation in the study; or
c. if you want to get access to/or change your personal data before (the expiry date).

Thank you for your interest in participating in this study.

THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學

CONSENT TO PARTICIPATE IN RESEARCH

User Experience Team Knowledge in China's High-Tech Industry

I _____ hereby consent to participate in the captioned research conducted by Xiuxiu Wu

I understand that information obtained from this research may be used in future research and published. However, my right to privacy will be retained, i.e. my personal details will not be revealed.

The procedure as set out in the attached information sheet has been fully explained. I understand the benefit and risks involved. My participation in the project is voluntary.

I acknowledge that I have the right to question any part of the procedure and can withdraw at any time without penalty of any kind.

Name of participant

Signature of participant

Name of Parent or Guardian (if applicable)

Signature of Parent or Guardian (if applicable)

Name of researcher Xiuxiu Wu

Signature of researcher

Date 09 February 2023

Hung Hom Kowloon Hong Kong 香港 九龍 紅磡
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Appendix 4: Sample Transcript from Case Study

The following transcript is selected from the case study. The original recordings were in Chinese; the samples demonstrate the translated English version.

Case Study 1

Participant Number: 01 / UX team member

Date: 2024, February 28 Duration: 45 mins	
Interviewer	I'd like to start with some of the earliest timelines or some of the events, at the very beginning, how was the UX team initially formed?
Participant 01	At first, they didn't have a complete product system—there was just an interaction team. It was mostly interaction designers and UI designers who handled all the tasks. No one specialized in things like motion effects. Back then, it was really just function-focused, designing some local features, responding quickly to what the end market needed, and then getting things online fast.
Interviewer	What prompted the formation of a specialized UX team?
Participant 01	When we started out, we were in a Blue Ocean market, there was not many competitions. As long as we could keep the product affordable with unique and attractive point to satisfy users' needs. But things have changed; the market's grown a lot, and now we need real innovation to stand out. That's why we formed the UX team and broke down roles more. Everyone could start specializing, aiming to make products that matched a higher-end strategy.

Interviewer	How would you describe the stages in the UX team's development?
Participant 01	I'd say there were two main phases. First, there was the phase before we had a clear strategy to go big and move into high-end products. And now, we're aiming to expand further into mid- and high-range markets.
Interviewer	How did the type of knowledge the UX team needed change over time?
Participant 01	Organizational knowledge wasn't there at the beginning. Everyone was just trying to reach a goal and get things done quickly. Once a product was complete, there wasn't ongoing refinement of the UX. The experience might be rough, but we wouldn't iterate on it. This was a clear characteristic of the team's initial period—it was like we were making a 'spaceship' for a short period of time. If it succeeds, it succeeds. If it fails, it's likely to be ignored. Many of the small spaceships we built before gradually disappeared because personnel changed, and people didn't understand why we did those things, so eventually, they were removed, and we stopped doing and continue those projects. In terms of organizational knowledge, the team was mainly formed to accomplish tasks. Design styles also shifted based on the preferences of whoever was leading at the time. When a new design lead would come in, they'd create a version according to their taste, and later, someone else might override it with their approach. It felt like things changed with every generation, but that consistent sense of quality was missing. In the first stage, the organizational and collaboration knowledge weren't heavily involved. Professional knowledge was key, as it helped us quickly understand user needs. When the UX team set a goal, like launching a product within three months, we could quickly put together a plan and observe market feedback. If it was effective, we'd launch more in that direction. But the core decision-making relied on the boss or leader, and project knowledge was mainly managed by the project manager or other roles. Nowadays, the UX team gets involved early in product development to conduct direct user research and gain insights.

Participant Number: 02 / UX team director

Date: 2024, April 1 Duration: 49 mins.	
Interviewer	Let's start by discussing why the UX team was created and if there were any significant events or decisions in that process.
Participant 02	If you look back, it's not very clear in detail, but from past experience, all these big companies have UX teams. When you create a product, UX has to be at the core. Only when the experience is well-designed can the product be good.
Interviewer	What was the state of the UX team when you joined?
Participant 02	When I first joined, there were just a few design departments, and I was in one of the divisions within that department. About a year later, we merged with the Shanghai department, and then, about another year after that, we merged with the software engineering department. Following the merger, we've been actively recruiting. Initially, there were only about a dozen people, but now the team is close to 100.
Interviewer	I see. After the merger, you must have encountered a lot of challenges, especially in communication and collaboration. Could you give me two examples of those challenges and how they were resolved?
Participant 02	For instance, the two leaders have different styles. The previous leader focused more on innovation, while the current leader pursues steady and achieves short-term goals, but the long-term ones are not as clear. It had an impact on the work of UX. With the previous leader, we had more freedom and took bigger steps. There was more room for imagination, even though the innovation goals may have been unrealistic. However, the current leader prioritized the implementation of short-term goals. This leadership change, along with the mergers, caused some chaos within the UX team for a time. The main goal then was to stabilize the team and support the business—essentially to get everyone aligned. Now, our main objective is recruiting high-end talent.

Interviewer	What kind of knowledge and skills are essential for achieving your team's current goals?
Participant 02	We're looking for expertise in 3D design, including 3D modeling, rendering, texturing, and lighting—lighting is actually one of the most critical areas we need. We also need a sense of aesthetics that aligns with our brand, as this is essential for presenting things like wallpapers elegantly. Besides that, system design improvement is a priority, as we're still receiving feedback that our current system could be better. Another important area is platform specification—consistency and uniformity across the platform, which is why we need talent in this area too. Lastly, we're integrating AI into design, so we need people with AI skills who can combine it effectively with our UX work.

Case Study 2

Participant Number: 03 / UX team director

Date: 2024, January 4 Duration: 57 mins.	
Interviewer	If we look at the UX team as a whole, a puzzle made up of pieces, what knowledge and experience do you think constitutes the whole team?
Participant 03	I think the UX department is an integrated team that needs to work closely with interaction designers and product designers. We especially need to consider the interactive experience and user experience from the very beginning of product design. Although the product and UX departments are separate, ensuring the user experience is a shared goal. Specifically, the UX team needs a knowledge base that includes ergonomic data. Interaction design guidelines and specifications are

	fundamental, such as having consistent sound and button feedback. Also, understanding the user's needs and pain points throughout the journey of using the product is essential. It allows us to break down UX dimensions, like the product's friendliness, fit, weight, portability, and repairability. From these dimensions, a UX standard can be developed, which helps categorize questions arising from the products. This way, the UX team can provide precise answers and solutions without being misled by user feedback alone.
Interviewer	What kind of experience does a UX team need to create UX guidelines?
Participant 03	First of all, the simplest starting point is definitely human-centered. We're all humans; for example, when leaders describe issues with a product, they might not have the professional terms, but they still notice the problems. When there are conflicting product requirements, industrial designers may sometimes sacrifice user experience for aesthetics. This is where understanding human needs really comes in. Basics like user journeys and target groups are essential, but empathy is even more critical. Designers need to imagine themselves as beginners, stepping out of their expert mindsets to experience the product as a novice. This empathy is also what sets exceptional UX designers apart from the ordinary ones.
Interviewer	Which knowledge and experience do you feel is important at this stage of your organization's development according to the four circles of knowledge?
Participant 03	Professional knowledge is definitely needed. Project and collaboration knowledge help in aligning everyone on the product specs and ensuring designs adhere to product guidelines. Our projects are more case-based, so we don't involve much organizational knowledge directly—project managers handle that part more. Within the UX team, we hope for strong ownership; we want everyone to take responsibility for their tasks and do them well. Also, UX designers should empathize with team members, understand the challenges others face, and find ways to help them meet their KPIs or complete their tasks.
Interviewer	How do you see these four circles of knowledge functioning in UX teams, or what problems do they solve for the organization?

Participant 03	I think it's a capability configuration. If the team possesses all types of knowledge, it reflects the complexity of the product portfolio. The complexity of knowledge is linked to the complexity of the product. When a company has only one type of business, it needs more specialized skills. But when the business becomes complex, with multiple product lines and categories handled by the same UX team, the team needs to be more advanced, with comprehensive knowledge. This allows the UX team to manage different projects effectively and adapt to various project requirements.

Participant Number: 04/ Senior UX designer

Date: 2024, January 3 Duration: 46 mins.	
Interviewer	What is the main responsibility of the UX team's current work?
Participant 04	Our daily responsibilities can be divided into two parts: one is managing the company's existing products, and the other involves new product development. We have dedicated members focusing on the UX issues of launched products, which includes after-sales and quality, as well as the integration and categorization of information—specifically, filtering UX-related issues, service issues, and process issues. The other part primarily focuses on the development of new products. Overall, each member is responsible for a specific product line.
Interviewer	What was the goal of establishing the UX team in the earliest days?
Participant 04	When I first joined the company, there was an independent application team, and they needed to recruit a UX designer to address the challenge of integrating hardware and software. This involved meeting the requirements set by software product managers, generating the UX design, and collaborating with the user interface designer. Initially, I was the only UX designer, so the work was relatively straightforward. Compared to that time, our work has become much more complex. As

	the company's business continued to grow and change, we went through department integrations, which eventually led to the formation of a dedicated UX team
Interviewer	Does the UX team have product managers as well as user interface designers?
Participant 04	Our UX team is divided into four sub-teams: operations, marketing, user insights, and after-sales. Overall, the UX team functions as both an integrative and supplementary team. We are the only team in the company that is involved throughout the entire product development process—from initial development to market launch. Each product we work on has a defined beginning and end. For instance, the after-sales team handles post-launch responsibilities, while the user insights team focuses on defining customer needs and requirements prior to launch.
Interviewer	It sounds like your team has gone through a lot of changes. Can you try to distinguish the more important periods or turning points?
Participant 04	There was definitely a transition period. When I first joined, my focus was primarily on design, especially on optimizing the UX of products that were already on the market. But it's challenging to make significant changes to a product after its release. The first major shift was understanding how to control the entire product experience during the R&D stage, before the product launches. For example, the product's appearance and button placement were often already determined by the time we made suggestions, limiting our influence. When a new leader came on board, they emphasized the importance of integrating UX earlier in the process.
Interviewer	Were there any problems with this transition?
Participant 04	Yes, there were several challenges, mainly due to a lack of established processes. Initially, there wasn't a UX role within the company at all, so no formal UX protocol existed. Product designers didn't fully understand why our input was necessary, as products had been launched without UX team involvement.
Interviewer	What core experiences or knowledge does the team possess that could help solve these challenges?

Participant 04	Apart from foundational knowledge, we need to strengthen our processes. While each of us is quite specialized in our fields, the main challenge is integrating our expertise in ways that have real impact. This requires aligning our efforts with the company's overall process. I think the team's capabilities have noticeably improved when facing challenges. We need to be proactive in creating and establishing processes, embedding our decision-making power and influence into these processes. Most importantly, it's not just about identifying problems but also knowing how to solve them.

Case Study 3

Participant Number: 05 / UX Director

Date: 2024, December 14 Duration: 72 mins.	
Interviewer	Can you briefly describe the daily UX design work, and what your role is?
Participant 05	Our UX team primarily manages the company's digital transformation systems, including financial and marketing systems used internally rather than by end-users. Currently, the team has about 30 people, though it previously peaked at 80 members. I am the Design Director, and my daily responsibilities include coordinating with group leaders across different sub-teams. I'm also the team's founder. When I joined, I underwent an interview with a leader highly skilled in digital transformation, and I joined with the intent to learn from him. I distinctly remember my first report to the boss, as that meeting reshaped my approach to UX. Initially, I believed we should focus on a few key products, heavily investing in their digital transformation to set an example. However, my boss advised, 'Don't focus on the product first; you need to establish

	principles.' He stressed the importance of creating standardized methods and workflows that would form our UX guidelines and regulations. That's when I realized we were building this team from the ground up.
Interviewer	How did you begin creating the UX principles and standards? What was the context of the digital transformation at that time?
Participant 05	Receiving this task felt like setting the rules for a game—defining the framework for UX. We needed to clarify the inputs, outputs, and stages for UX involvement, tailoring them to different project types. Some systems are developed in-house, while others are purchased from third-party vendors. Our approach differs based on the system type. For purchased systems, we mainly handle local adaptations, while in-house systems offer more flexibility. Beyond defining these rules, I also set recruitment standards and specifications for equipment purchases. One of our key achievements was establishing a user research lab.
Interviewer	How does the UX team transform from beginning stage to the presence?
Participant 05	I've been building and working with this team for about three years, and its development can be divided into three phases. The first phase focused on establishing rules, recruiting talent, and discussing the role of UX with other departments. During this time, we hired a lot of people, and the budget was very generous. The second phase saw a slower pace of hiring and tighter budgets, but everyone was working hard towards the goal of digital transformation. The team's rhythm was very cohesive, and during this stage, we were mainly coding, testing, and preparing PowerPoint presentations for reports. The third phase involved downsizing as most major features had already been launched without significant issues, and maintenance work had decreased. The most challenging part of this phase was the layoffs. Many of the employees had worked together for over two years to bring these features online, so reducing staff had a big emotional impact on everyone.
Interviewer	What knowledge and experience do you think are essential to achieving the team's goals? Or what core roles are necessary for the team?

Participant 05	Different roles are essential at various project stages. Early in a project, we need interaction designers and visual designers. Later on, brand designers and user researchers become crucial. Brand designers ensure consistency, as we have around 70-80 major products that must look cohesive, reflecting a unified brand identity. User researchers are equally important due to the business's complexity. For instance, financial accounting, taxation, and customs processes are intricate. While product managers focus on functionality, they may overlook usability challenges. User researchers help make these complex processes more user-friendly.

Participant Number: 06/ UX Middle-Level Manager

Date: 2024, December 18 Duration: 42 mins.	
Interviewer	How do you understand the impact of these four types of knowledge in the team development process?
Participant 06	The depth of project knowledge needed actually depends on the extent of the UX team's involvement in creating UX solutions. When collaborating with the product manager, the goal is to build more efficient operations and make the system more user-friendly. Different roles bring unique types of knowledge, and each impacts the project in different ways. For example, core team members need to master these four types of knowledge, but each individual focuses on different strengths—some are highly skilled in professional expertise, while others excel in project management. Together, these diverse skills form a well-rounded team. In the early stages of digital transformation, when we were quickly building products and making plans, leadership emphasized professional skills, so the team concentrated on acquiring that knowledge. Now, in the operational phase, the demand for professional expertise has decreased. The focus has shifted towards responding quickly to requests and completing tasks to meet basic standards, placing greater emphasis on project management skills.

Interviewer	How is the knowledge accumulated by the team usually preserved and shared?
Participant 06	For colleagues with limited knowledge and experience, we needed to share our knowledge and experience with them using summary templates, modules, tangible frameworks, such as standardized structures in PowerPoint presentations, covering background, products, planning, and project design concepts. Extracting commonalities from past projects and organizing them into templates. The key was to reuse knowledge and experience in other projects and learn through the project execution process. We also tried organizing specialized learning groups for visual and interaction design, but these didn't work well. The format was too time-consuming for both organizers and participants, and it was challenging to apply the learning directly to projects, so we discontinued them.
Interviewer	Aside from the four types of knowledge I mentioned, would you like to add anything?
Participant 06	At the beginning of a project, it's essential to deeply understand the product itself, including industry and user needs. This falls under user research skills. For designers, I'm not entirely sure if this should be categorized as professional knowledge or additional knowledge, so I'll leave it here for now. The second part is how designers solve problems, whether those problems are identified by themselves or passed on from researchers. That's another crucial aspect. How the UX team communicates and conveys design concepts to all project teams—including product managers and business leads—ensures that the design outputs can be successfully implemented. I think this falls more under collaborative knowledge, especially in terms of influencing and embedding ideas. Finally, when it comes to implementation, it leans more towards project management—whether in terms of timelines, project workflows, or collaboration within the team.
Interviewer	What do you see as the main issues facing the current UX team?
Participant 06	In the past, we focused more on system development itself—examining what design could contribute to this process and how we could enhance user experience. Now, after reaching a certain stage in the product lifecycle, the company's focus has shifted. The challenge is no longer just about building the system but also about demonstrating the results of these

	large-scale efforts. The new priority is on continuous improvement through daily operations and optimization, making incremental progress to refine the product step-by-step.

Case Study 4

Participant Number: 07 / Senior UX designer

Date: 2024, January 12 Duration: 49 mins.	
Interviewer	How do you understand the impact of these four types of knowledge in the team development process?
Participant 07	The designers in the UX team spend 40% of their time on completing tasks. However, 30% of their time is spent on communication and collaborating with various departments. Another 30% of their time is dedicated to guarantee the implementation. Even with the best solutions, if the execution or delivery deviates from the design plan, only 10% of the design's potential can be realized. This does not make for a good UX team. I believe a good UX team should have a foundation of basic knowledge and the expertise necessary to push the project forward during execution. Basic knowledge includes understanding the user; for instance, if designing a health product, a designer should quickly grasp what 'health' entails and what users expect. Our team must also deeply understand the product, such as the data requirements of specific modules and the attributes of that data. Of course, all knowledge connects back to business understanding, which is essential to truly understand the user—especially since our users are often internal employees. Collaboration is critical, especially when the product manager may also evaluate the UX team’s performance and even act as our manager. Sometimes, we co-create

	projects with frontline business personnel who have direct insights into user needs. We also consult them on their satisfaction with the product. Overall, I think our team possesses all four types of knowledge.
Interviewer	How do you manage and share the accumulated knowledge in the team?
Participant 07	We have some members dedicated to managing a specialized internal design platform. This platform explains concepts like UX and user-centered design, and everyone can share their design insights on it. Some designers regularly publish articles, and every one or two weeks, we hold a sharing session where designers discuss their project experiences, followed by a Q&A for further discussions.
Interviewer	Are there some design methodologies developed by the team?
Participant 07	Previously, the company didn't prioritize developing methodologies, as summarizing and sharing approaches wasn't recognized in performance evaluations. But now the company has expanded evaluations to include an 'impact' dimension, so sharing and documenting methodologies can contribute to team and individual performance. Although summarizing design methodologies is challenging, designers still make an effort to write them down. We also have an archiving platform where all project materials, such as final user research reports and user testing feedback, are uploaded. Additionally, we have a dedicated team that builds tools. For instance, they developed a tool that allows us to download customizable icons, where we can directly adjust the thickness and color. This tool helps us quickly customize and use icons. Overall, we feel the company's support for UX work.
Interviewer	What challenges do you think the UX team currently faces?
Participant 07	One challenge is competition among teams—everyone wants to be the most innovative. When a design task is proposed, it's not always clearly assigned; some teams may have better ideas and be more eager to take on the project. The boundaries of project allocation aren't always clear. For example, we primarily work on internal enterprise tools, but sometimes other departments request us to handle customer projects. When AI became popular, every UX team wanted to work on AI-related projects, leading to some overlap in efforts. While the company benefits from exploring different solutions to find

	the right direction, it can also lead to resource duplication, with everyone working on AI and potentially wasting resources on redundant work. But since the company has the capacity and budget to allow for this redundancy, it's not a major issue.

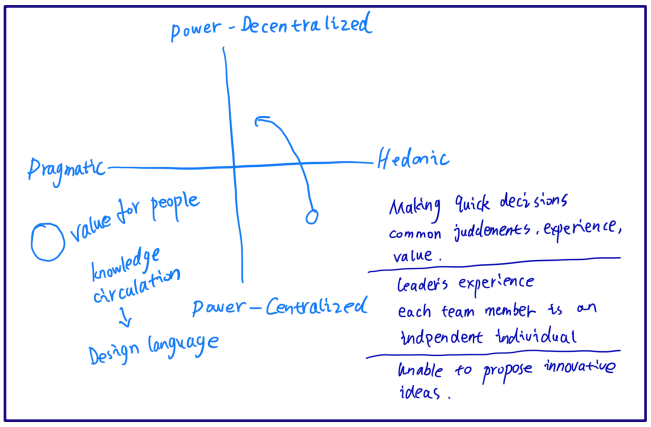
Participant Number: 08/ Senior UX designer

Date: 2024, January 25 Duration: 50 mins.	
Interviewer	What types of projects was your team mainly responsible at the beginning?
Participant 08	Initially, we managed many projects aimed directly at end users. However, as these end-user products matured, the potential for improvement gradually decreased. As a result, we shifted our focus to working primarily on internal projects for employees.
Interviewer	What role do you think the four types of knowledge play in your team?
Participant 08	I believe our company places significant emphasis on organizational knowledge. For example, design standards and processes are strictly enforced, these UX standards are like a "fish net" that couldn't be easily disrupted and breaking them required layers of review and approval. In terms of collaboration knowledge, the design, IT, and testing departments are separate, so cross-departmental collaboration is essential for completing a product. This collaboration can be challenging because everyone is at an equal level, with each department having the power to propose questions and approve solutions. For instance, if the testing team disagrees with a solution, they can reject it. Decisions are made collectively, rather than solely by the UX team. Within or between teams, there is no concept of hierarchy, and the voice of each department is equal. The core purpose of this approach is to ensure that everyone took responsibility for the product and has a sense of

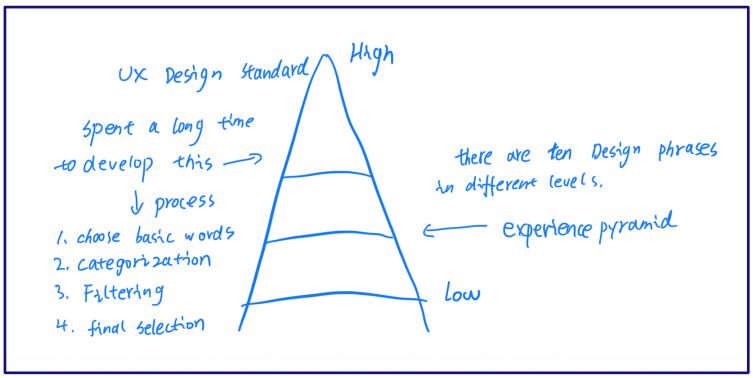
	accountability. However, the downside is that project timelines could be extended. Before launching a product, all departments—product, UX, and development—need to send 'take responsibility' emails to the testing team, stating their confidence in the product's readiness and assuming responsibility if any issues arise. Only then will the testing team approve it. This process is crucial, as the company enforces strict accountability for any problems that occur.
Interviewer	What knowledge and experience are particularly important for your team?
Participant 08	Our design rules, methodologies, and tools are highly developed, so we follow established requirements when delivering projects. However, one unique aspect of our team is the project bidding process. When a department proposes a need, they outline the product requirements, and the UX team presents their UX concepts and specific solutions. We then compete with other UX teams, and the proposing department decides which team's proposal they prefer.
Interviewer	What skills does the team need to deliver a winning proposal?
Participant 08	A successful proposal is the result of collaboration, not just individual effort. At the foundational level, the team's professional knowledge is essential—we must provide the product manager with the ideas and directions they're looking for. Additionally, if we can deliver something that exceeds their expectations, we're more likely to secure the project. After winning the project, meticulous attention to detail becomes crucial. The ability to execute detailed requirements at a high standard is key to achieving a successful outcome. As the company has grown, many core components are already established, so the focus has shifted to refining details.
Interviewer	In terms of professional knowledge, which part do you think your team excels at?
Participant 08	Our team is exceptionally strong in terms of professional knowledge among the four types. We ensure only highly skilled individuals are hired, creating a robust team where everyone can pursue their professional growth through their work. One of our strengths is continuous learning. For example, we often discuss new features introduced by leading companies and explore how we can incorporate or learn from them in our projects, even outside of work.

Appendix 5: Sample of Memos

During one interview, I asked the participant to identify their team's type within a two-dimensional framework, which I documented in my notes for data analysis. I also recorded additional notes to capture the participant's explanations in detail.

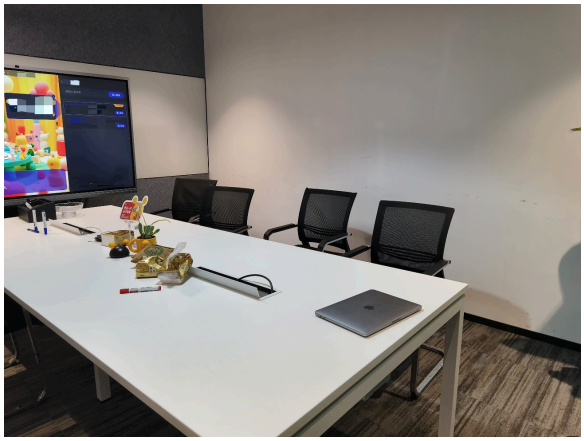


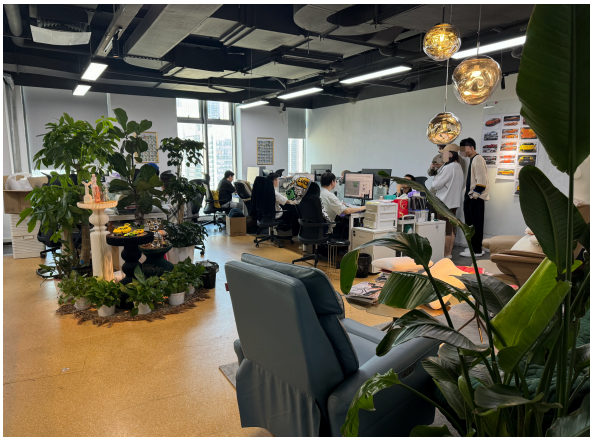
The participant shared an example of how they structure their team's approach to UX management. They mentioned developing a "UX pyramid" to manage and evaluate their projects more systematically, allowing for clearer judgments on team performance and design quality.

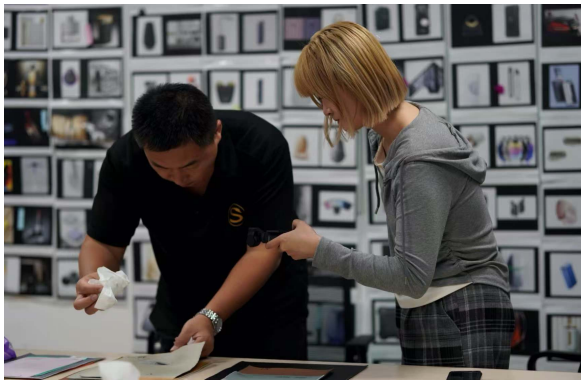


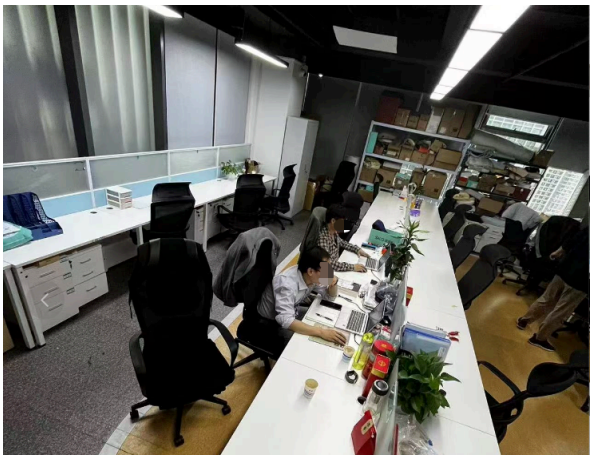
Appendix 6: Site Visit Photos

I visited several of the participants' companies to gain a deeper understanding of their work environments and team dynamics. Some interviews were held in the companies' meeting rooms, allowing me to observe the context in which these UX teams operate. These images offer additional context about the organizational settings and help illustrate the environments where UX practices are developed and implemented.










和用户在一起
GO WHERE YOUR USERS ARE
通过关键技术解决问题
USE KEY TECHNOLOGIES TO SOLVE KEY PROBLEMS
满足用户核心需求
MEET YOUR USERS' CORE NEEDS