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Adapting a Comprehensive Integrated UX Maturity (CIUXM) Framework to Startups Through Multi-Grounded Theory: A Longitudinal Exploration

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Les membres du jury qui ont évalué ce mémoire ont demandé des corrections mineures.

Abstract

In today's competitive landscape, user experience (UX) is a critical factor for success across various sectors, including healthcare, government, and startups. Despite its importance, there is a lack of consensus on defining UX and measuring UX maturity, which hampers the ability to track return on investment (ROI) and implement effective UX practices. Many existing UX maturity models are criticized for being based on authors' experience rather than grounded in theory and empirical data. This study addresses these challenges by proposing a Comprehensive Integrated UX Maturity (CIUXM) Framework through a systematic literature review. Since existing UX maturity models are unsuitable for startups, due to their particular characteristics in comparison to more established organizations, the CIUXM Framework is subsequently tested and adapted to startups through empirical research. By comparing existing UX maturity models, this study identifies gaps, overlaps, and inconsistencies, integrating insights to offer a nuanced, standardized tool for assessing and improving UX maturity in organizations. Additionally, recognizing the distinct operational constraints and agile nature of startups, the research utilizes Multi-Grounded Theory (MGT) and conducts a longitudinal study with nine startups over ten months. We identified barriers and drivers affecting UX maturity in startups, beyond known limitations such as resource constraints. The findings contribute to advancing the UX field by providing a comprehensive framework that aligns with industry standards and supports the strategic implementation of UX practices, particularly tailored for dynamic startup environments.

Keywords : UX maturity, user experience, systematic literature review, UX capacity, UX capability, CIUXM Framework, startups, Multi-Grounded Theory, longitudinal study, UX assessment tools, organizational development, resource constraints, UX management.

Research methods : Multi-Grounded Theory

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Comité d'éthique de la recherche

Le 19 janvier 2024

À l'attention de : Pierre-Majorique Léger, Professeur titulaire, HEC Montréal

Projet # 2023-5360

Titre : Évaluation d'applications UX de startups dans le programme d'entrepreneuriat numérique asterX - Quebecor. Cohorte 2024

Source de financement : Subvention HEC - Chaire Institutionnelle (G798); Contrat de recherche

Titre de la subvention : Programme d'entrepreneuriat Numérique AsterX (Québecor) - HEC Montréal

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Bonjour,

Pour donner suite à votre demande de renouvellement, le certificat d'approbation éthique pour le présent projet a été renouvelé en date du 01 février 2024. **Ce certificat est valide jusqu'au 01 février 2025.**

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Cordialement,

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Projet # : 2023-5360

Titre du projet de recherche : Évaluation d'applications UX de startups dans le programme d'entrepreneuriat numérique asterX - Quebecor. Cohorte 2024

Chercheur principal : Pierre-Majorique Léger, Professeur titulaire, Technologies de l'information, HEC Montréal

Cochercheurs : Sylvain Sénécal; Frédérique Bouvier; David Brieugne; Salima Tazi; Xavier Côté; Marine Farge; Luis Carlos Castiblanco; Rachel Cosby; Constantinos K. Coursaris; Marc Fredette; Astrid Rutten; Juan Fernandez Shaw; Barbara Scheed; Noémie Beauchemin; David Tessier

Date d'approbation du projet : 08 février 2023

Date d'entrée en vigueur du certificat : 01 février 2024

Date d'échéance du certificat : 01 février 2025

Maurice Lemelin
Président
CER de HEC Montréal

Signé le 2024-01-19 à 15:15

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Comité d'éthique de la recherche

Formulaire de fin de projet d'un étudiant dont la collecte de données s'incrit entièrement dans un projet de recherche déjà certifié d'un chercheur

Titre du protocole : **Évaluation d'applications UX de startups dans le programme d'entrepreneuriat numérique asterX - Quebecor. Cohorte 2024**

Numéro(s) de projet : **2023-5360**

Identifiant Nagano : **asterX**

Chercheur principal (au CER Éval) : **Pierre-Majorique Léger**

Date d'approbation du projet par le CER : **2023-02-08**

Formulaire : **F9a-23057**

Date de dépôt initial du formulaire : **formulaire non déposé**

Date de dépôt final du formulaire : **formulaire non déposé**

Statut du formulaire : **Formulaire créé**

A. Soumission

1. **Indiquez le titre complet du projet de recherche.**

Quel est le titre du projet?

Évaluation d'applications UX de startups dans le programme d'entrepreneuriat numérique asterX - Quebecor. Cohorte 2024

---

2. **Indiquez le nom du chercheur principal**

Qui est le chercheur principal de ce projet ?

Léger, Pierre-Majorique

3.

En plus du chercheur principal, y a-t-il d'autres personnes dans votre équipe de recherche?

Oui

Indiquez, le cas échéant, les membres de votre équipe de recherche, incluant les étudiants.

Saisir les premières lettres du nom ou du prénom d'abord.

Sénécal, Sylvain

Sélectionnez un type de cochercheur.

Cochercheur - HEC

Saisir les premières lettres du nom ou du prénom d'abord.

Bouvier, Frédérique

Sélectionnez un type de cochercheur.

Professionnel de recherche

Saisir les premières lettres du nom ou du prénom d'abord.

Brieugne, David

Sélectionnez un type de cochercheur.

Professionnel de recherche

Saisir les premières lettres du nom ou du prénom d'abord.

Tazi, Salima

Sélectionnez un type de cochercheur.

Professionnel de recherche

Saisir les premières lettres du nom ou du prénom d'abord.

Côté, Xavier

Sélectionnez un type de cochercheur.

Professionnel de recherche

Saisir les premières lettres du nom ou du prénom d'abord.

Farge, Marine

Sélectionnez un type de cochercheur.

Professionnel de recherche

Saisir les premières lettres du nom ou du prénom d'abord.

Castiblanco, Luis Carlos

Sélectionnez un type de cochercheur.

Professionnel de recherche

Saisir les premières lettres du nom ou du prénom d'abord.

Cosby, Rachel

Sélectionnez un type de cochercheur.

Étudiant

L'implication de l'étudiant dans le projet de recherche

Mémoire s'inscrivant dans le présent projet

Saisir les premières lettres du nom ou du prénom d'abord.

Coursaris, Constantinos K.

Sélectionnez un type de cochercheur.

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Saisir les premières lettres du nom ou du prénom d'abord.

Fredette, Marc

Sélectionnez un type de cochercheur.

Cochercheur - HEC

Saisir les premières lettres du nom ou du prénom d'abord.

Rutten, Astrid

Sélectionnez un type de cochercheur.

Étudiant

L'implication de l'étudiant dans le projet de recherche

Mémoire s'inscrivant dans le présent projet

Saisir les premières lettres du nom ou du prénom d'abord.

Fernandez Shaw, Juan

Sélectionnez un type de cochercheur.

Professionnel de recherche

Saisir les premières lettres du nom ou du prénom d'abord.

Scheed, Barbara

Sélectionnez un type de cochercheur.

Étudiant

L'implication de l'étudiant dans le projet de recherche

Assistant de recherche

Saisir les premières lettres du nom ou du prénom d'abord.

Beauchemin, Noémie

Sélectionnez un type de cochercheur.

Étudiant

L'implication de l'étudiant dans le projet de recherche

Assistant de recherche

Saisir les premières lettres du nom ou du prénom d'abord.

Tessier, David

Sélectionnez un type de cochercheur.

Étudiant

L'implication de l'étudiant dans le projet de recherche

Assistant de recherche

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4. **Veuillez confirmer le statut actuel de la collecte de données pour laquelle vous remplissez ce formulaire.**

Est-ce que la collecte ou la consultation de données est terminée?

Oui

B. Fin de projet de l'étudiant

1. **Veuillez indiquer le nom de l'étudiant dont le projet qui s'incrivait entièrement dans le projet de recherche du chercheur principal est terminé.**

Quel est le nom de l'étudiant?

Rutten, Astrid

Quel type de projet s'agit-il ?

Thèse

---

2. **Veuillez indiquer le titre finale du projet de l'étudiant**

Quel est le titre du projet de l'étudiant

Adapting a Comprehensive Integrated UX Maturity (CIUXM) Framework to Startups Through Multi-Grounded Theory: A Longitudinal Exploration

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3. **Veuillez indiquer le nom du directeur de recherche ou des co-directeurs de votre projet. Nagano ajoutera automatiquement comme utilisateur(s) à votre projet les professeurs de HEC afin qu'ils puissent aller signer électroniquement le formulaire VIA LEUR COMPTE NAGANO. ** Si un codirecteur n'est pas professeur de HEC, seulement indiquer son nom ici en l'ajoutant comme contact. Seuls les professeurs de HEC peuvent être ajoutés comme utilisateurs à un projet.**

Saisir les premières lettres du nom d'abord

Coursaris, Constantinos K.

4. **Veuillez indiquer l'implication de l'étudiant dans le projet de recherche du chercheur principal.**

Quel à été l'implication de l'étudiant dans le projet de recherche du chercheur principal ?

- [x] Participation directe à la collecte de données du projet du chercheur pour utilisation dans le projet de l'étudiant
- [ ] Consultation des données collectés par le chercheur principal
- [ ] Consultation des données consultés par le chercheur principal

5. **Veuillez indiquer si l'étudiant a utilisé des données ne faisant pas partie de la certification éthique du projet de recherche du chercheur principal.**

Des données ne faisant pas partie du projet du chercheur principal ont-ils été utilisées par l'étudiant ?

Non

C. Déroulement du projet de l'étudiant

1. **Veuillez indiquer si des participants se sont retirés du projet ou si vous avez dû retirer des participants du projet? Si oui, indiquez pour quelles raisons.**

Des participants se sont-ils retirés du projet ou avez-vous dû retirer des participants du projet? Si oui, pour quelles raisons?

non

2. **Veuillez indiquer si des participants ont subi des effets indésirables ou des inconvénients? Si oui, veuillez les décrire et nous indiquer comment il vous a été possible d'y remédier.**

Des participants ont-ils subi des effets indésirables ou des inconvénients? Si oui, veuillez les décrire et nous indiquer comment il vous a été possible d'y remédier.

non

3. **Veuillez indiquer si vous avez rencontré des situations où la confidentialité a été compromise? Si oui, dans quelles circonstances et qu'avez-vous pu y faire?**

Avez-vous rencontré des situations où la confidentialité a été compromise? Si oui, dans quelles circonstances et qu'avez-vous pu y faire?

non

4. **Veuillez indiquer quelles mesures sont actuellement prises pour conserver les données recueillies.**

Quelles mesures sont actuellement prises pour conserver les données recueillies?

Les données recueillies sont actuellement sauvegardées sur un cloud protégé (situé en Irlande).

5. **Veuillez indiquer si vous avez rencontré d'autres difficultés. Si oui, précisez lesquelles.**

Avez-vous rencontré d'autres difficultés? Si oui, lesquelles?

non

D. Signature

1. **Le chercheur principal doit signer ce formulaire électroniquement en cochant l'option ci-dessous, ce qui authentifiera que c'est bien lui qui a apposé sa signature.**

   IMPORTANT : Une fois le formulaire rempli, le chercheur principal du projet doit appuyer sur le bouton DÉPOSER afin de déposer le formulaire.

   Astrid Rutten

2. *Signature de l'étudiant:*_____ *Date* 16/08/2024

3. **Veuillez imprimer ce formulaire de fin de projet étudiant et le faire signé par l'étudiant. Vous devez ensuite le joindre ci-dessous.**

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Retrait d’une ou des pages pouvant contenir des renseignements personnels

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CHAPTER 2

CHAPTER 3

List of Abbreviations and Acronyms

UX = User Experience

CIUXMF = Comprehensive Integrated UX Maturity Framework

GP = Growth Points

Acknowledgements

I would like to express my gratitude to AsterX and Quebecor, our funding partners, for providing us with the financial support and samples needed to conduct this study. I am also thankful to HEC and Tech3lab for their guidance, meetings, consistent support and community. Of course, a special thanks to Dr. Constantinos Coursaris for inspiring me, for his time, insights, effort, for selecting me for this project, and for believing in my abilities. To all of the nine startup representatives involved, thank you for generously taking the time and for the detailed insights that formed the key building stones for this research. An extended and heartfelt thanks to Dr. Camille Grange, Dr. Piere-Majorque Leger and Dr. Sylvain Senecal for their informal yet invaluable contributions throughout the process.

To my parents, Eric and Benedicte - thank you for your unconditional support, a thesis acknowledgement could not cut it. To my siblings Felix, Elise and Jules for their friendship and friendly competition in completing our theses at the same time. And, to my partner Ahmed, thank you for making everything easier and more fun.

CHAPTER 1

Introduction

Ensuring excellent user experience (UX) has become increasingly crucial across all sectors. Large corporations have set high standards for UX design in consumer products, and this expectation has extended to non-consumer organizations and contexts. The same individuals, who also act as consumers, now bring similarly elevated expectations to their workplace when using enterprise applications or even utilizing consumer-oriented products for professional tasks (Chapman & Plewes, 2014).

UX has not only become important in the business world; these increased standards also affect other industries such as the health sector, relating to the need for enhanced patient-experience, as well as in government entities. A reduced user experience may cause users not to come back, or to resort to other services or platforms (Buis, 2021). All in all, a good user experience enhances quality of life and satisfaction on the user's side, and leads to time-efficiencies and cost-effectiveness (along with adoption, retention, and loyalty) (Van Tyne, 2010). Back in 2014, it had already been estimated that the value of investment in user experience varied from a return of $2 to $100 for every $1 invested in user experience design (Ross, 2014). Today, with the advancements in AI and technology, which are only expected to continue to evolve at increasingly high pace, consumers bring higher expectations in terms of user experience, and are expected to use digital tech more and more (Guseva et al., 2023).

Considering these facts, one would expect that everyone employs and prioritizes UX. However, due to the lack of consensus about the definition of UX (Buis, 2021) and the activities it involves (Kieffer et. al, 2019), it is difficult to (convince management to) track UX ROI and prove UX value to some strategic leaders. The lack of defined parameters is in contrast with management culture, in which Key Performance Indicators (KPIs) drive decision-making, goal tracking and resource allocation (Hinderks et al., 2019). In short, implementing and prioritizing UX comes with its (managerial) challenges.

1.1. UX maturity

Attaining exceptional UX design is not solely reliant on the skills of individuals; it is a characteristic ingrained within the organization itself (Chapman & Plewes, 2014). The above observations highlight the need for assessing UX maturity. It is common practice, amongst those who are aware -or at least curious- about the importance of UX, to assess the UX maturity level of an organization through the lens of a UX maturity framework. UX maturity refers to the level of understanding, implementation, and continuous improvement of UX within an organization (Chapman & Plewes, 2014). The higher the level of UX maturity, the better equipped a company is to create products and services that meet the needs and expectations of its users - and, by extension, to enhance the chances of succeeding (Chapman & Plewes, 2014; Buis, 2021). Assessing UX maturity is beneficial: First, in today's fast-paced digital age, businesses need to be agile and innovative. Second, success requires a focus on user experience and customer experience. Third, UX maturity frameworks aid in identifying and implementing the right measures for staying competitive and relevant (Meyer, 2019).

A preliminary review of existing UX maturity models brings forward an apparent lack of consensus between the frameworks in terms of scopes, scales, terminology and levels. They also seem to lack continuity of parameters across levels, making it difficult to extract quantifiable UX goals to improve UX maturity. This overall lack of consensus could lead to confusion, increased complexity and interpretation bias. Additionally, research for UX best practices for UX work in startups is missing (Hokkanen & Väänänen-Vainio-Mattila, 2015) and since these operate differently than their larger counterparts, there would be value in adapting UX maturity tools to startups (MacDonald *et al.*, 2022).

Considering all the existing models with varying scopes and depths, there is value in developing and validating a comprehensive UX maturity model, which would undoubtedly help drive the UX industry forward (MacDonald et al., 2022). Our research was also inspired by the foundational work “Maturity Models Development in IS Research: A Literature Review” by Lasrado, Vatrapu, and Andersen (2015), which illuminates several critical gaps in the maturity models across information systems disciplines. These gaps include a lack of standardization, insufficient empirical validation, methodological shortcomings, theoretical inadequacies, and

limited practical relevance. The Comprehensive Integrated UX Maturity (CIUXM) Framework aims to address these deficiencies by providing a standardized tool that integrates disparate existing UX maturity models. One of Lasrado et al's (2015) recommendations pertained to the scarcity of maturity models that are empirically validated (Lasrado et al., 2015). Through the application of Multi-Grounded Theory, the CIUXM Framework was adapted to startups with an emphasis on empirical testing to ensure its applicability and effectiveness in startups.

1.2. UX maturity in startups

Treder, a UX expert in the industry is explicit in his statement: "UX is the air successful startups breathe" (Treder, 2023). Another - perhaps, more compelling - way this can be phrased is: bad UX causes failure. After conducting an analysis of 473 post-mortem startups, CB Insights reported that 17% of startups fail because of ignoring the users, their needs and not accounting for great user experience (CB Insights, 2023). UX can thus significantly contribute to start-up survival, also because those that have an informed approach to design generate more revenue (Kretzschmar, 2005) and are financially sustainable (Schreiber *et al.*, 2017).

Startups, characterized by resource scarcity, innovation, rapidly evolving, small and inexperienced teams, and time pressure, operate differently than more established organizations. This distinction is paramount in the context of UX maturity, as product development in startups is influenced by these factors (Giardino *et al.*, 2014). However, as mentioned, research for UX best practices for UX work in startups is missing (Hokkanen & Väänänen-Vainio-Mattila, 2015). These disparities between startups and more established organizations are important to keep in mind when reviewing currently available UX maturity assessment tools.

Common themes in existing UX maturity models are established processes, resource allocation, and team structures (Chapman & Plewes, 2014; Van Tyne, 2010; Pernice et al., 2021) - all things that are not inherent to the identity of a startup according to our definition above (Giardino et al., 2014). Penalizing a startup for a lack of established UX processes or not having a dedicated UX team seems inappropriate given that startups often operate without formalized procedures and may only consist of one or two multidisciplinarians, for instance. According to that perspective,

a startup would struggle to attain UX maturity at its inception, regardless of their overall UX efforts within their capabilities. It appears more appropriate to assign a lower maturity level to a well-established company that possesses clearly delineated departments and processes but neglects UX considerations. This observation highlights the need for a more tailored approach when it comes to utilizing existing UX maturity assessment tools and prescribing best practices for startups, considering their distinct attributes. Overall, UX best practices and maturity assessment tools appear to be geared primarily to more established organizations.

UX maturity assessment tools can be a relatively easy and low-risk manner of assessing an organization's overall user-centeredness, but they need to be suitable for startups. Startups are widely acknowledged as pivotal players within any country's production sector. In the five years preceding the 2020 pandemic, the global startup economy has more than doubled (Gauthier et al. 2021). Digital businesses are particularly crucial to UX, and according to predictions from the World Economic Forum, over the next ten years, digital business models will account for 70% of new value created globally. For the first time, "digitally transformed" businesses accounted for more than half of GDP in 2023, according to Statista. According to PWC, by 2030, the benefits of AI alone would boost the world economy by $15.7 trillion (Startup Genome, 2022). SMEs, which include the stage right after startup, account for the majority of businesses worldwide and are important contributors to job creation and global economic development. They represent about 90% of businesses and more than 50% of employment worldwide. Formal SMEs contribute up to 40% of national income (GDP) in emerging economies. These numbers are significantly higher when informal SMEs are included (World Bank, 2023).

Taking their contribution to the global economy as well as their representation within existing business across the world into consideration, ensuring that these organizations can easily and accurately assess their UX maturity can be particularly impactful. Considering the rising importance of good UX in digital businesses and the high failure rate due to poor UX, this research aims to offer more suitable tools to ultimately implement best practices in startups. The research will focus on the following question and objectives:

RQ1. How can existing UX maturity assessment tools be optimized to better suit startups, considering their distinct structure, challenges, and resources?

O1. To investigate ways to better suit existing UX maturity assessment tools for startups, considering their distinct structural features, daily operational dynamics, and resource constraints.

O2. To contribute to increased consistency in terminology, scales, identity and processes within the UX industry;

O3. To identify specific drivers of UX maturity applicable to startups;

O4. To generate insights that will inform the enhancement of existing UX maturity frameworks to facilitate extraction of clearly defined UX maturity goals.

1.3. Expected Research Contributions

This study is anticipated to contribute to both academia and industry by enhancing the understanding of UX maturity, particularly in the context of startups. The development of the CIUXM Framework, and the recommendations that follow in adapting it to startups, will fill a gap in existing literature, providing a practical tool that accounts for the unique challenges faced by these smaller organizations. The framework is expected to standardize UX maturity assessments across different organizational contexts, offering a more accurate and relevant evaluation of UX practices. Additionally, the study's integration of Multi-Grounded Theory (MGT) into UX maturity research introduces a novel methodological approach, strengthening the theoretical underpinnings of the field. The findings will advance theoretical knowledge but also offer actionable insights for startups seeking to enhance their UX maturity. This research is expected to inform future studies and guide the development of industry-specific adaptations, thereby contributing to the broader discourse on UX maturity in diverse organizational settings.

1.4. Student's Contributions in this Thesis

The description below aims to communicate my individual intellectual contribution to each aspect of the thesis, taking into account that this thesis was conducted in the Tech3Lab with multiple collaborators, including our industrial partner AsterX, at varying levels of contributions across varying stages of the thesis. The lab's guidelines state that a student must contribute 50% of their total effort overall. In dimensions where my own contribution is greater than fifty percent, it indicates that I am the phase's leader and owner.

- RQs: 80%
- Experimental Design: 50%
- Questionnaires: 95%
- Ethics: 50%
- Interview Guides: 75%
- Recruitment: 0%*
- Data Collection: 95%
- Analysis: 95%
- Writing: 75%

*Sample was provided by our industrial partner AsterX.

1.5. Thesis Structure

Prior to the submission of this thesis, the request was approved by the administrative management of the M.Sc. User Experience programme. This thesis consists of two articles, presented in Chapter 2 and Chapter 3, respectively):

- Article 1: *Proposing A Comprehensive, Integrated Framework for Assessing UX Maturity (CIUXM): A Systematic Literature Review*
- Article 2: *Enhancing UX Maturity Assessment Tools for Startups Through Multi-Grounded Theory: A Longitudinal Exploration*

The research was approved by the HEC Research Ethics Board (REB) under project number #2023-5360 on 2023-02-08.

CHAPTER 2: Article 1

Proposing A Comprehensive, Integrated Framework for Assessing UX Maturity (CIUXM): A Systematic Literature Review

Abstract

In today's competitive business environment, user experience (UX) is increasingly critical across sectors, including healthcare and government. Despite its importance, the lack of consensus on defining UX and measuring UX maturity hampers the ability to track return on investment (ROI) and implement effective UX practices. Additionally, many models are criticized as they are based on the authors' experience rather than grounded in theory and empirical data. This systematic literature review (SLR) aims to address these challenges by proposing a Comprehensive Integrated UX Maturity Framework (CIUXM). Through a detailed comparison of existing UX maturity models and frameworks, this study identifies gaps, overlaps, and inconsistencies. By integrating insights from various models and extending the analysis to include UX capacity and capabilities, the CIUXM Framework offers a nuanced, standardized tool for assessing and improving UX maturity in organizations. This framework outlines stages and criteria for UX maturity and incorporates the key findings of our analysis. The findings contribute to advancing the UX field by providing a comprehensive framework that aligns with industry standards and supports the strategic implementation of UX practices.

Keywords: UX maturity, user experience, systematic literature review, UX capacity, UX capability, CIUXM Framework, self-assessment tools, UX practices, UX management.

2.1. Introduction

In today's business landscape, user experience (UX) plays a growingly important role. This impacts all sectors, including healthcare and government, with its absence leading to increased costs and decreased user satisfaction (Van Tyne, 2010; Ross, 2014). Despite this, a lack of consensus on UX definition hinders UX ROI tracking and prioritization (Kieffer et al., 2019; Hinderks et al., 2019). This leads to resistance when it comes to implementing UX practices into daily operations (Buis, 2021), ultimately translating into lost opportunities and decreased service quality (Buis, 2021).

The era of technology has come with escalating consumer expectations regarding digital products (Guseva et al., 2023). The backbone of good UX is good UX management - reflected by high UX maturity (Chapman & Plewes, 2014). Measuring and achieving UX maturity brings significant benefits to organizations, such as enhanced user experience and satisfaction, increased business success, efficient development processes, informed decision-making, and competitive advantages (Interaction Design Foundation, 2024).

UX maturity is commonly assessed through UX maturity models. However, existing models differ in their scopes and depths (Chapman & Plewes, 2014; Van Tyne, 2010; Meyer, 2019; Pernice et al., 2021). Lacerda & Wangenheim (2018) carried out an SLR on Usability Capability/Maturity Models (UCMMs) and concluded that the majority of the models did not provide assistance for their use, lacked information regarding development and validation processes, and had limited practical acceptance. These claims further support the need to streamline existing models to enhance their validity and applicability. At the end of their SLR, MacDonald *et al.* (2022) suggested that there would be value in developing and validating a comprehensive UX maturity model, claiming it would undoubtedly help drive the UX industry forward.

In seeking increased standardization, consensus, and coherence across the UX industry, particularly for UX maturity assessment tools, we conducted a systematic literature review (SLR). We aimed to shed light on inconsistencies in existing UX maturity models and further support and complete the ideas presented in those models with related existing knowledge. Our

objectives were to find existing literature presenting UX maturity models, compare the selected models in terms of scopes and depth, cross-verify their ideas with each other and relevant literature, and propose a nuanced yet comprehensive framework.

Through this SLR, we sought to propose a nuanced yet comprehensive framework that merges the selected models, covering gaps and adjusting for any misalignments for increased standardization: the Comprehensive Integrated UX Maturity (CIUXM) Framework. Our research extends the work of previous studies by providing a set of recommendations for adapting UX maturity models and offering a new, more standardized framework. This new model aims to drive the UX industry forward by enhancing the validity and applicability of UX maturity assessments, ultimately fostering better UX practices across various organizations.

In conducting this SLR, we seeked to:

1) Find existing literature presenting UX maturity models, extending the search into relevant capacity & capability models,
2) Compare the selected models in terms of scopes and depth, and cross-verify them their ideas with eachother and relevant literature,
3) Propose a nuanced yet comprehensive framework that merges the selected models, covering gaps and adjusting for any misalignments for increased standardization.

We defined three research questions, based on the above objectives:

- **RQ1.** What are existing UX maturity models (and other relevant models) and what are their characteristics?
- **RQ2.** What are recurring themes in existing UX maturity models and how are they supported by existing literature?
- **RQ3.** How do the selected UX maturity models compare in terms of scopes and depths, and how can their ideas be reorganized into one comprehensive, nuanced version?

This article is structured as follows: Section 2 discusses the evolution of UX and the relevance of UX maturity models and is followed by Section 3 which presents related work. Section 4 presents the research method including objectives, search method and selection criteria. Then,

Section 5 presents and compares the final selection of articles for this SLR. Lastly, Section 6 presents the CIUXM Framework and is followed by the limitations and contributions of this research.

2.2. Purpose of Study

The purpose of this study is to address the lack of a comprehensive UX maturity framework that integrates and compares existing models, while correcting for gaps and misalignments in such models. Unlike previous efforts, such as MacDonald *et al*.'s (2022) UX Capacity Assessment Framework (UXCAF), which did not include a detailed self-assessment rubric, this research aims to develop a framework that meets the following demands (Kieffer & Vanderdonckt, 2016; Lasardo *et al.*, 2015; Lacerda & v. Wangenheim, 2018; MacDonald *et al.*, 2022; Sauro *et al.*, 2017):

1) The framework is designed to be generalizable across industries;
2) The framework is grounded in theoretical foundations;
3) The framework is grounded in empirical foundations;
4) The framework designed to facilitate practical implementation;
5) The framework contributes to increased standardization across the UX industry.

2.3. Importance of the Research

The significance of this SLR lies in its identification of gaps and inconsistencies in existing UX maturity models, leading to the development of the CIUXM Framework, which aims to standardize UX maturity assessment. By addressing the limitations of previous models and integrating both strategic and actionable insights, this research provides a more comprehensive and theoretically grounded framework that can advance the UX industry. The CIUXM Framework contributes to the theoretical understanding of UX maturity and offers practical tools for organizations to assess and improve their UX practices.

2.4. Outline of the Content

This article is structured as follows: it begins with a review on existing literature and details the research methodology used in conducting the SLR. The findings are presented, focusing on recurring themes and the introduction of the CIUXM Framework. It concludes with a discussion of the framework's implications, limitations of the study, suggestions for future research, and contributions to both theoretical knowledge and managerial practices.

2.5. Research Method

In this SLR, we focussed on scientific papers that produced UX maturity models and/or frameworks. The different maturity models were compared to one another, seeking to identify gaps and overlap, as well as inconsistencies. Due to the nature of the subject, that is, the UX industry, and considering the room for improvement regarding UX identity and implementing UX, our research also extended to papers referring to UX capacity, UX capabilities or aiming to identify UX through descriptions of UX activities, methods and questionnaires - ultimately aiming to come out with a comprehensive and nuanced overview which formed the building stones of the CIUXM Framework. Lastly, to ensure that the CIUXM Framework conformed to industry and scientific norms, a review of good practices of self-assessment tools was included.
In conducting this SLR, we followed Kitchenham & Charters' SLR protocol (2007). This methodology comprised a selection criteria procedure, a quality assessment, and a qualitative data analysis. Our main research contribution in this chapter is the proposal of a Comprehensive Integrated UX Maturity Framework (CIUXMF).

To gather a comprehensive list of existing UX maturity models and other irrelevant sources that would serve to support the ideas in these models, we followed the guidelines by Kitchenham and Charters (2007) and applied: 1) research questions, 2) keywords and search engines, 3) selection criteria, 4) quality assessment, and 5) extraction and analysis of data. This ultimately resulted in a final selection of eleven articles that were analyzed and formed the building blocks of the CIUXM Framework. The process is outlined in this section.

2.5.1. Keywords and Databases

We followed a five-step process, inspired by other SLRs (Martinelli *et al.*,2024; Lacerda & von Wangenheim, 2018), which is outlined in Figure 1.

Figure 1. Five-Step SLR Search Process

Based on our RQs and preliminary searches, we compiled a list of core concepts with their definitions and synonyms (in this context), which are outlined in Table 1. Although the key focus was to compare UX maturity models, capability and capacity models were not excluded as we considered them relevant to this study - excluding them would decrease the level of comprehensiveness. Based on this list, we compiled a list of search terms and search strings following Kitchenham & Charters' (2007) PICOC protocol. Each component of the PICOC Protocol was outlined before compiling the final list of keywords in Table 1.

Table 1. List of Core Concepts

CORE CONCEPTS		
Term	**Synonyms (in this context)**	**Definition**
UX	user experience; user-centeredness; user-centered design; usability ; human-computer interaction	"User experience (UX) encompasses all aspects of the end-user's interaction with the company, its services, and its products." (ISO, 2010)
UX maturity	UX capability	"UX maturity is the extent to which an organization understands, values, and effectively implements user experience (UX) practices across its projects and processes" (Pernice et al., 2021).
UX capability	business capability	"(...) the ability of an organization to achieve a specific outcome or objective. It is a combination of the people, processes and technology that an organization needs to perform a task or function. Business capabilities are the building blocks of an organization's strategy and are essential for achieving its goals (Hanna & Denman, 2023).

UX capacity	-	“the competencies and structures required to employ UX processes, methods, and tools (capacity to do), as well as the organization’s ability to integrate UX knowledge into its decision-making process and create quality products (capacity to use)” (MacDonald et al., 2022).
maturity model	-	"A UX maturity model assesses the maturity level of UX practices within an organization, providing a roadmap for continuous improvement and development." (Chapman & Plewes, 2014)
model	method; framework; assessment	"A maturity model is a tool to evaluate the capability of an organization’s processes, using a structured collection of elements that describe characteristics of effective processes at different levels of maturity." (De Bruin et al., 2005)
framework	-	"Frameworks in HCI bring together previously unrelated research, offering a full picture of research on a specific topic, helping scholars identify open research questions, and providing context and explanation to research results." (Girouard et al., 2018)

Table 2. PICOC, Terms and Search Strings used in SLR

Component	Description	Keywords	Boolean Operator
Population (P)	Organizations from various industries (e.g., software, healthcare, finance)	“organizations” OR “management” OR “manager”	AND
Intervention (I)	Implementation and evaluation of UX maturity models, frameworks, or methodologies	“assess” OR “improving” OR “measure” OR “implement”	AND
Comparison (C)	Different UX maturity models/frameworks	“UX maturity model” OR “UX maturity framework”	AND
Outcomes (O)	Improved UX maturity levels, better user-centered design practices, enhanced user satisfaction, understanding of UX activities	“UX activity” OR “UX practice” OR “user-centered” OR “user satisfaction”	AND
Context (C)	“large enterprise” OR “SME” OR “startups”	“management” OR “enterprise” OR “organization”	AND

The PICOC procedure led to a set of five search strings (see Appendix 1), which were carried out in five databases: Google Scholar, ACM Digital Library, Web of Science, ResearchGate, ScienceDirect and IEEEE Xplore. Unfortunately, the initial search strings as listed in Appendix 1 did not return the desired volume of articles. As a result, shorter and less specific search strings were put in instead. This led to small variations in search strings, depending on the database’s functionalities, as outlined in Table 3. The searches led to final selection, and the article ID is listed in Table 3, under column “Final Selection” in order to trace back the original database where the article came from.

Table 3. Number of Articles per Database at Each Step

NUMBER OF ARTICLES PER DATABASE, PER STEP				
Database	**Search String**	**Initial**	**Selected after Step 2**	**Final Selection**
ScienceDirect	“UX management” AND “UX maturity” AND “model” OR “framework”	N=411	N=37	1[A7]
ScienceDirect	("enterprise" OR "organization" OR "management") AND ("assess" OR "improving" OR "measure" OR "implement") AND ("UX maturity model" OR "UX maturity framework")	N=9	N=3	0
Google Scholar*	UX management 'AND' UX maturity 'AND' model 'OR' framework	N=5690	N = 12*	N = 3[A4; A7; A10]

NUMBER OF ARTICLES PER DATABASE, PER STEP				
Web of Science	UX maturity model OR framework	N = 28	N = 11	N = 1[A1]
ResearchGate	UX maturity model	N = unknown	N = 2	N = 2[A3,A7]
IEEEE	UX maturity model OR framework	N = 9	N = 8	N = 1[A6]
ACM Digital Library	UX maturity model	N = 2045	N = 2	N = 2[A4, A5]
Total		**N > 4127**	**N = 37**	**N** = 7**

**In Google Scholar, an advanced Search Criteria was executed in Step 2: "with the exact phrase: UX maturity model"*

***without duplicates*

2.5.2. Selection Criteria

The selection criteria in Table 4 were put together based on the RQ's as well as inspired by other SLRs (Martinelli *et al.*,2024; Lacerda & von Wangenheim, 2018). After applying the exclusion criteria (ECs) to the selection, we eliminated papers that at least partially matched one of the ECs. We applied the inclusion criteria (ICs) after the first two ECs (Martinelli *et al.*, 2024).

Table 4. Selection Criteria (EC & IC)

IC/EC	Description	Step #
IC1	The paper proposes a UX maturity model with clearly defined criteria and outlined stages.	3
IC2	The paper proposes a UX capacity model with clearly defined criteria and outlined stages.	3
IC3	The paper describes UX dimensions, factors, questions, activities or strategies to improve or assess UX maturity of an organization.	3
EC1	The paper is not written in English.	2
EC2	The paper focuses on the application of UX rather than the managerial perspective (e.g. "framework to assess user satisfaction")	2
EC3	The search result is a book rather than a paper.	2
EC4	The paper was published more than 20 years ago, or a revised version was published.	2
EC5	The paper is a duplicate.	5

Step 2 in Figure 1 involved applying EC1 and EC2 (see Table 4) and led us to exclude 4090 papers. For this step, we used the database filters, then most often reviewed the title alone, and in case of hesitation, the abstract and keywords before eliminating any papers. The filtering options also helped with EC1. In the end, this led to the remaining 37 papers, which were then gathered into a spreadsheet and reviewed in Step 3.

In Step 3, we went over the following important sections of each paper: a) the title, abstract, and keywords; b) the introduction and conclusion (if applicable); and c) the entire document (if applicable). If insufficient information was found in part a) to apply a criterion, part b) was read. If portion b) did not include enough information, we read section c) (Martinelli *et al.*,2024). The goal of Step 3 was to select for IC1, IC2 & IC3. As we were reading the papers, additional UX maturity models and relevant papers were discovered which we included in our selection as well (this led to an additional four papers). If the papers satisfied at least one of the ICs at this stage, they were included for Step 4.

Step 4 involved applying EC3, EC4, and EC5. The reason for first going through the inclusion criteria was that EC3 and EC4 are softer exclusion criteria and may not be relevant for other research, so we wanted to keep a trace of the papers that almost made the cut into our selection - which can be found in Appendix 2 and involved a total selection of 14 papers. After Step 4, a total of eleven papers remained.

2.5.3. Quality Assessment

In the last step, a Quality Assessment was conducted, to ensure that the papers were of good quality (as outlined by the criteria in Table 5) and relevant for comparison, and to distinguish between those maturity models that would directly be compared to one another, and the content that was aimed to support rather than be included in the main comparison.

Three quality categories were assessed by using QA questions (Martinelli *et al.*, 2024), see Table 5. Based on this, out of the remaining eleven papers, four were selected as presenting a UX maturity model with clearly defined stages and with demonstrated relevance in the industry. Despite not conforming to QA3, out of these four, two papers remained part of the final selection due to their scientific grounding and notoriety ([A2], [A9]).

Table 5. Quality Assessment (QA) Questions

QA Criteria	Category	Question
QA1	Quality of Reporting	*Is there a clear statement of the aims of the research?*
QA2	Relevance	*Does it present a UX maturity model with clearly defined stages?*
QA3	Credibility	*Is it peer reviewed?*

2.5.4. Data Extraction and Analysis

The qualitative data analysis combined open coding (identifying recurring themes and grouping categories) and closed coding (in the form of levels). To analyze various UX maturity models, unique ideas and quotes from each model were extracted and visualized using a digital brain mapping tool, Miro version 0.7.37 (Miro (Amsterdam, The Netherlands), 2023). Each framework, with its distinct stages, terminologies, and focuses, was analyzed in-depth to maintain their complexity while providing a comprehensive overview.

All the stages of each model were visualized on Miro and the assessment parameters within each stage were extrapolated. The complete visualization of the dissection of these models is available in Appendix 5.

2.6. Results

As mentioned, eleven papers remained after the selection process. Four of these proposed UX maturity models with clearly defined stages, while the other six presented various models or questionnaires related to UX maturity, capability, and capacity. These latter papers were selected to provide additional theoretical backing for the recurring themes in the four UX maturity models, ultimately contributing to the CIUXM Framework.

In this section, we present the selected papers, followed by a comparative analysis. Based on the key findings from this analysis, we propose the CIUXM Framework.

2.6.1. Selected Articles

The most important papers for this research were those who presented UX maturity models as these directly tap into the subject we were aiming to bring to consistency. Notorious for their Ten Usability Heuristics, the Nielsen Norman Group (NN/g) are pioneers in UX and have put forward multiple UX maturity models (Pernice *et al.*, 2021; Nielsen (2006). In the context of this analysis, the latest of their models - a six-stage UX maturity model- was included in the final selection (Pernice *et al.*, 2021). As a second input, Chapman & Plewes' model was informed by the authors' extensive experience in UX and consultation across various organizations (MacDonald *et al.*, 2022; Chapman & Plewes, 2014). It incorporates a five-level approach, from the initial recognition of UX importance to fully embedding UX into the organizational culture and processes (Chapman & Plewes, 2014). Van Tyne's model is a little older, dating from 2010 and published in the User Experience Professionals Association (UXPA) Magazine, it goes very in-depth regarding the implementation of UX processes, which made it an interesting addition to the mix (Van Tyne, 2010). Lastly, Meyer's model, which is based on the Kreitzberg model and Nielsen's 2006 maturity scale (Nielsen, 2006; Meyer, 2019) was included. The other papers, which were considered highly relevant and contributed to the CIUXM Framework, are listed in Table 6 along with the four papers mentioned above.

Table 6. List of Selected Papers

A#	Name	Author(s) & Year	Focus Area	Type	Assessment
A1	UXCAF (UX Capacity Assessment Framework)	MacDonald et al. (2022)	UX Capacity	Framework	Dimensions / Question-based
A2	Nielsen's 6 Levels of UX Maturity	Pernice et al. (2021)	UX Maturity	Model	6 Levels (1-6)
A3	UX Capability Maturity Model	Rukonic et al. (2019)	UX Capability/Maturity	Model	Capability scale/maturity scale/rating scale/set of process attributes
A8	UX Process Reference Model	Kieffer et al. (2019)	Strategic planning of UX activities	Model	Process-Level Assessment Questionnaire
A4	UX Maturity Assessment Questionnaire	Sauro et al. (2017)	UX Maturity		Questionnaire
A5	STRATUS Model	Kieffer & Vanderdonckt (2016)	Strategic Usability	Model	3-Level + Questionnaire
A6	AGILEUX Model	Peres et al. (2014)	Integration of UX Processes in Software SMEs	Model	
A7	UX Maturity Model	Chapman & Plewes (2014)	UX Maturity	Model	5 Stages (1-5)
A9	6 Degrees of UX Maturity	Meyer (2011)	UX Maturity	Model	6 Stages
A10	Corporate User Experience Maturity Model	Van Tyne (2010)	UX Maturity	Model	5 Stages (0-4)
A11	Standardized Usability/UX Maturity Model	Marcus et al. (2009)	Usability/UX Maturity	Model	5 Levels (1-5)

2.6.2. Identifying Recurring Themes

The result of the data extraction and open coding led to grouping of recurring themes across the articles and identification of parameters within these themes, all of which are presented in Table 7. This grouping exercise was performed iteratively as more data was being extracted.

In addition to open coding, we engaged in closed-coding, based on the main factors as outlined by N/Ng (Nielsen Norman Group) and Chapman & Plewes (Pernice *et al.*, 2021; Chapman & Plewes, 2014). Favoring cumulative research as a preferred practice and recognizing that there is no need to reinvent the wheel when integrating these models (Goldkuhl and Cronholm, 2010), we laid the factors identified to influence UX maturity side by side, ultimately seeking to use them to form the building blocks of the CIUXM Framework. These factors were also acknowledged in other articles (see Table 7), although not as explicitly. NN/g identify four factors which require growth if an organization wishes to improve their UX maturity: Strategy, culture, process, and outcomes. Meanwhile, Chapman & Plewes present six key indicators of UX Maturity, amongst which one pertaining to leadership and culture, similarly to NN/g's 'strategy' and 'culture' factors, and another referring to the integration UX processes, which could be equaled to NN/g's 'process' factor. Chapman & Plewes built upon that, by adding 'UX expertise and resources', 'the use of appropriate techniques and deliverables for user input and UX design', 'the application of design thinking for consistent customer experience', and 'the timing of UX involvement in the design process'. Rukonić *et al.* (2019) also cover the notion of frequency of UX activity, in the form of a questionnaire. In this questionnaire, users are encouraged to fill out the frequency at which they come across specific UX activities.

We performed a visual brain mapping exercise to compare and merge these factors to see if, and if so, how, they all fit in one picture. Chapman & Plewes' 'leadership and culture' (Factor 4, depicted in yellow) are closely tied to 'strategy' (NN/g), while 'the use of appropriate techniques and deliverables' was placed between having 'established processes' and 'in-house expertise', as we perceived it to be related to both factors. Proceeding in this fashion, we organized the factors and overlapping key ideas (presented in Table 7), which led to the foundation for the comprehensive framework (see Figure 2).

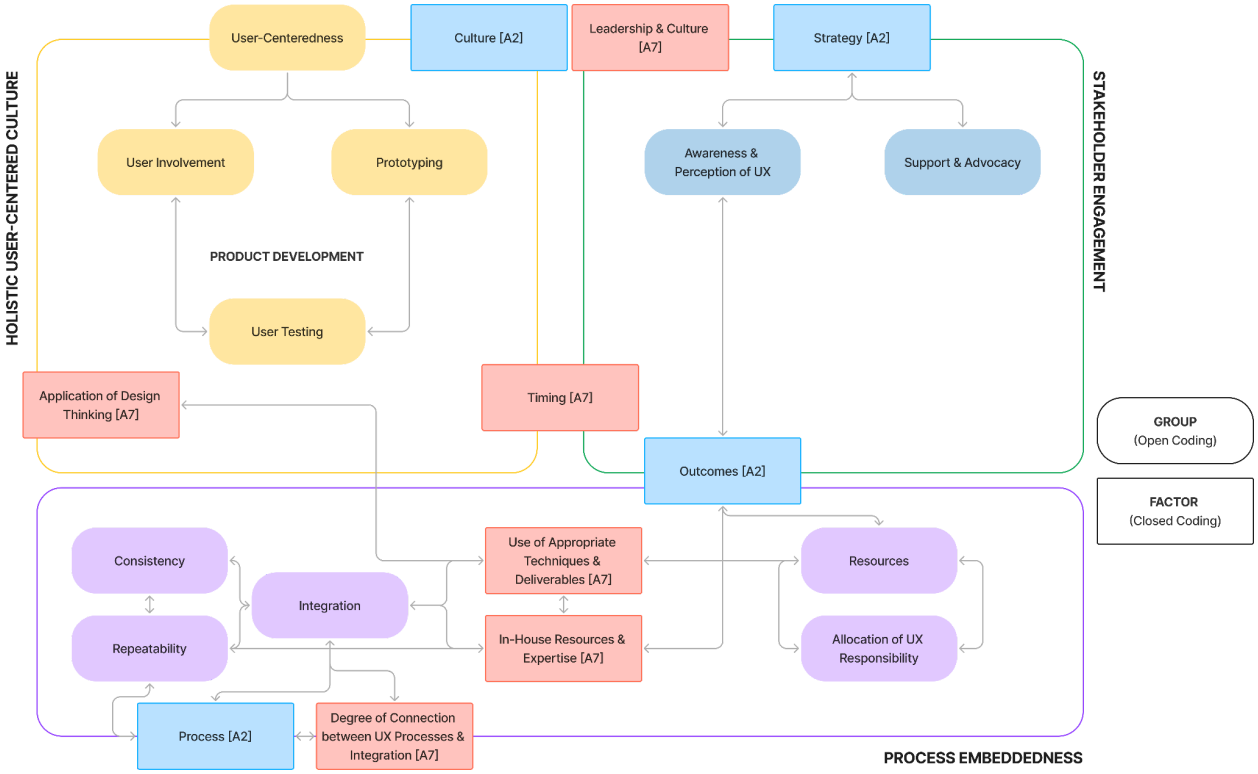


Figure 2. Visualization of Connecting Themes (Groups & Factors)

This grouping exercise (both open- and closed-coding) ultimately led to the three main dimensions of the CIUXM Framework:

Dimension A: *Holistic & User-Centered Culture*

Dimension B: *Stakeholder Engagement*

Dimension C: *Process Embeddedness*

Table 7. Recurring Ideas in Existing UX Maturity & Capability Models

Key Theme	Key Ideas/Keywords	Source
GROUP 1A	LEADERSHIP, CULTURE & STRATEGY	
Leadership, Strategy & Culture [A7; A4]	strategy[A2]; leadership[A7]; focus on functionality[A7]; product-driven methodology[A5]; (lack of) user-centered mindset[A2; A5], corporate strategy, understanding user needs, user-centered design, strategic UX culture[A5; A2; A7], leadership support, nature of decision-making, user feedback, integration of UX intro strategy; formalized strategy[A6]; culture[A2]; UX as strategic advantage[A9]; (presence of) UX goals[A7]; UX goals (not) tied to business objectives[A7]	[A1]; [A2]; [A5]; [A6]; [A7]; [A9]; [A10]
GROUP 1B	PRODUCT DEVELOPMENT	
User-centered product development cycle	user testing, prototyping[A9]; user research[A9];; application of design thinking[A7]; UX research methods[A4]; iterative design process[A9]; integration of practices on development cycle[A6]; application of design thinking[A7]; early user research[A9]; early user involvement[A9]; consulting users in the development process[A7]; timing (of initial UX)[A7];	[A1]; [A2]; [A5]; [A6]; [A7]; [A9]; [A10]
GROUP 3	ESTABLISHED CULTURE	
Awareness & Perception	(lack of) awareness of added value[A2;A9;A10; A5]; (lack of) understanding of UX as a whole[A9]; benefits are generally (mis)understood[A5]	[A1]; [A2]; [A5]; [A7]; [A9]; [A10]
Support & Advocacy	(lack of) internal authority[A9]; reliance on few people[A2, A10]; proactive usability[A5]	[A2]; [A5]; [A9]; [A10]
Outcome-Driven	outcomes[A2]; product-driven methodology[A5]; UX is perceived as competitive advantage[A5]	[A2]; [A5]
Resources	in-house resources & expertise[A7] ; budget[A6]; dedicated staffing[A6]; (presence of) UX team/UX Staff/UX manager[A9;A4; A5]; external expertise[A6]; UX budget and resources[A4]; availability of resources[A7]; (lack of) UX tools[A5];	[A4]; [A5] [A6]; [A7]; [A9]
GROUP 4	PROCESS EMBEDDEDNESS	
Embedding Processes / Consistency	process[A2];corporate design standards[A6]; knowledge database of successful cases[A6]; degree of connection between UX processes and integration[A7]; (un)documented processes[A6]; (not) critically evaluating user feedback[A7]; (lack of) formal structure in UX activities[A7]; UX integration[A4]; integration of UX in corporate processes[A7]; embedded in organizational culture[A5]; repeatable (predictable) UX processes[A5]	[A1]; [A2]; [A5]; [A7]; [A9]; [A10]
Skills	use of appropriate techniques and deliverables[A7]; education and training[A6]; required skills and experience to integrate UX into existing processes[A9]; UX training and skill[A4]; key usability techniques (champion)[A5];	[A4]; [A6]; [A7]; [A9]
Miscellaneous	UX challenges & future directions[A4]	[A4]

2.6.3. Differing Scopes & Depths

We also conducted a brain mapping activity with each of the ideas found in the selected models (see Appendices 6 and 7). We found that these models have differing scopes (i.e. subject areas) and depths (i.e. level of detail), with some models heavily covering a certain area and certain levels of maturity when compared to others more focussed on the general scope. To get a grasp on how exactly the scopes and depths differed, Table 8 was compiled to visually illustrate the spread of these unique ideas across the three dimensions (Dimension A: *Holistic & User-Centered Culture;* Dimension B: *Stakeholder Engagement;* Dimension C: *Process Embeddedness*) and five UX maturity levels (Levels 1-5) of what later became the CIUXM Framework.

As depicted in Table 8, some models cover all levels and dimensions relatively equally (Nielsen and Chapman's models) while, for instance, Meyer's [A9] ideas were more scattered across levels and dimensions but leaving gaps in comparison to the other models, suggesting less scope. Nielsen's ([A2]) conveyed a higher number of unique ideas, which suggests more depth, while others presented dense information but more focus on a specific area (such as Van Tyne's [A10]). Generally, we found inconsistencies in the levels allocated (naturally caused by a differing number of levels between models). This meant that the highest stage in one model could be a middle stage in another, confirming the need for standardization.

Chapman & Plewes' model was largely based on their extensive experience in the UX industry (Chapman & Plewes, 2014). The strength of their paper lies in its practical application and the clear, actionable steps it offers for organizations at different maturity levels. However, as pointed out by the authors themselves, the model could benefit from additional validation through empirical studies and might be too generalized for organizations with unique or niche UX challenges (Chapman & Plewes, 2014). As illustrated in Table 8, their ideas are relatively spread out across the different dimensions and they have a relatively high count of unique ideas, implying scope and depth. By contrast, Van Tyne's (2010) Corporate User Experience Maturity Model in Table 8, contains ideas condensed around Dimension C.

Table 8. Frequency and Allocation of Unique Ideas per Article into Each Level

Source →	Meyer (2019)			Van Tyne (2010)			NN/g (2021)			Chapman & Plewes (2014)			Kieffer & Vanderdonckt (2016)		
Dimension →	Holistic & User-Centered Culture	Stakeholder Engagement	Process Embeddedness	Holistic & User-Centered Culture	Stakeholder Engagement	Process Embeddedness	Holistic & User-Centered Culture	Stakeholder Engagement	Process Embeddedness	Holistic & User-Centered Culture	Stakeholder Engagement	Process Embeddedness	Holistic & User-Centered Culture	Stakeholder Engagement	Process Embeddedness
Level 1	2	1	0	0	3	4	1	2	0	2	1	2	4	0	3
Level 2	0	6	3	0	0	5	1	2	3	4	1	3	0	2	1
Level 3	3	3	4	1	0	5	1	2	4	2	2	5	2	1	1
Level 4	0	2	4	0	0	2	2	1	1	2	3	5	0	1	1
Level 5	5	0	0	0	0	4	3	3	4	4	1	0	4	3	5
Sum	10	12	11	1	3	20	8	10	12	14	8	15	10	7	11
Total	**33**			**24**			**30**			**37**			**28**		

2.6.4. Integration of Recurring Themes

As mentioned, the mapping activity revealed that the models are not scaled in the same way (see Appendices 6 and 7). For instance, yellow cards representing Meyer's Framework are mostly on the left, indicating an emphasis on Dimension A. The group 'process embeddedness' (which later became Dimension C of the CIUXM Framework) primarily contains orange and pink cards, representing the Van Tyne and NN/g models, respectively. Additionally, yellow cards are more prevalent in Levels 1 to 4, with almost none in Level 5, while orange cards in the 'process embeddedness' group were more spread out across the five levels. This disparity only further confirmed the need for a comprehensive framework, as the models overlapped but also complemented each other. Attributes defined at a specific level in one framework might appear at different levels in another, necessitating the reordering of levels in Appendix 5 to create a consistent baseline for all frameworks.

2.6.5. Structural Analysis

A general lacking in these UX maturity models, along with the lack of continuity for each parameter, is the lack of description of UX activities (along with relevant methods and artifacts) that belong to each level. This leaves these frameworks open to interpretation, which can lead to reduced quality of the assessment. Referring once more to Chapman & Plewes (2014) model, "UX practices", "UX goals" or "all aspects of customer experience" (Appendix 3) "Stage 1" and "Stage 5", respectively) might mean one thing for one manager and something else for someone else. Alternatively, a manager may have the best intentions and This is especially true when taking into account the overall lack of consensus on what UX entails, this leaves these frameworks subject to risk for introducing response- and/or interpretation bias.

To reduce the risk of introducing interpretation bias of a framework and avoid assigning the wrong maturity level to a company, a good place to start would seem to be to agree on what UX activities involve and, when possible, how these activities are connected to a given level. Kieffer et al. (2019) proposed a UX Process Reference Model (UXPRM) towards the strategic planning of UX activities. This model includes a description of the primary UX lifecycle process as well as a comprehensive classification of UX methods and artifacts. It classifies the UX methods in attitudinal- or behavioral methods, and lists the artifact-mediated communication methods. Their

findings were referred to in order to cross-verify existing model's content as well as adhered to when constructing the CIUXM Framework.

Observation 1: Lack of Continuous Parameters

The need to measure UX maturity in the first place -unsurprisingly- arises from the fact that not all companies are UX mature. By definition, it implies that a company can graduate from a lower maturity level to a higher one through a non-linear process (Pernice *et al.*, 2021). Naturally, a company could be mature in one area, and less mature in another. Current maturity models do not facilitate that distinction: A company is assessed as a whole, and if two parameters are evaluated at extremes, the overall assessment will simply lead to an evaluation in the middle, at the cost of nuance, depth and complexity. Even if separate attributes pertaining to a certain maturity level are distinguished, the existing model structures do not encourage nor facilitate an isolated analysis of a specific attribute or parameter. To illustrate this, the stages of Chapman & Plewes (2014) UX Maturity Model (which totals five stages) can be solicited in Appendix 3.

In Stage 1, Chapman & Plewes refer to the absence or vagueness of UX goals. However, the Stages 2 and 3 fail to mention UX goals. It is in Stage 4 that suddenly the jump is made to "clear goals". This does not seem very practical for a company seeking to evaluate its maturity level regarding its UX goals. In other words, the parameter on which UX maturity is assessed does not provide continuity. The same can be inferred for many other elements in this particular UX maturity framework as well as in other UX maturity frameworks, of which four have been presented and analyzed further in this literature review.

Observation 2: Lack of Isolated Indicators

The lack of continuity of parameters is surprising, as it increases the difficulty of extracting appropriate KPIs from the frameworks. It is often difficult for a company to use only one key indicator for the entire product (Hinderks *et al.*, 2019). Business decision makers usually use several different indicators. Each KPI represents one aspect that is important to the success of the company or its products. Therefore, each department involved in product success typically has its own key performance indicators that reflect the department's contribution. Monitoring can be done based on these key elements to better manage the business (Hinderks *et al.*, 2019). Since

UX maturity concerns the management of UX on an organizational level, it would only make sense to measure UX maturity in a set of specified KPI's which can be measured independently of one another, rather than conglomerating all the different facets under the "UX maturity"-umbrella - at the cost of the depth and complexity of the assessment.

UX maturity models generally lack standardized definitions of the parameters involved, as well as clear stage delimitations. Existing models are generally not showcasing the continuous progression of the parameters used to assess UX maturity. Regarding their applicability in real-world situations, models are not adapted to industry common practices: In many companies, decisions are mostly made based on key figures, such as turnover, profit, or employee satisfaction. Managers are accustomed to information being summarized and available via their key figures (Hinderks *et al.*, 2019). Assessing an organization's UX maturity should be aligned with those standards, to motivate better applicability of those models.

With regard to improving the interpretation of the models, solely listing that "activities are in place" (an example quote from Chapman & Plewes' model) still leaves some room for interpretation that could be minimized. Referring back to the NN/g UX maturity definition: "...it encompasses the quality and consistency of research and design processes, resources, tools, and operations (...)", the presence of UX activities is an indicator that these processes are in place, but it does not say anything about the consistency, or frequency, at which these activities take place.

In summary, our review of the existing literature on UX maturity models revealed several key findings. Firstly, there is a lack of coherence among the existing models, characterized by inconsistencies in attributing specific parameters to particular UX maturity levels and variations in terminology. Secondly, the models appear to be complementary to each other, with overlaps and gaps that suggest a need to use multiple models for a comprehensive assessment. Relying on a single model might result in an incomplete evaluation. Lastly, there is a lack of continuity in the parameters subject to assessment and unclear delimitations of each level within some frameworks, making it difficult to track these parameters and increasing the chances of interpretation bias.

2.7. CIUXM Framework

Incorporating these key findings with existing criticism and advice aided in the compilation of a list of product requirements for the CIUXM Framework, which is presented in Appendix 3. Based on this list, we compiled the CIUXM Framework, presented in Tables 9, 10 and 11. Additionally, Lasrado *et al.* (2015) identified that researchers and practitioners lack theoretical considerations during model development and the lack of standard vocabulary for model description. Following their suggested best practices and in the aim of contributing to increased standardization across the industry, we filled out their template to describe our newly developed framework. This description can be found in Appendix 4.

2.7.1. About the Framework

By proposing CIUXM Framework, we aimed to address all identified requirements (R) and key findings from the existing literature on UX maturity models.

First, the framework contains clearly defined UX maturity levels (R1), ensuring a structured progression through different stages of UX development. Each level is associated with specific criteria to avoid ambiguity and ensure consistent assessment (R2), addressing the inconsistencies and terminological disparities (F1a, F1b) found in existing models. The framework comprehensively covers all relevant domains of UX maturity, including processes, technology, people, and governance (R3), aiming to provide a holistic view of an organization's UX maturity rather than focusing on isolated areas (R4). This approach should mitigate the risk of incomplete assessments and the need to use multiple models to gain a complete understanding (F2a, F2b). Also, as much as possible, we ensured that the framework employs simple language and to avoid complex or technical terms that could confuse respondents (R6). We hope that this leads to increased clarity and that it reduces the risk of interpretation bias (F3b). Lastly, the CIUXM Framework was designed to contain as much as possible continuity of assessment parameters and clear delimitations for each level (F3a). We hope that this integration fosters a nuanced yet comprehensive framework that merges and refines the selected models, covering gaps and adjusting for any misalignments to increase standardization.

Table 9. CIUXM Framework, Dimension A - Holistic User-Centered Culture

A	HOLISTIC USER-CENTERED CULTURE							
Code	**Indicator**	**Description**	**Level 1: Initial**	**Level 2: Managed**	**Level 3: Defined**	**Level 4: Integrated**	**Level 5: Optimizing**	**Source**
A1	STRATEGIZING							
A1.1.	***Prioritizing***	*The importance placed on user needs and input*	Strategic priority is functionality over user input[A2;A9]	Transitioning towards a more user-focused approach[A2;A9]	Integration of UX into corporate strategy, but not prioritized as essential[A7;A10]	High importance on understanding user needs through research[A2;A7]	Comprehensive user-centered design; strategic UX culture[A2;A7;A9;A5]	[A1]; [A2]; [A5]; [A7]; [A9]; [A10]
A1.2.	***Decision-Making***	*How decisions are made regarding UX*	Decisions prioritize functionality over user needs[A2;A5;A9]	Decisions from external UX sources; conferences, articles, personal interpretation[A7; A9]	Decisions are driven by understanding user needs[A2;A7]	Decisions reflect UX integration into strategy[A1;A7]	User feedback consistently informs decisions[A5]	[A1]; [A2]; [A5]; [A7]; [A9]; [A10]
A2	GOAL SETTING							
A2.1.	***UX Goals***	*The clarity and measurability of UX goals*	No UX goals[A7]	Existing UX goals lack measurability and clarity	Some projects have measurable & clear UX goals[A7]	Almost all projects have measurable UX goals; included in corporate balanced scorecard[A7; A10]	UX goals are intricately linked to organization objectives[A2;A7;A2;9]	[A1]; [A2]; [A7]; [A10]
A3	PROTOTYPING & TESTING							
A3.1a.	***Prototyping***	*The use and integration of prototypes in the design process*	No prototyping in place[A9]	Some prototyping in place	Occasional Lo-Fi prototyping	Regular implementation of lo-fi and hi-fi prototypes[A3;A7]	Iterative design with thorough testing using lo-fi and hi-fi prototypes[A3 ; A7; A9]	[A3]; [A7]; [A9]
A3.1b.	*Timing of Prototyping*	*The timing of prototyping*	Never	End of product development[A7]	Occasionally throughout development[A3 ;A7]	Regularly throughout development[A3; A7]	Systematically throughout the development cycle[A3;A7]	[A3]; [A7]; [A9]
A3.2a.	***Testing***	*The extent and methods of testing*	No testing[A7]	Simple tests to assess UI and product features[A7;A9]	Expanded testing methods[A3]	Testing integral to design feedback[A3;A5]	Systematic testing and refinement throughout development[A7]	[A3]; [A7]; [A9]
A3.2b.	*Timing of Testing Activities*	*The timing of testing activities*	Never	End of product development[A7]	Occasionally throughout development[A7]	Regularly throughout development[A7]	Systematically throughout the development cycle[A7]	[A3]; [A7]; [A9]
A4	INVOLVING USERS							
A4.1.	***Type of User Feedback***	*How user feedback is utilized in the design process*	Confined to marketing input[A7;A9]	Feedback on design/functionality without impact	Needs improvement in methods/timing[A2;A3;A7]	Occasionally influences strategy/project prioritization	Consistently drives strategy/project prioritization[A2;A7;A9]	[A2]; [A3], [A7]; [A9]

A	HOLISTIC USER-CENTERED CULTURE							
A4.2.	***Evaluating User Feedback***	*The critical evaluation and implementation of user feedback*	Not critically evaluated, dismissed[A10]	Critically evaluated, implemented occasionally[A10]	Critically evaluated, implemented sometimes[A10]	Critically evaluated, implemented most times[A10]	Always critically evaluated, implemented[A10]	[A10]

Table 10. CIUXM Framework, Dimension B - Stakeholder Engagement

B	STAKEHOLDER ENGAGEMENT							
	Indicator	**Description**	**Level 1**	**Level 2**	**Level 3**	**Level 4**	**Level 5**	**Source**
B1	ALIGNING							
B1.1.	***Awareness***	*The level of awareness of UX across the organization*	No awareness[A2; A7; A9]	Seen as a tool to improve UIs[A2; A9; A10]	Topic of discussion for some projects[A7]	Regularly debated and considered important[A2; A7]	Fully enlightened about user-centered design[A2]	[A2]; [A5]; [A9]; [A7]; [A10]; [A11]
B1.2.	***Consensus***	*The degree of consensus on the importance of UX*	Everyone agrees it's irrelevant[A2;A7;A9]	Some disagreement[A2; A9; A10]	High polarization on UX relevancy[A7]	Some agreement on importance[A2;A7]	Agreement that UX is important[A2]	[A2]; [A5]; [A7]; [A9] [A10]; [A11];
B2	COMMUNICATING							
B2.1.	***Subject***	*The subject of UX discussions*	Limited to graphic/UI design/developers' tasks[A7; A9]	Initial interest in understanding user needs	Scattered but increased interest in understanding user needs & UX	Discussions on techniques, process improvementA9; A10	Leadership supports discussions about full integration, ongoing improvement[A2; A7;A10]	[A2]; [A9]; [A10]
B2.2.	***Frequency***	*The frequency of UX discussions*	Rare or neverA[A7;A9]	Occasionally[A7]	Sometimes[A7]	Frequently[A7;A10]	Every time/on all projects[A7;A10]	[A2]; [A7]; [A9]; [A10]
B3	CONVINCING							
B3.1.	***Valuing***	*The recognition of the added value of UX*	Unaware of added value[A2; A9; A5]	Inconsistent awareness, buy-in[A2; A7; A9; A10]	Heuristic reviews, initial success, and/or expert input show value[A7; A9; A10]	Structured approach to UX, some departments adopt practices[A9; A10]	Fully integrated, UX value recognized in all aspects[A2; A5]	[A2]; [A5]; [A9]; [A10]
B3.2.	***Advocating***	*The presence of UX advocates within the organization*	No one or one individual[A9]	A few advocates[A2; A10; A5]	Some teams[A2 ; A10]	All levels, but missing some stakeholders[A2; A10]	All levels, strong leadership advocacy[A2; A9; A10]	[A1]; [A2]; [A5]; [A9]; [A10];

Table 11. CIUXM Framework, Dimension C - Process Embeddedness

C	PROCESS EMBEDDEDNESS							
	Indicator	**Description**	**Level 1: Initial**	**Level 2: Managed**	**Level 3: Defined**	**Level 4: Integrated**	**Level 5: Optimizing**	**Source**
C1	INVESTING							
C1.1.	***Investing [resources]***	*The allocation and systematic use of tools and space dedicated to UX activities*	No dedicated UX tools and/or space[A5;]	UX tools/space exist, lack systematic use[A5]	Dedicated UX tools/space[A5]	UX testing lab, tools, equipment used consistently[A5]	Comprehensive resource allocation, strategic investment in UX[A5]	[A5]
C1.2.	***Investing [budget]***	*The presence of a dedicated budget for UX*	No dedicated UX budget[A7]	UX budget exists, lacks systematic allocation[A2; A7; A9; A10]	Dedicated UX budget: resources and tasks are being integrated[A7; A9; A10]	Dedicated UX budget allows for team formation, dedicated hires	Comprehensive budget allocation, strategic investment[A7; A9; A10]	[A1]; [A2]; [A7]; [A9]; [A10];
C1.3.	***Tracking ROI***	*The tracking of return on investment for UX activities*	No tracking of UX activities for ROI	Basic UX activities tracked for ROI[A10]	More comprehensive tracking of ROI	ROI tracking becomes refined	Fully integrated, optimized ROI tracking[A2]	[A1]; [A2]; [A9]; [A7]; [A10]
C2	DELEGATING							
C2.1.	***Dedicated UX Team***	*The establishment and structure of UX teams*	No dedicated UX roles[A9]	Late consultation, external experts hired[A2; A7; A9; A10]	Dedicated UX roles[A2; A7]	Official UX team, led by UX manager[A7; A9]	Well-defined roles, team collaboration[A7; A9; A10]	[A1]; [A2]; [A7]; [A9]; [A10]; [A11]
C2.2.	***Defining***	*The extent to which UX roles and activities are clearly defined*	No defined UX roles and no UX responsibilities allocated[A9]	Basic activities initiated by advocates, roles still undefined[A2; A7; A9; A10]	UX roles are clearer, but report to Marketing, Product Management, Engineering[A7; A9]	Defined responsibilities in the UX process[A9]	Well-defined roles, efficient outcomes, UX manager drives approach, strategic integration[A7; A9; A10]	[A1]; [A2]; [A7]; [A9]; [A10]; [A11]
C3	EMBEDDING							
C.3.1.	***Documentin g***	*The documentatio n of UX activities*	Always undocumented, reactive[A7]	Mostly undocumented, reactive[A7]	Sometimes documented, proactive[A7]	Mostly documented, proactive[A7]	Always documented, proactive[A7; A9]	[A7]; [A9]
C3.2.	***Integrating***	*The integration of UX roles, activities, and artifacts into processes*	Never integrated into processes[A2]	Integrated into one or few processes	Integrated into some processes[A2; A10]	Integrated into most processes and repeatable[A5]	Integrated into all processes and repeatable[A5; A7]	[A1]; [A2]; [A5]; [A7]; [A]10

2.7.2. Interpreting the Framework

Interpreting the CIUXM Framework requires understanding that not all stages demand the same resources, time, or effort to achieve; some stages may progress much faster than others. Additionally, organizations can move both up and down in levels, such as when letting go of an internal UX expert, which might reduce their UX maturity. While the framework aims to be as comprehensive and continuous as possible, the qualitative nature of UX means it cannot be perfectly continuous. The specific application of the framework may vary depending on the unique context of each organization and industry. This variability underscores the need for further research to test and validate the framework, capturing nuances that may have been missed despite a thorough review.

2.8. Discussion

2.8.1. Summary of Main Results

The study reviewed eleven papers, identifying four that proposed UX maturity models with defined stages, while the remaining six offered models or questionnaires related to UX maturity, capability, and capacity. These were included to provide theoretical support for the CIUXM Framework. The key findings from these papers were used to identify recurring themes, which were then categorized into three main dimensions: Holistic & User-Centered Culture, Stakeholder Engagement, and Process Embeddedness. The analysis revealed inconsistencies and a lack of continuity in existing models, leading to the development of the comprehensive CIUXM Framework to address these gaps and provide a standardized assessment of UX maturity.

2.8.2. Theoretical Contributions

The CIUXM framework aims to bridge gaps and address inconsistencies found in existing UX maturity models (Chapman & Plewes, 2014; Pernice *et al.*, 2021; Meyer, 2019; Van Tyne (2010); Rukonic *et al.*, 2019; Kieffer *et al.*, 2019) by integrating a comprehensive understanding of UX activities, artifacts, and methods. MacDonald *et al.* (2022) conducted an SLR on existing UX Maturity and Capacity models and suggested that there would be value in developing and validating a comprehensive UX maturity model, claiming it would undoubtedly help drive the UX industry forward. This integration should enhance the theoretical foundations of UX maturity assessment, offering a more nuanced and coherent framework for the industry, as called for by Lasrado *et al.* (2015). Additionally, the CIUXM framework contributes to the standardization of UX maturity definitions and assessment criteria, facilitating more consistent and comparable research findings across different assessments. By incorporating insights from both UX capability and maturity models (MacDonald *et al.,* 2022; Chapman & Plewes, 2014; Pernice *et al.*, 2021; Meyer, 2019; Van Tyne (2010); Rukonic *et al.*, 2019; Kieffer *et al.*, 2019), the framework provides a balanced approach that combines strategic perspectives with actionable, detailed insights into UX practices.

2.8.3. Managerial Implications

From a managerial perspective, the CIUXM framework will serve as a practical tool for organizations aiming to assess and improve their UX maturity. By providing clear definitions, criteria, and stages of UX maturity, the framework will help organizations identify their current maturity level and pinpoint areas for improvement. The inclusion of objective, measurable indicators and a focus on comprehensive coverage of key business domains (processes, technology, people, and governance) will enable organizations to integrate user-centered design principles into their strategic planning and decision-making processes.

2.8.4. Limitations & Research Avenues

The proposed CIUXM Framework has several threats to validity and limitations that must be acknowledged. Firstly, the framework may not be suitable for startups with limited resources, as these organizations might lack the necessary infrastructure, budget, and personnel to effectively implement and benefit from a comprehensive UX maturity framework (MacDonald, 2021). This is a limitation that goes against our product requirement R5, and further research will need to investigate how to adapt this framework to startups. Secondly, the qualitative nature of the data presents inherent limitations, such as subjectivity in data interpretation, potential biases from researchers' perspectives, and challenges in ensuring consistency and transferability of findings. Additionally, the systematic literature review was conducted using a selected number of databases, potentially omitting relevant studies that could have influenced the results. The research was primarily conducted by a single researcher, increasing the risk of personal bias and reducing the reliability of the findings due to the lack of double-checking or validation by multiple researchers. Furthermore, the process of grouping themes was inherently subjective, even though it was based on existing frameworks, introducing the risk of personal biases affecting the organization and interpretation of data. Lastly, the study did not employ card sorting techniques, or other types of techniques which involved other researchers outside the study to validate the grouping of themes and ensure that the categorization would make sense in other people’s perception. The absence of this method means that the thematic organization may lack validation from a broader user base. Future research should focus on empirically validating the CIUXM framework across diverse organizational contexts to ensure its robustness and generalizability. Longitudinal studies could examine the framework's effectiveness in tracking

and fostering UX maturity over time. Additionally, research could explore the development of industry-specific adaptations of the CIUXM framework to address unique challenges and requirements in different sectors. Further studies could also investigate the impact of cultural differences on UX maturity assessment and how the framework can be adapted to accommodate these variations. Finally, incorporating feedback from practitioners through case studies and practical applications will be crucial for refining and enhancing the framework, ensuring it remains relevant and effective in real-world settings.

Appendices

Appendix 1 | Search Strings (PICOC Procedure)

Search String 1:

("organizations" OR "management") AND ("assess" OR "improving" OR "measure" OR "implement") AND ("UX maturity model" OR "UX maturity framework") AND ("UX activities" OR "UX practices" OR "user-centered" OR "user satisfaction") AND ("management" OR "enterprise" OR "organization")

Search String 2:

("management" OR "enterprise" OR "organization") AND ("assess" OR "improving" OR "measure" OR "implement") AND ("UX maturity model" OR "UX maturity framework") AND ("UX activities" OR "UX practices" OR "user-centered" OR "user satisfaction")

Search String 3:

("organizations" OR "management") AND ("assess" OR "improving" OR "measure" OR "implement") AND ("UX maturity model" OR "UX maturity framework") AND ("UX practices" OR "UX activities" OR "user-centered" OR "user satisfaction") AND ("enterprise" OR "organization")

Search String 4:

("enterprise" OR "organization" OR "management") AND ("assess" OR "improving" OR "measure" OR "implement") AND ("UX maturity model" OR "UX maturity framework") AND ("UX practices" OR "UX activities" OR "user-centered" OR "user satisfaction")

Search String 5:

("enterprise" OR "organization" OR "management") AND ("assess" OR "improving" OR "measure" OR "implement") AND ("UX maturity model" OR "UX maturity framework")

Appendix 2 | Selected Articles - Before Application of IC2 & IC3

A#	Name	Author(s) & Year	Focus Area	Type	Assessment	IC/EC
A1	UXCAF (UX Capacity Assessment Framework)	MacDonald et al. (2021)	UX Capacity	Framework	Dimensions / Question-based	IC2
A2	Nielsen's 6 Levels of UX Maturity	Pernice et al. (2021)	UX Maturity	Model		IC1
A3	UX Capability/Maturity Model	Rukonic et al. (2019)	UX Capability/Maturity	Model		IC1/IC2
A4	UX Maturity Assessment Questionnaire	Sauro et al. (2017)	UX Maturity	Questionnaire	Questionnaire	IC3
A5	STRATUS Model	Kieffer et al. (2016)	Strategic Usability	Model	3-Level Questionnaire	IC3
A15	Keikendo Maturity Model	Carrero (2014)	UX Maturity & Barriers	Model	5 Levels	No (not peer reviewed)
A7	UX Maturity Model	Chapman & Plewes (2014)	UX Maturity	Model	5 Stages (1-5)	Yes
A8	Human Factors International Usability Maturity Model	Schaffer & Lahiri (2014)	UX Maturity	Model		EC3
A9		Meyer (2011)	UX Maturity	Model		IC1
A10	Corporate User Experience Maturity Model	Van Tyne (2009)	UX Maturity	Model	5 Stages (0-4)	IC1
A11	Standardized Usability/UX Maturity Model	Marcus et al. (2009)	Usability/UX Maturity	Model	5 Levels (1-5)	IC1
A12	Nielsen's Corporate UX Maturity Model	Nielsen (2006)	UX Maturity	Model	8 Levels	EC2
A13	The Organizational Human Centeredness Scale	Earthy (1998)		Model		EC2
A14	The Usability Maturity Model	Earthy (1998)	Usability Maturity	Model	6 Levels (1-6)	EC2

Appendix 3 | Chapman & Plewes' UX Maturity Model

Chapman & Plewes' UX Maturity Model

Stage 1: Beginning

→ Little to no consideration of UX design, often seen as visual design applied after coding. UX goals are absent or vague.

Stage 2: Awareness

→ Some consideration of UX design, but with minimal structure. There is an awareness of UX potential, but understanding is limited.

Stage 3: Adopting

→ Growing pains in adopting more sophisticated UX practices. Success is inconsistent, and there is a risk of reverting to old habits.

Stage 4: Realizing

→ Excellence in UX design maturity with clear goals, processes, and guidelines. UX is a differentiator, and success is consistent.

Stage 5: Exceptional

→ UX is fully integrated into all aspects of customer experience. The organization has a gold standard reputation for excellence in all customer touchpoints.

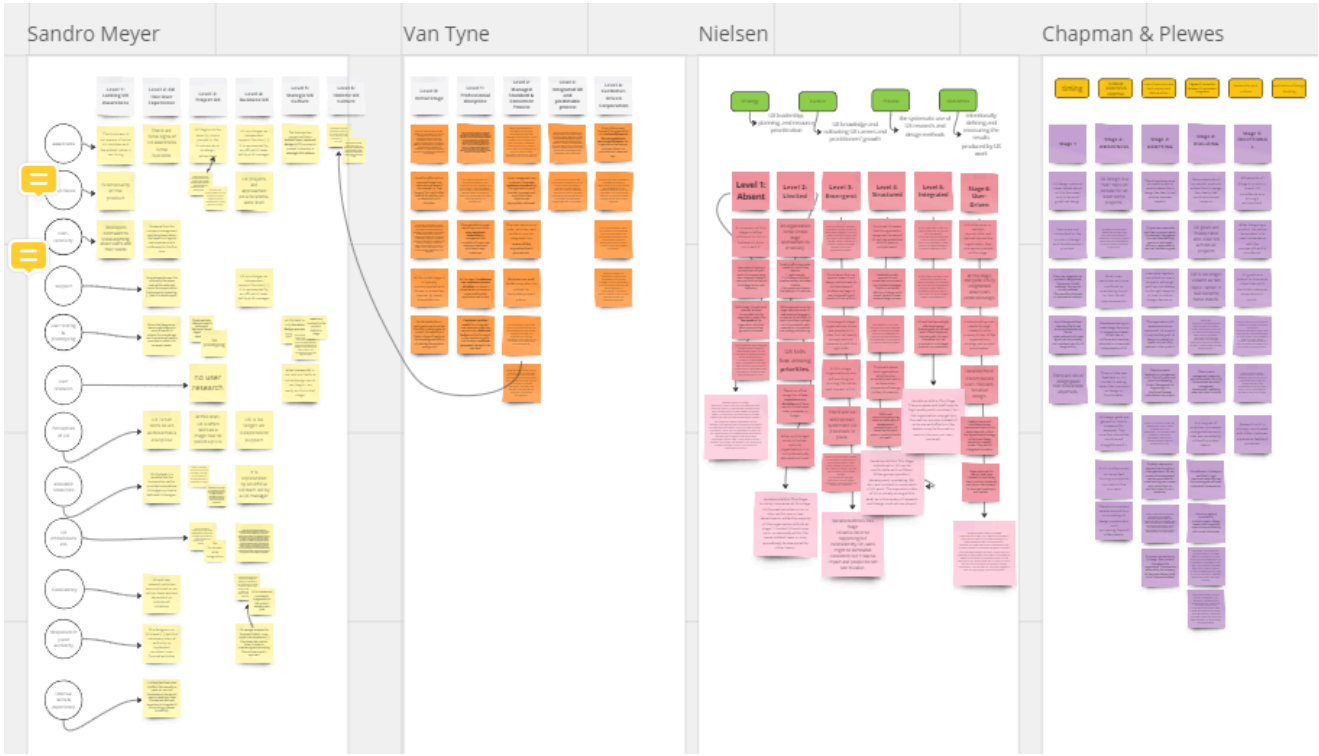
Stages Derived from The UX Maturity Model (Chapman and Plewes, 2014)

Appendix 4 | List of Requirements for Developing the CIUXM Framework

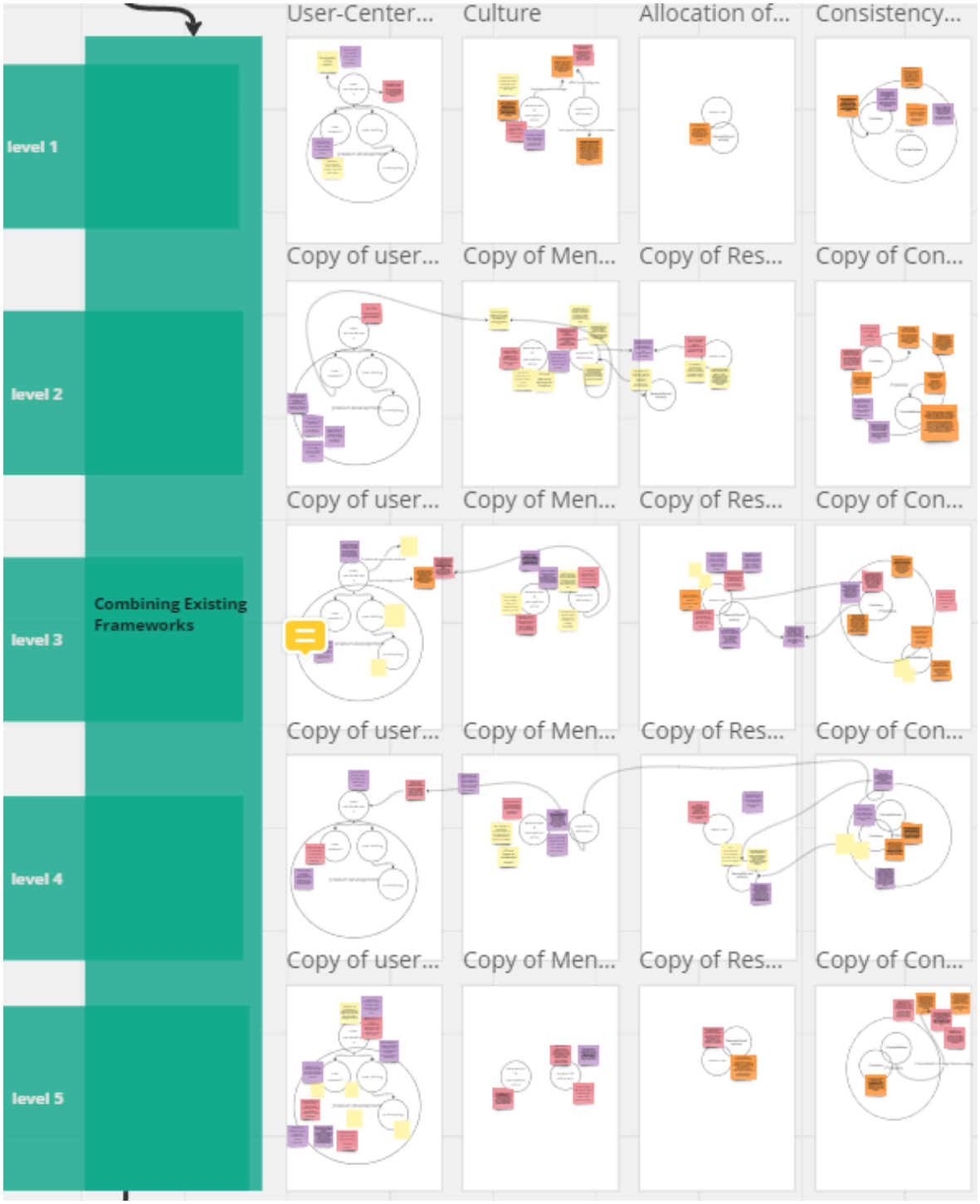
List of Requirements for Developing the CIUXM Framework

- ☐ R1. The framework contains clearly defined UX maturity levels.
- ☐ R2. The framework contains criteria for each level to avoid ambiguity and ensure consistent assessment.
- ☐ R3. The framework covers all relevant domains of UX maturity, including processes, technology, people, and governance.
- ☐ R4. The framework provides a holistic view of the organization's maturity, not just isolated areas.
- ☐ R5. The framework is adaptable to different sizes and types of organizations.
- ☐ R6. The framework uses simple language and complex or technical terms that may confuse respondents and are avoided (Dawes, 2008).

Appendix 5 | Brain Mapping Activity



Appendix 6 | Reconstructing the Existing Models



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CHAPTER 3: Article 2

Enhancing UX Maturity Assessment Tools for Startups Through Multi-Grounded Theory: A Longitudinal Exploration

Abstract

This study seeks to enhance UX maturity assessment tools for startups by leveraging Multi-Grounded Theory (MGT). Startups, characterized by their agility, limited resources, and rapid growth potential, face unique challenges that existing UX maturity model fail to address adequately. To bridge this gap, the study focuses on adapting the Comprehensive Integrated UX Maturity (CIUXM) Framework, a framework that represents existing literature, to better align with the specific needs of startups. A longitudinal study was conducted over ten months with nine diverse startups, enabling an in-depth exploration of the barriers and drivers influencing UX maturity within these dynamic environments.

By integrating MGT, which combines empirical, theoretical, and internal grounding, the research offers a robust approach to understanding and adapting UX maturity models. The findings reveal that beyond the commonly recognized constraints like limited resources, startups encounter unique challenges and opportunities that traditional UX maturity models do not account for. These insights highlight the necessity for a tailored UX maturity framework that resonates with the fast-paced, evolving nature of startups.

The study's recommendations aim to adapt the CIUXM Framework to make it more applicable and beneficial for startups by proposing an agile methodology aimed at enhancing their ability to achieve higher UX maturity. This adaptation is crucial for startups as they navigate the complexities of the digital economy, where a strong UX strategy contributes to their survival and success.

Keywords: UX maturity, UX capacity, startups, Multi-Grounded Theory, longitudinal study, UX assessment tools, user experience, organizational development, resource constraints.

3.1. Introduction

It is no secret that small organizations function differently from their larger counterparts. They often operate under time constraints, lack resources, have small and inexperienced teams, and have no established operating history (Giardino *et al*., 2014; Martinelli *et al.*, 2024). Despite these unique characteristics, existing UX maturity assessment tools fail to cater to the specific context of startups, leading to frameworks and models that unjustly penalize them for not having established UX processes, dedicated budgets, or teams.

In today's business landscape, UX plays a growingly important role. This impacts all sectors, including healthcare and government, with its absence leading to increased costs and decreased user satisfaction (Van Tyne, 2010; Ross, 2014). Startups may differ from larger organizations, but the era of technology is universal and comes with escalating consumer expectations for all (Guseva *et al.*, 2023). UX can significantly contribute to startup survival; those with an informed approach to design generate more revenue (Kretzschmar, 2005) and are financially sustainable (Schreiber *et al.,* 2017). Consequently, ensuring that startups can easily and accurately assess their UX maturity can be particularly impactful.

Lasrado et al. (2015) conducted an SLR on the development of maturity models in information systems (IS) in which they presented several critical gaps: lack of standardization, insufficient empirical validation, methodological shortcomings, theoretical inadequacies, and limited practical relevance. These gaps are also found in UX maturity models, which are often derived from studying large technology-driven companies and are less applicable to smaller organizations with fewer resources (Chapman & Plewes, 2014; MacDonald et al., 2022). This highlights the need for an adapted framework for startups, one that accounts for their differences from larger, more established companies, to increase the applicability and relevance of these frameworks.

To bridge these gaps, this study applied Goldkuhl and Cronholm's Multi-Grounded Theory (MGT) to balance empirical, theoretical, and internal grounding in researching UX maturity (Goldkuhl and Cronholm, 2010). We adapted the CIUXM Framework to startups, as it represents a comprehensive and cross-verified overview of current literature on UX maturity assessment. Our study followed a set of nine startups for eight months while providing expert-led training bootcamps through a UX training program. This approach aimed to assess the relevance of existing UX maturity dimensions and uncover missing elements in the form of barriers and drivers, drawing a picture of the path towards UX maturity in the context of startups.

More specifically, our research questions were as follows:

RQ1. How relevant are existing UX maturity dimensions in the context of startups?

> **RQ1.a.** What are the key barriers and drivers affecting UX maturity in startups, and how can these inform removal or expansion of existing dimensions in the CIUXM Framework?

RQ2. In what ways does the partial elimination of financial and human resource barriers (lack of in-house experts, expertise, and time) through the implementation of a UX training programme impact the progression of UX maturity in startups?

Through this longitudinal, exploratory study, we collected qualitative insights into the nuances of UX maturity progression in startups. Our research questions focused on the relevance of existing UX maturity dimensions and the impact of reducing financial and human resource barriers through a UX training program. The main contributions of this study include a set of recommendations for adapting the CIUXM Framework to startups and an analysis of the impact of the UX training program. By testing and adapting the CIUXM framework, we aim to provide better-suited UX maturity assessment tools for startups, ultimately enhancing their chances of success in a rapidly evolving digital economy.

3.1.2. Related Work

While past research has developed various frameworks and models to assess UX maturity, each with distinct methodologies and focus areas, there is a notable gap in how practitioners can leverage these tools to overcome practical challenges in low UX maturity environments. MacDonald et al. (2022) introduced the UX Capacity Assessment Framework (UXCAF), which uses dimensions and question-based assessments to gauge UX capacity. Pernice et al. (2021) detailed Nielsen's 6 Levels of UX Maturity, providing a model that ranks organizations from levels 1 to 6. Rukonić et al. (2019) presented the UX Capability Maturity Model, which includes capability, maturity, and rating scales along with a set of process attributes.

In addition, Kieffer et al. (2019) offered the UX Process Reference Model, focusing on the strategic planning of UX activities assessed through a process-level questionnaire. Sauro et al. (2017) developed the UX Maturity Assessment Questionnaire, while Kieffer and Vanderdonckt (2016) proposed the STRATUS Model, which integrates strategic usability with a three-level model and accompanying questionnaire. Peres et al. (2014) targeted the integration of UX processes in software SMEs with the AGILEUX Model. Chapman and Plewes (2014) contributed a UX Maturity Model with five stages, Meyer (2011) introduced the 6 Degrees of UX Maturity, and Van Tyne (2010) formulated the Corporate User Experience Maturity Model, featuring five stages from 0 to 4. Lastly, Marcus et al. (2009) developed the Standardized Usability/UX Maturity Model, which delineates five levels of UX maturity.

Despite these existing models and frameworks, there is limited research on how UX is best assessed in startups (MacDonald *et al.,* 2022; Martinelli *et al.,* 2024) and which dimensions and drivers serve as particularly relevant tools for startups. These existing models often fail to address the unique needs and constraints of smaller organizations, such as resource limitations and the necessity for rapid iteration. As a result, there is a need for adapted frameworks that consider the specific context of startups, ensuring that UX maturity assessments are both practical and meaningful for these smaller entities.

3.2. Methodology

3.2.1. Research Design

To refine our understanding of the evolution of UX maturity in startups, we employed a longitudinal, exploratory research design using Multi-Grounded Theory (MGT) as outlined by Goldkuhl and Cronholm (2010). MGT integrates empirical grounding, theoretical grounding, and internal grounding which is aimed at ensuring consistency and congruence within the theory itself. Unlike Grounded Theory, which strictly relies on empirical data and follows a pure inductive approach, MGT incorporates deductive elements from existing theories. Grounding, in this context, means providing justification from multiple knowledge sources, not just empirical data (Goldkuhl and Cronholm, 2010).

Figure 3 presents a rough overview of how MGT was applied to this particular research. Taking into account the previous criticism regarding the lack of theoretical & empirical grounding in the development of UX maturity assessment tools, this research design is particularly suited to our subject, as it prevents redundant theory development and promotes cumulative knowledge. The CIUXM Framework is a UX maturity assessment framework that represents a comprehensive overview of existing literature regarding UX maturity. In our study, the CIUXM Framework served as a foundational knowledge source that supported the empirical data, but it was complemented with other existing literature as new insights came up. This approach allowed for cross-verification between empirical data and existing theory, leading to rich and critically evaluated insights to enhance the theory (i.e. the recommendations to adapt the CIUXM Framework to startups). (Goldkuhl and Cronholm, 2010).

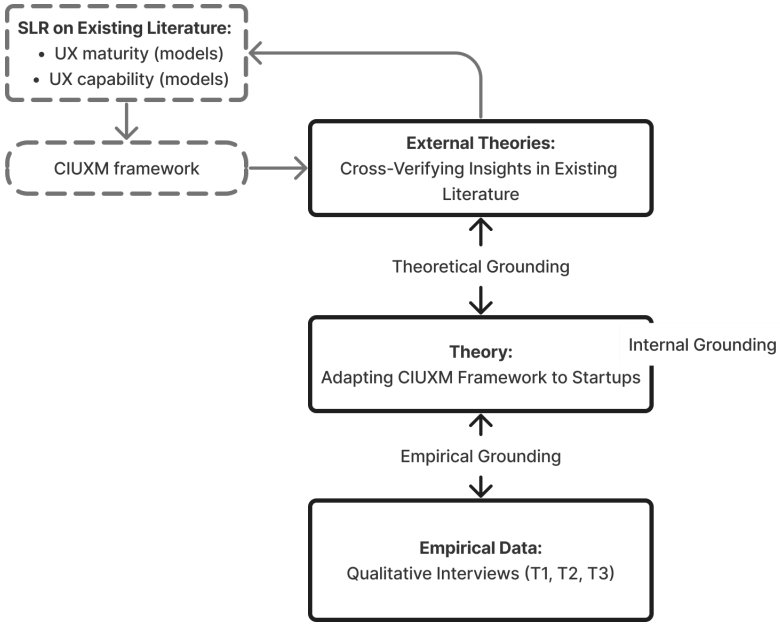

Figure 3. Overview of Multi-Grounded Theory - As Applied To This Research

Given the novel, non-numeric and unstructured nature of the subject (as far as we know, no UX maturity assessment frameworks have been developed specifically for startups), we chose an exploratory and qualitative approach. Qualitative research provides a holistic understanding of rich, contextual, and generally unstructured, non-numeric data by engaging in conversations with the research participants in a natural setting (Ponelis, 2015). In order to describe processes, individual or group behavior in its overall context, and/or the sequence of events in which the behavior occurs, an emphasis on "how" and "why" questions is advised (Ponelis, 2015), which is why we chose to conduct semi-structured interviews in this study.

The choice for a longitudinal study design stems from the fact that UX maturity inherently involves a progression. Such a design facilitated tracking of the path taken towards maturity of each of these startups - acknowledging that this path is different for every startup. This was important, as maturity tools are also commonly criticized for lack of foundation in their claiming that organizations follow a certain path towards UX maturity (MacDonald *et al.*, 2022). To further ensure to answer common criticism, we also selected a sample that was diverse in terms of industry, startup size and years in operation - enhancing the chances of our research output to be valid beyond our sample (a point that is beyond the scope of this particular research).

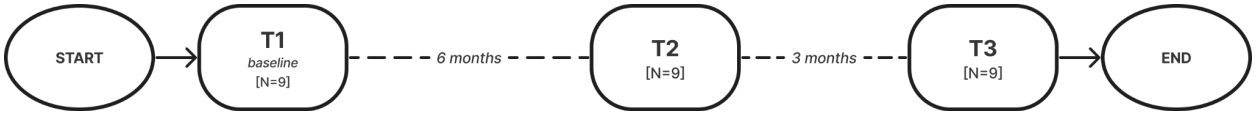

Figure 4. Overview of Longitudinal Study Design

In order to accelerate UX maturity, a sample of startups was exposed to an eight-month UX training programme, led by UX experts. This programme included seminars with theory, practice, as well as consulting in the form of heuristic reviews, user tests and reporting. As these startups were going through the programme (described in Table 12 below), periodic semi-structured interviews were conducted (this is explained in more detail in Section 3.2.2 "Procedure").

Table 12. UX Training Program, Overview of Activities

Phase 0: Pre-Training ● Month 0: June ○ Call for applications, application submissions. ● Month 0: July ○ Initial selection, interviews, final selections. ● Month 0: September ○ Prototype preparation by startups.
Phase 1: Programme Kickoff - Theory & Heuristics Reviews ● Month 1: October ○ Program kickoff event; ○ User research conference; ○ Heuristics evaluations report and one-on-one (1h) meetings with UX experts.
Phase 2: Theory & Practice ● Month 3: December ○ User test preparation workshop ● Month 4: January ○ Prototype debugging and preparation.
Phase 3: User-Tests ● Month 5: February ○ Laboratory testing. ● Month 6-7: March-April ○ User test report compilation. ● Month 7: Late April ○ User test report presentations and one-on-one (1h) meetings with UX experts.

Phase 4: Post-Training

- Month 8: May
    - Final networking event.

Sampling

Nine early to mid-stage startups were recruited, aiming for a diverse representation across different stages of UX maturity. The inclusion and exclusion criteria (IC and EC) used in the sample selection are presented in Table 13.

Table 13. Sample Selection Criteria (EC & IC)

IC/EC	Criteria	Description
IC1	Working prototype (app or website)	Startup must have a functional prototype, application, or website by a specified date.
IC2	General population testing capability	Products or services should be suitable for testing with the general population.
IC3	Level of Innovation	Products or services must demonstrate a certain level of innovation.
IC4	Promising business model & response to an existing need	Startups should have a promising business model and demonstrate an ability to address existing needs.
EC1	The organization is not a young startup	The organization is a young startup.
EC2	The startup is considered outside the geographic scope of the research.	Startups located outside of the province of Quebec (where the UX research programme took place) to ensure in-person presence for the training and other events.

Description of Sample

As mentioned, the sample comprised nine startups, making the unit of analysis at the organizational level rather than individual participants. Each of these startups was represented by one startup representative (referred to as a participant). Most commonly (5 times out of 9) these representatives (referred to as participants in the rest of this article) were the founders of their respective startups. The sample is described in Table 14.

As illustrated, the sample was diverse in terms of years in operation, product development stage, industry (eight distinct industries across the nine startups), and the number of permanent employees. Most commonly (4 times out of 9), the startups were in their first year of operations at measurement point T_1 (and 2 years at T3). The youngest startup (S9) was created halfway through the programme as they changed their product and startup name. The oldest startup was also the largest in terms of employees at 13 employees; contrasting the three startups with just a single employee (their founder). To provide more context to our analysis, we asked startups to disclose their product development stage, for which we referred to Asana's six stages of product development: 1) ideation, 2) concept development; 3) feasibility analysis, 4) design and prototyping, 5) development, 6) testing and validation, 7) market launch, 8) post-launch evaluation, 9) scaling (Asana, 2024).

Table 14. Descriptive Statistics (Self-Reported, T3)

ID	#Years in Operation	Product Development Stage (Asana, 2024)	Industry	# Permanent Employees	Participant
S1	2	Testing & Validation	Business and Finance	7	DEI Specialist
S2	4	Post-Launch Evaluation	Transportation	4	Developer
S3	2	Scaling	Information & Communication Technology	2	President
S4	6	Post-Launch Evaluation	Health Science and Medical Technology	13	CEO
S5	3	Scaling	Energy, Environment and Utilities	7	CIO (developer)
S6	2	Feasibility Analysis	Real Estate	1	Founder
S7	1	Market Launch	Arts, Media and Entertainment	1	CEO
S8	2	Post-Launch Evaluation	Information and Communication Technology	1	CEO
S9	0.5	Testing & Validation	Education, Child Development, and Family Services	4	CEO

3.2.2. Procedure

The research objectives were centered around the quest to better suit the CIUXM Framework, which, as mentioned, is a UX maturity assessment framework that represents a comprehensive overview of existing literature regarding UX maturity. More specifically, this meant seeking to find the irrelevant elements of the framework, as well as uncovering missing assessment parameters, that could contribute to a more nuanced assessment. The elements in the framework that were subject to review, include dimensions, drivers, indicators as well as within each of the levels.

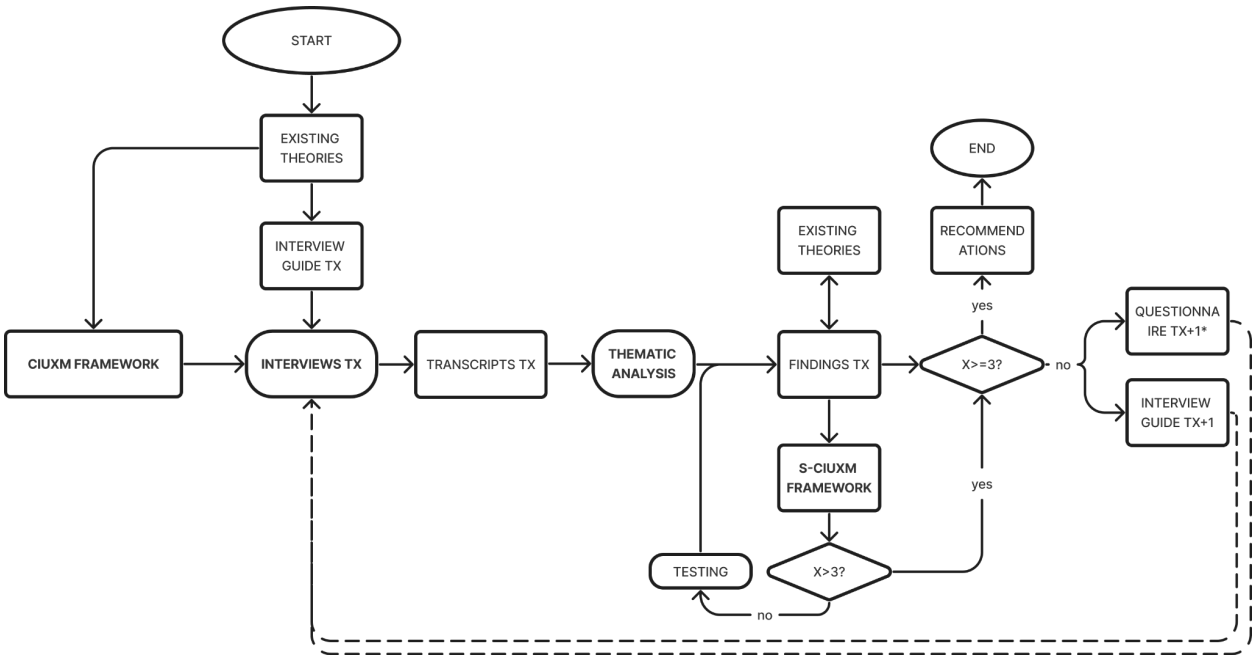

Figure 5. Overview of General Procedure

Periodic Interviews & Assessments

Each of the nine startups was interviewed, resulting in transcripts that were analyzed after each interview to extract themes (see Section 3.3.3., “Data Analysis”). This iterative thematic analysis led to periodic updates in the CIUXM framework. The research was conducted in three distinct data collection rounds, each coinciding with a specific milestone within the UX training program, as depicted in Figure 6.

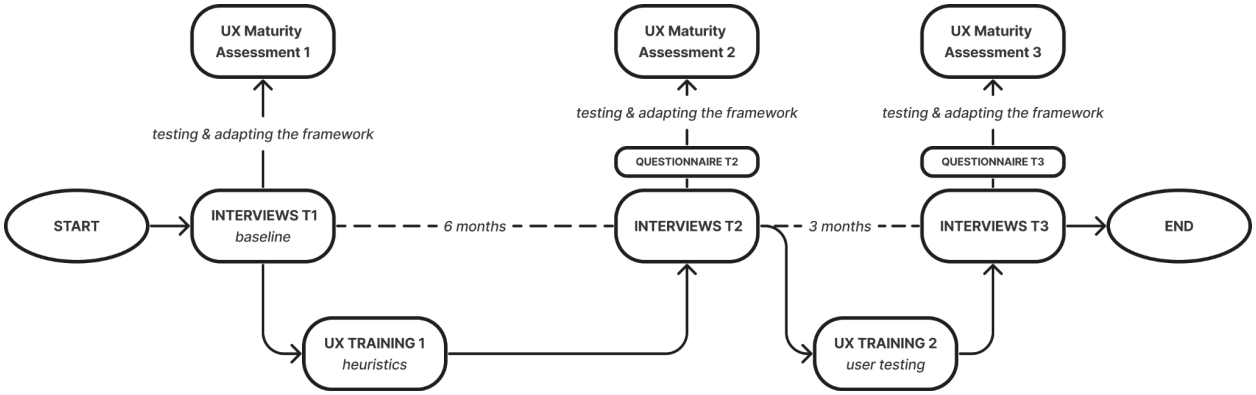

Figure 6. Overview of Periodic Assessments

The first round (T1) served as the baseline measure, where baseline UX maturity was assessed before any UX training was conducted on the startups. Following T1, UX Training 1 began and lasted six months, comprising multiple training activities spread across these months. The second round (T2) aimed to measure changes in UX maturity since T1 and further explore the relevant and irrelevant factors in assessing UX maturity in startups. This round also sought to gain insights into how startups perform UX, including the tools they use and the resources they need to enhance their UX capabilities. Additional themes identified during T2 were incorporated into the updated Interview Guide T2 (see Appendix 11B). The objectives for the third round (T3) included further understanding the startups' needs and their development in UX maturity, along with obtaining feedback on the Qualtrics questionnaires while assessing their UX maturity.

Data Collection Tools

In terms of data collection tools, the study utilized an interview guide, Microsoft Teams, and Qualtrics questionnaires. The interview guide was subject to updates between periodic interviews as new insights emerged, leading to new questions and themes, as elaborated in the section “Procedure”. Microsoft Teams was used to record and transcribe the semi-structured interviews. At T2 and T3, the Qualtrics questionnaires (presented in Appendix 12A and 12B, respectively) were administered to record descriptive statistics and any changes in the startups, providing further context for the qualitative analysis. These questionnaires were developed alongside the framework throughout the study to test the framework and assess each startup’s UX maturity.

Interview Guide and Questionnaire Development Procedure

An initial interview guide was curated based on the CIUXM Framework and Nielsen's quiz (2021). This first round of interviews served as a baseline measure and tested the CIUXM Framework. Insights from these interviews were divided into those specific to startups and those for optimizing the framework. These initial insights led to improvements in the framework, as presented in Chapter 2. Insights pertinent to startups were annotated and used to update the interview guide for T2. Following MGT principles, the interview guide and questionnaire were iteratively adapted as the research uncovered new insights, leading to updated guides at each measurement point (TX). The questions in interview guide T2, as well as the qualtrics questionnaires were inspired by the updates in the framework, as well as Nielsen's UX maturity assessment quiz and Rukonić *et al.* 's (2019) questionnaire.

The development of each of the three interview guides adhered to several key practices. Initially, the interview objectives were defined following Patton's (2015) best practices, based on the study's research questions but specified for each interview round according to MGT guidelines (Goldkuhl and Cronholm, 2010). The objective of T1 was to have a baseline measure before any training, based on the Nielsen Norman Group UX Maturity Quiz and completed with dimensions in the CIUXM framework. This guide was meant to ensure a holistic initial interview and avoid narrowing the focus too early in the process. The objective of T2 was to obtain a mid-point measure, targeting the progression of maturity and refining irrelevant dimensions. Lastly, T3 focused on reflecting on the training program and serving as the final measurement point for UX maturity. Following Lasrado *et al.* (2015), a questionnaire was developed in T2 and updated based on insights from T3, used in tandem with the semi-structured interviews to assess startups' UX maturity.

Interview Procedure

Open-ended questions were used to obtain detailed answers and allow participants to freely express ideas (Creswell, 2014). During the interviews, the researchers stayed adaptable, following up on interesting leads and new themes even if they were not outlined in the original

interview guide (Seidman, 2013). To ensure complete data collection, follow-up questions were crafted to delve deeper into specific topics (Booth, Colomb, & Williams, 2016). Questions were logically ordered from general to specific to put respondents at ease (Creswell & Poth, 2018).

Questionnaires

Based on key learnings from T1 and favoring an iterative approach to enhance the data collection process, we developed Qualtrics questionnaires. The objective was to optimize interview time by focusing on exploratory questions during the interviews while testing the framework's indicators through these questionnaires. The Qualtrics questionnaires were administered after completing Phase 1 of the UX Training Program but before the semi-structured interviews in T2, ensuring that any additional questions prompted by the questionnaire could be addressed during the interviews. In T3, the same procedure was followed, with the questionnaire updated based on existing theories, new key insights from T1 and T2, and developments in the CIUXM Framework. This process ensured the questionnaires were current and reflective of the latest findings and framework adjustments.

3.3.3. Data Analysis

In this section, we discuss the thematic analysis, along with the analysis of the progression of UX maturity, obtained by testing the framework.

The analysis was entirely qualitative, focusing on the thematic analysis facilitated by Figjam, a digital brainstorming tool, and Optimal Workshop to facilitate the qualitative coding procedure. These tools aided in categorizing qualitative and interpreting data effectively, and allowed visualization and identification of patterns through the ‘tagging’ function, which served to code the data. Through tagging, the thematic analysis was structured around the identification of recurring themes and patterns related to UX maturity factors identified in the startups.

Thematic Analysis

As mentioned, the interviews verbatim were transcribed using Microsoft Teams, and then post-processed (see Section 3.4. Ethical Considerations) before we engaged in a detailed thematic analysis as described by Belotto (2018): Initially, the transcriptions were read multiple times to ensure familiarity with the data and identify initial codes, which capture key thoughts or concepts relevant to the research objectives. This stage involved coding the "meaning units" found within the transcripts, which required identifying ideas aligned with the research questions (Belotto, 2018). Considering the nature of this research being based on the structure of the CIUXM Framework, the open-coding was supplemented with closed-coding, with categories inspired by the themes involved in the CIUXM Framework. This mixed-approach helped maintain a certain direct comparative structure without being too limited by the existing structure and remain open-minded with regards to emerging patterns.

The following phases were followed iteratively, following the principles of MGT:

1) Inductive Coding

In Phase 1, quotes were extracted from transcripts after each interview to prepare for analysis. This open coding activity involved keeping an open-minded attitude toward the empirical data,

following MGT principles (Goldkuhl and Cronholm, 2010). This step involved adding the quotes into Optimal Workshop for “tagging”, the aim was to categorize initial recurring ideas.

2) Conceptual Refinement

In Phase 2, the quotes were progressively grouped into a visual brainstorming tool (Figjam), roughly based on the dimensions of the CIUXM Framework. The aim was to have a global overview of the data and roughly see how the data matched up with the main dimensions and drivers of the CIUXM framework. This served to challenge data and avoid taking empirical statements at face value, in accordance with the MGT guidelines. It also served to highlight where clarifications were needed, giving the opportunity to refine important concepts by updating the interview guide throughout the process. To complete this phase, the quotes in Optimal Workshop were further coded (“tagged”). This time using closed coding to include existing theories, the previously identified connections with the CIUXM framework dimensions were coded.

3) *Pattern Coding*

Phase 3 involved pattern coding (axial coding): initial codes and categories were examined to identify relationships between them. This involved looking at how categories were linked through their properties and dimensions. More specifically, this involved further developing the tags with the aim to search for any elements that would complete or disprove the relevance of existing dimensions of the CIUXM Framework, as well as seeking to extract drivers or barriers to UX maturity and identify characteristics of relative UX maturity (i.e. low UX vs. high UX within the startup context). Once the initial (open and closed) codes were established, these codes were grouped into potential themes by analyzing how different codes combined to form overarching ideas or patterns in the data. Each theme was then reviewed and refined to ensure it represented the collected data comprehensively and accurately. This step included going back and forth between the dataset and the coded extracts to verify that the themes reflected the data (Belotto, 2018). This iterative process helped refine the specifics of each theme and how it relates to the broader analysis, ensuring that the interpretation of the data was grounded in the actual data collected.

Phase *4) Theory Condensation* (selective coding) and Phase *5) Explicit Grounding* involved matching the insights to the existing CIUXM Framework and, if necessary, confirming new insights with other existing theories not included in the framework. This ultimately led to a set of recommendations for adapting the CIUXM Framework to startups (see Section 5, 'Discussion').

A Note on AI

Incorporating insights from Christou (2023) on the use of AI in qualitative research, the analysis of semi-structured interview transcripts was enhanced by AI tools to assist in the thematic analysis process. These tools, equipped with advanced algorithms, facilitate the identification of patterns and themes within large text datasets, enabling a more efficient preliminary analysis. Additionally, AI transcription tools were utilized to convert audio recordings to text, ensuring accuracy and saving valuable time. While AI supported us in organizing and initially categorizing the data, the critical interpretation and integration of these findings into a coherent theoretical framework remained a manual task, relying on the researcher's expertise to ensure depth and context are adequately considered (Christou, 2023).

Analysis of UX Maturity Progression

The progression of UX Maturity was analyzed based on the transcripts, and supplemented with the Qualtrics questionnaires. Since the Qualtrics questionnaires were self-reported, the participants' answers were critically evaluated to avoid inconsistencies in the UX Maturity assessments. As mentioned, this part of our study had two objectives: to report on the impact of the training programme on the sample, as well as to test the iterations in the framework. It was important to follow the progression of each startup towards maturity, so that the path could be outlined and to provide additional context, rather than just looking at the isolated observations. Building an evolution profile for each startup would increase the richness of our findings and recommendations.

3.3.4. Ethical Considerations

To maintain the integrity and reliability of the study, this research complied with standard ethical criteria. Participants were fully informed about the nature of the research, its objectives, procedures, and potential risks. Consent was obtained voluntarily at the beginning of each interview, ensuring that participants understood that their involvement was not obligatory and they could withdraw at any time without any consequences. To minimize bias and increase consistency across the data collection, all participants were presented with the same verbatim quote at the beginning of each interview (see Appendix 11). To maintain reliability of the study, participants were informed that there were no right or wrong answers, emphasizing the exploratory nature of the interviews, and assured that their responses would remain confidential and anonymous to encourage truthful answers. Furthermore, no personal questions were asked and no questions were asked that were irrelevant to the research, aside from casual warm-up questions such as “How are you?”.

To protect participants' privacy, all data was anonymized. This meant that the interview transcripts were post-processed to make sure that individual participants (and startups) cannot be traced back from published results. Additionally, the data was stored securely to prevent unauthorized access. Researchers avoided any form of data fabrication, falsification, or selective reporting. To the best of the researchers’ ability, the findings were reported honestly and transparently, and raw data was saved to allow for verification of results.

3.4. Results

Let's recall that the main research question of this study was concerned with increasing the relevance of existing UX maturity tools in the context of startups, ultimately to improve UX maturity in startups. The analysis of 26[1] transcripts ultimately led to the selection of 164 quotes and 62 tags (12 descriptive tags, such as a description of the participant/startup number or interview round, and 50 thematic tags). A summary table of the tags, along with a frequency count has been provided in Appendix 9, and example quotes were provided in Appendix 9. The collected quotes revealed recurring themes and subthemes that represent the realities of startup life and the barriers and drivers affecting UX maturity. In this section, the findings are presented in this section and were categorized across various dimensions inspired by the original CIUXM Framework dimensions. These dimensions, along with their indicators, can be referred to in Appendix 14.

[1] One startup was not interviewed in T3 due to no-show. However, the participant filled out the T3 Qualtrics questionnaire.

3.4.1. Thematic Content Analysis

Strategic Focus on UX

A common UX maturity assessment parameter is to ask whether an organization's strategic focus is UX (Chapman & Plewes, 2014; Pernice *et al.*, 2021; Meyer, 2019). In our sample, although participants acknowledged the importance of UX, they all (9/9) reported to encounter difficulties in consistently prioritizing it within their startup. For example, P5 noted general team consensus on the value of UX, although it does tend to fall to the background when critical tasks arise:

"I think it's just that (...) as a startup (...) we just need to focus on the (...) critical things when they happen, but also as a general, as a team, we're all pretty focused on UX."- P5, T2

It is worthwhile to consider that S5 is one of the that is furthest in their product development in our sample (i.e. Stage 9/9, "scaling" (Asana, 2024)). At the same time, P3, P8 and P9 noted that they understood the importance of UX for driving sales and that it was their priority that their product was easy to use:

“I mean the part of the reason we haven't really invested in UX specifically is really the fact that we're focusing right now on acquiring users, but then the next steps that when we acquire them then we want to make sure that they're happy that they can actually use the product.” - P8, T2

Given that the startups were primarily focused on product development and each has only one product, their strategic priority often centered on rapid product release or meeting specific deadlines. For instance, P6 aimed to launch his real estate app for landlords by the summer, coinciding with the peak moving season. These constraints, combined with resource (skills, time, financial) limitations make prioritizing UX challenging. Throughout the study, it became apparent that strategic focus is closely tied to where participants (and their respective startups) were in their product development. Their product development stage did, in some instances, form a barrier to strategically prioritize UX, such as in the case of S1:

“Right now there's no user other than the team because it's not completed (...) even the UX [programme expert] team found a bug again, but it's not even stable yet.” - P1, T2

This quote showcases the realities of startup context. Consistently prioritizing UX is challenging due to their unstable environment, perceived lack of readiness and limited resources.

"[for me it's the] resource thing, because just as a startup you there's so many things you can do, so you have to figure out cutting corners. We do know we sell the UX part, but what we sell first is the feature, it's a feature that is usable and that's easy to use. So we have to first invest in feature [development]" - P8, T2

UX Goals

None of the startups (0/9) in the sample had UX goals, even by the end of the UX training programme (T3). When asked whether they had any UX goals or metrics in place, the researchers were met with a sense of confusion, as the participants either did not know what to track, nor how to track them. As far as we know, the only metrics being tracked -albeit not consistently, nor formally- were user satisfaction or time it took to complete a certain task (of which 3/9 startups made mention).

Tracking UX Metrics

In the instances that tracking did occur, we observed different methodologies which we categorized in either 1) manual, or 2) automated tracking. Unsurprisingly, some manual techniques were time-costly, and although some processes cannot be automated (i.e. in the case of qualitative user research), some processes seemed inefficient and unscalable, still leaving room for interpretation, such as in the case of S8:

"Sometimes we'll look at user sessions (...) you know they're spending more time on a specific page and then [we]look at those interactions to find [out] 'OK maybe they're trying to find this'. (...) and then we'll try to pick up on the pattern. So it's very manual because you look at the actual [session]" - P8, T2 (manual

By contrast, other startups engaged in automated processes, facilitating the repeated integration of UX activities, such as in the case of S5:

"Yes, in the app, we have a button, like "Report a Bug", or just "Give a Review" there. " - P5, T1 (automated)

Types of Decision-Making

In general, decision-making appears to be somewhat ad hoc and reactive, as expected in startups (Silveira *et al.*, 2021). For example, P3 mentioned prioritizing tasks based on immediate needs and resource constraints (P3, T1) and this strategy was mentioned by at least two more startups (S8 and S9). Beyond resource-constraints, however, we identified three ways that startups made decisions when it comes to UX: 1) intuitively, 2) informed by users and/or 3) inspired by existing products.

- *Intuitive decision-making:* 7/9 participants reported that their startup engaged in intuition-based decision-making based on intuition, rather than through user involvement. Although some employ both methods, it seemed that intuitive decision-making is done rather frequently, as some startups mentioned it on multiple occasions throughout the study. Example quotes include:

"I don't really have any UI-UX knowledge, so everything I've done I've done by intuition." - P6, T1

“(...)it goes much more by feel [in a] start-up…it's much more about intuition and reactivity than analysis." - P3, T1

The reasons for this approach include insufficient in-house skills, time constraints, but also lack of awareness of (the importance of) UX. For example, one startup (S4) launched its product without user testing, recognizing it as a ‘rookie mistake’.

- *User feedback-informed decisions:* 8/9 startups incorporated (informal) user feedback into their decision-making processes at T1 (and beyond), but not always consistently. S7 started implementing user feedback at T2. One participant (P6) described their approach as a living organism, constantly integrating user feedback into new features.

- *Inspired by existing products:* At least 4/9 startups (S2, S3, S7 and S8) mentioned to have drawn inspiration from successful existing products for feature development and aesthetics-related choices. By analyzing other applications, they aimed to adopt good practices and avoid common mistakes.

Resource Constraints

As mentioned, resource constraints are an important barrier to UX maturity - and this was also observed in our sample. All nine startups reported challenges related to lack of time, financial resources, and/or in-house UX expertise. These constraints limit their ability to invest in dedicated UX budgets and teams - common UX maturity assessment parameters (Chapman & Plewes, 2014; Pernice *et al*., 2021; Meyer, 2019).

"We don't necessarily have a budget for UX specifically (...) yeah, we don't yet have a budget for anyone." - P8, T2

Instead, we observed that startups made informal investments in UX by dedicating time to user tests, hiring temporary UX expertise, or using tools for prototyping and communication. Despite resource limitations, some of the startups employed creative, alternative methods to obtain user

feedback: they offered free access to products in exchange for feedback (S3 and S6), ran test campaigns with volunteers (S3, S5 and S6), and used social channels (such as Facebook groups) for feedback (S3 and S5). By contrast, others (S1 and S2) resorted mostly to their own team to test out features, while P7 (founder and sole employee at T1) was only testing the features that he had developed himself (S7, T1) at the beginning of the UX training programme.

Types of User Involvement

In terms of user involvement, we identified two sub-categories that would be pertinent to distinguish: user feedback and user testing. We then found that the way that users were involved in our sample could be categorized into three distinct groups: 1) informal, 2) moderately formal, and 3) formal.

<u>Informal User Involvement</u>

- *Informal user feedback:* Informal feedback is gathered through personal interactions and casual discussions. In this study, at least 6/9 startups relied on feedback from colleagues, friends, acquaintances, or typical customers during demonstrations.

"Sometimes, we'll ask the question directly to customers who come to test a new feature, for example. Do you think it would be nicer to have the buttons, for example, on the handlebars behind or in front?" - P5, T1

This feedback is less structured, and it can still offer insights into user experience and preferences. However, it is undocumented and in the case of our sample, that the questions asked often referred to the product in general rather than with a specific hypothesis in mind:

"I've had some informal feedback, no surveys or anything, from a few friends and acquaintances who told me they liked it quite a bit when they first used it." - P3, T1

Informal testing involves internal team members, acquaintances or friends testing new features before release, in an undocumented format, often without a specific test objective. All (9/9) startups in this study engaged in some form of informal user testing, although in some cases not exclusively. However, there were nuances within this

category, as 2/9 startups considered conducting the tests themselves a user test, while the rest tested on internal team members, acquaintances or friends.

Moderately Formal User Involvement

- *Moderately formal feedback:* Moderately formal feedback comes through forms or reviews. For instance, startups might ask users to leave reviews on Google or provide feedback through in-app chats. This type of feedback is documented but not as rigorously as formal feedback (discussed below). In the case of forms, it has some sort of goal that is intended to be measured, but it is still quite general. In this study, 3/9 startups employed this technique.

"We have a kind of chat in the app [where] people (...) can send their questions. So it's often questions that are [about] the product, you can just go into the chat and see their comments or questions actually." - P8, T1

Moderately formal testing: Meanwhile, moderately formal testing might involve sending test links to knowledgeable individuals (i.e. potential customers or experts) outside the immediate team (S3 and S6). This testing is more structured and documented than informal testing but not as comprehensive as formal testing. Unlike more formal testing it is not observed.

“I called the president of the [university’s] real estate club...to send [the test link] to them...they may have more knowledge than the average person.” - P6, T2

Formal User Involvement

- *Formal user feedback:* Formal user feedback is collected through structured tests and pilot projects. For example, one startup conducted pilot projects with healthcare institutions, gathering feedback from both patients and healthcare professionals (their target users). This formal approach provides more structured insights but is resource-intensive and requires a functional prototype or product. Formal feedback is documented, is led by a distinct goal and is more in-depth than just asking an opinion

regarding the product or a feature. In our sample, 4/9 startups engaged in gathering formal feedback. These were also the startups that were more advanced in their UX maturity (S3, S4, S5, S6).

Formal user testing: Formal testing includes well-planned test sessions with clear objectives and documented results. One startup (S3) described how they conducted a series of mini-tests, measuring the time taken for each task and noting user feedback. Another characteristic of more formal testing was the fact that the participants were observed (through Zoom, Teams etc.) and recorded while they were performing the tasks, which was not the case in the case of informal and moderately formal user testing.

UX Roles

In the startups in our sample, employees juggled multiple roles next to UX, including development, marketing, and UX (see Table 15). By extension, these startups reported lacking dedicated UX roles. By the end of the program (T3), 6/9 participants reported being the main responsible for UX within their startup, but it was just one of their multiple roles. Only 2/9 startups had dedicated UX(/UI) designers, out of which one of them lost their UX/UI designer mid-programme. At no point in this study did any of the startups have a UX manager, let alone a full and dedicated UX team - as is usually expected in existing UX maturity models. Reliance on external UX contributors and the need for internal skill development were recurring themes, as well as unstable teams and lack of communication with developers:

- *Hiring UX expertise:* 7/9 startups chose to delay hiring UX experts due to resource constraints (6/7) and the perception that a dedicated UX role is unnecessary at their current stage (S2 and S5). 3/9 preferred to outsource UX tasks to subcontractors (S3, S5 and S7) rather than hiring full-time staff. However, there was a growing recognition of the importance of UX throughout the study, with at least 2/9 startups planning to hire developers with UX knowledge to bridge this gap (S2 and S6).

- *Unstable teams:* the instability of startup teams was a barrier to UX maturity for at least 3/9 startups in our sample. For example, in the case of S1, one of the co-founders left early in January due to the demanding nature of startup life, which often requires working

weekends and nights. This departure left the team struggling to maintain their UX focus. Similarly, P9 (entrepreneur) struggled to keep his team motivated, and considering S9's limited resources, it led him to be forced to let them go, while others decided for themselves to move on to other things. Meanwhile, S4 lost their UX designer in the middle of the UX training programme leading them to also lose the additional expertise he had acquired during the programme - as reported by P4 (T2).

- *Siloed developers:* the lack of integration between the development team and UX efforts was reported to block UX initiatives: 2/9 startups reported that they had never held a UX meeting with their tech/developers' team (T1, T2, T3), reinforcing the idea that there is a disconnect that hinders UX maturity. Meanwhile, the majority of the startups (7/9) prioritized hiring a developer over a UX expert - leading to feature-focused language and decisions - rather than including user-centered decision-making. Interestingly, 2/9 participants reported (at T3) that their startup intended to remedy this by looking to recruit a developer with UX skills.

Table 15. Qualtrics Questionnaire - Q7

Q7 - Are you the main responsible for UX?	
Yes, but I also have other roles	5
Yes, and it's my only role	1
No one is responsible for UX	0
Everyone is responsible for UX	0
Someone else is mainly responsible (please explain):	0

UX Processes

In UX maturity assessment tools, companies are generally rewarded for having integrated, repeatable UX processes that ensure consistent and efficient user experience improvements (Kieffer & Vanderdonckt, 2016). However, in our sample, the startups were too young, and their operational methods were much more ad hoc. This led to the observation that the startups were unlikely to have many established (UX) processes. As one participant noted,

"I think you know having (...) startup friendly processes that you can put in place that could at least kind of like get something going 'cause (...) if you have something then as the company grows as you get more resources, we can start improving (...) but at this point it's just (...) delaying the problem as well." - P8, T2.

The lack of established processes is not a bad thing in itself, as it's merely a startup characteristic: As described by Picken (2017), a startup is small enough that the entrepreneur can oversee every aspect of day-to-day operations and get by on the basis of ad hoc processes and controls. It is only upon transition into the post-startup stage that the need to develop necessary infrastructures to stay efficient at conducting business (Picken, 2017). The participant (founder of S8) in our study also emphasized the need for flexibility, stating,

"So I think having something that's very light, very flexible for startups, but that [we can] still consider some kind of process [would be more appropriate]." - P8, T2

This lack of formalized processes was further highlighted by the preference for simplicity:

"It's like having a very simple process with a very simple KPI that you know I could say, hey, you know what, this is easy enough that I can implement today" (P8, T2).

The challenges faced by startups in developing and maintaining structured (UX) processes calls for more agile tools if the aim is to present implementable solutions to improve startup UX maturity.

3.4.2. Drivers and Barriers to UX Maturity

The results presented above can be summarized as descriptive characteristics of UX initiatives, which in turn can be translated into barriers and drivers. Below, in Table 16 and 17, we present the barriers and drivers uncovered in our thematic open-coding analysis. Their implications are discussed further in Section 3.5 of this article.

Table 16. Characteristics Affecting UX Maturity in Startups

Category	Code	Coding Method	Total Occurrences
characteristic	external	open coding	22
characteristic	internal	open coding	5
characteristic	formal	open coding	13
characteristic	informal	open coding	27
characteristic	tracking	open coding	13
characteristic	timing	open coding	15
characteristic	proactive	open coding	24
characteristic	reactive	open coding	17
characteristic	intuitive	open coding	17
characteristic	automated	open coding	7
characteristic	manual	open coding	5
characteristic	documented	open coding	16
characteristic	undocumented	open coding	3
characteristic	inspired	open coding	2
characteristic	fit (high or low)	open coding	9

Table 17. UX Maturity Drivers & Barriers for UX Training and Collaboration

Category	Driver (Barrier)	Coding Method	Description
training	(lack of) practical experience	open coding	insufficient hands-on activities hindered practical understanding and application;
training	(limited) collaboration	open coding	lack of a collaborative environment reduced the effectiveness of UX training;
training	practical experience (theoretical overload)	open coding	excessive focus on theory over practice made it challenging to apply UX principles;
training	(inadequate) implementation support	open coding	insufficient guidance on applying test findings left skill gaps unaddressed in some cases;
training	(absence of) frameworks	open coding	participants expressed the need for roadmaps or frameworks to help startups plan, prioritize, and measure UX activities;
training	(lack of) immersive activities	open coding	limited immersive experiences reduced engagement and learning effectiveness.

3.4.3. Testing the CIUXM Dimensions

Our research aimed to refine our understanding of the evolution of UX maturity in startups and to adapt the CIUXM Framework to startups. The framework underwent testing at three stages: T1, T2, and T3, with adaptations made along the way as new insights came to light - in accordance with MGT principles (Goldkuhl and Cronholm, 2010). The framework, as detailed in Chapter 2, emerged from an initial test round focused on refining its flow and wording. Insights gathered from the exploratory analysis highlighted discrepancies between the framework and startup realities, leading to the recommendations presented in Section 5, "Discussion". Meanwhile, a UX maturity evolution profile was developed for each of the nine startups included in our sample. This section presents the general sample trends in UX maturity across the various dimensions.

Results of the Periodic UX Maturity Assessments

We chose to express the evolution of UX maturity between T1 and T3 in Growth Points (GPs) (see Table 18). They are calculated by subtracting the UX maturity level at T1 from the one assigned at T3, for each dimension and subsequent indicator. For example, S4 increased by two levels of UX maturity for the indicator *goal-setting* (A2), meaning it gained two GPs between T1 and T3. Meanwhile, no growth was observed for S4 on the indicator *involving users* (A5). Note that this does not mean that the UX maturity level for *involving users* (A5) is low - the metric in this table only refers to progression rather than reporting actual maturity levels.

Using this points system, we can infer that *testing* was the indicator with the best results between T1 and T3, while *delegating* (C2) and *communicating* (B2) were the indicators with the smallest growth across the entire framework.

Table 18. UX Maturity Growth Points per Dimension (Indicator), per Startup

	Growth Points (T3-T1)											Sample Avg		
	S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**Total**	**Relative GP**	**T1**	**T2**	**T3**
A1. Strategizing	1	1	0	3	1	1	3	0	3	**13**		2	2	3
A2. Goal-Setting	0	3	2	3	1	3	3	2	1	**18**		1	2	3
A3. Prototyping	1	1	1	3	-1	2	2	1	-1	**9**		3	3	3
A4. Testing*	3	3	3	3	3	3	4	2	3	**27**				3
A5. Involving Users	1	2	0	3	0	0	2	1	0	**9**		2	2	3
Dimension A: Total	**9**	**13**	**6**	**17**	**4**	**9**	**14**	**6**	**6**	**76**	**15**			
B1. Aligning	1	1	1	1	1	1	2	3	3	**14**		2	2	3
B2. Communicating	1	1	0	1	1	0	2	0	0	**6**		3	3	3
B3. Convincing	1	1	1	0	3	0	2	3	3	**14**		2	2	3
Dimension B: Total	**3**	**3**	**2**	**2**	**5**	**1**	**6**	**6**	**6**	**34**	**11**			
C1. Investing	1	0	2	1	1	1	2	2	0	**10**		2	3	3
C2. Delegating	1	0	1	0	1	2	2	0	-1	**4**		1	2	2
C3. Embedding	3	2	1	0	-1	2	3	0	1	**11**		2	2	3
Dimension C: Total	**5**	**2**	**4**	**1**	**1**	**5**	**7**	**2**	**0**	**15**	**5**			
Total	17	22	12	20	8	16	26	14	12	**125**				

The total growth points across all dimensions are all positive, reflecting there was an overall growth in UX maturity for all startups and across all dimensions (this is also illustrated in Figure 7 below). This growth, however, was more prevalent in Dimension A than in the other two dimensions, as reflected by the highest relative GPs (that is, adjusted for the amount of indicators in the dimension). At the same time, the smallest growth was observed in Dimension C. This is inline with our observations in the qualitative interviews, as questions referring to UX experts, UX champions, knowledge on user satisfaction, UX budgets, UX resources, UX processes and UX goals usually led to low response (i.e. less insightful or in-depth answers) compared to those questions regarding product development-related activities (which Dimension A represents).

Considering that one single GP stands for a jump from one maturity level to the next, and that the total GPs acquired across the year, the trend is clear: the UX training program did have a positive impact on the UX maturity of the startups in our sample.

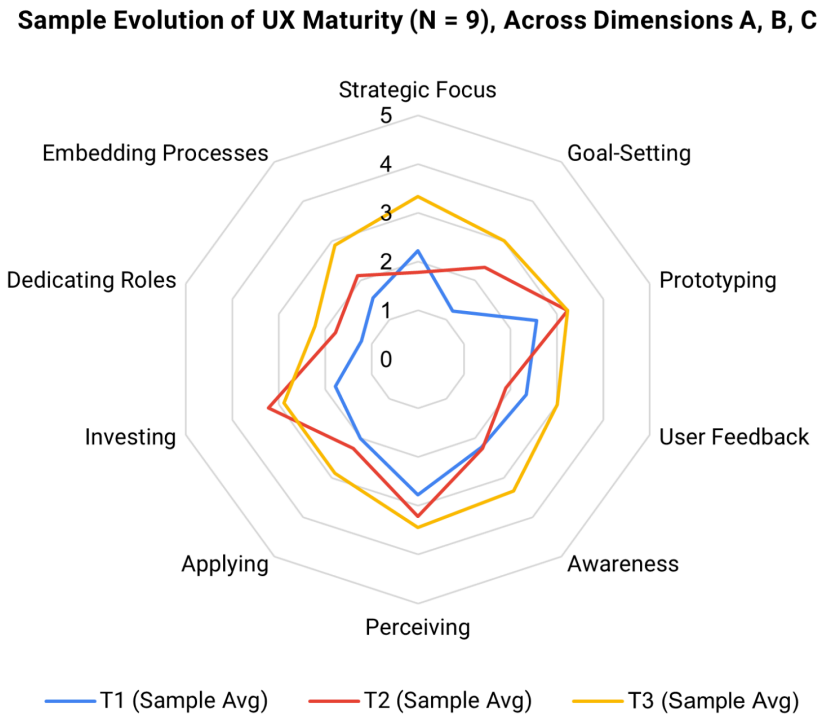

Figure 7. Sample Evolution of UX Maturity

Taking a look at the graphs below (Figures 8, 9 and 10) illustrates the positive trend associated with the UX training programme and average UX maturity over time (T1, T2, T3). These findings are in line with the qualitative data, where participants reported that they felt that the UX training programme had had a positive impact on their overall knowledge of UX (see Appendix 8 for more detailed feedback and reflection on the UX training programme).

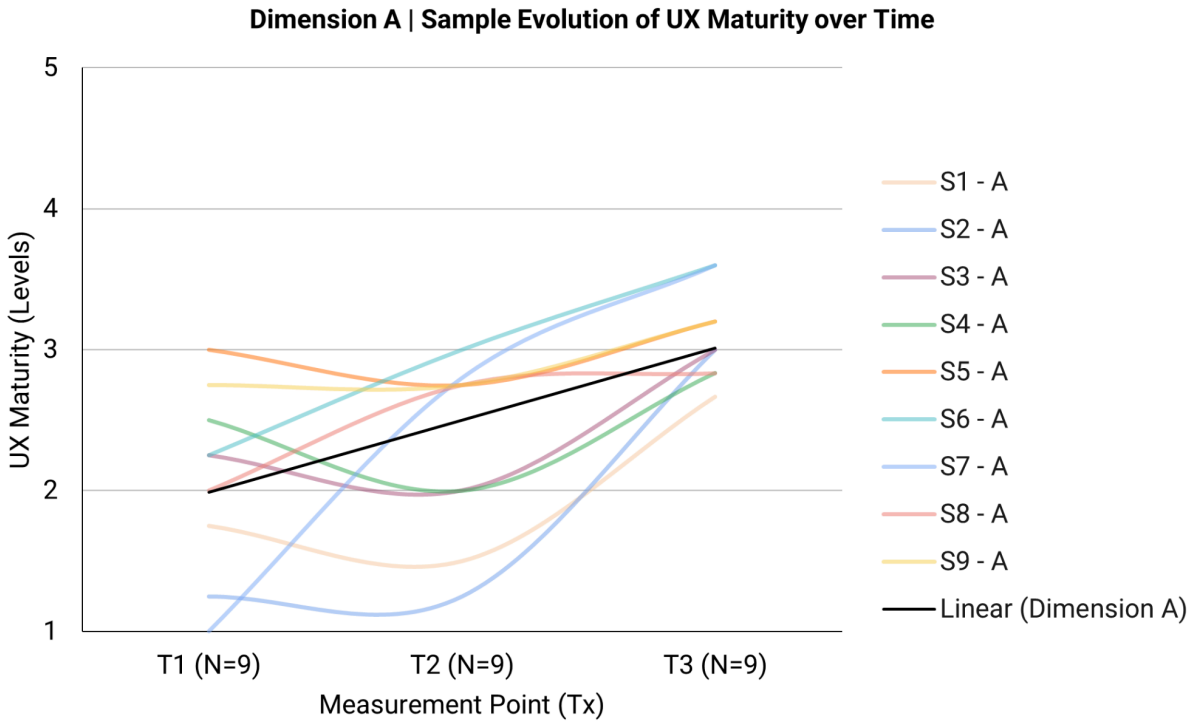

Figure 8. Dimension A (Holistic User-Centered Culture) - UX Maturity Evolution T1, T2, T3

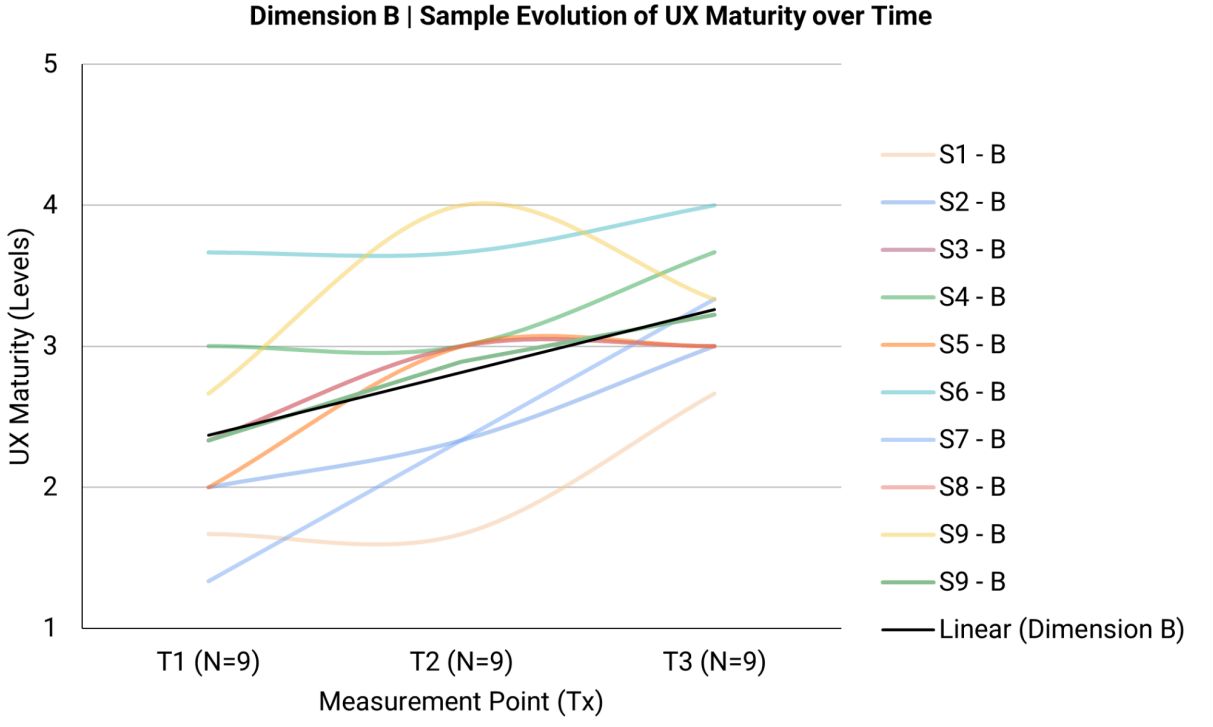

Figure 9. Dimension B (Stakeholder Engagement) - UX Maturity Evolution T1, T2, T3

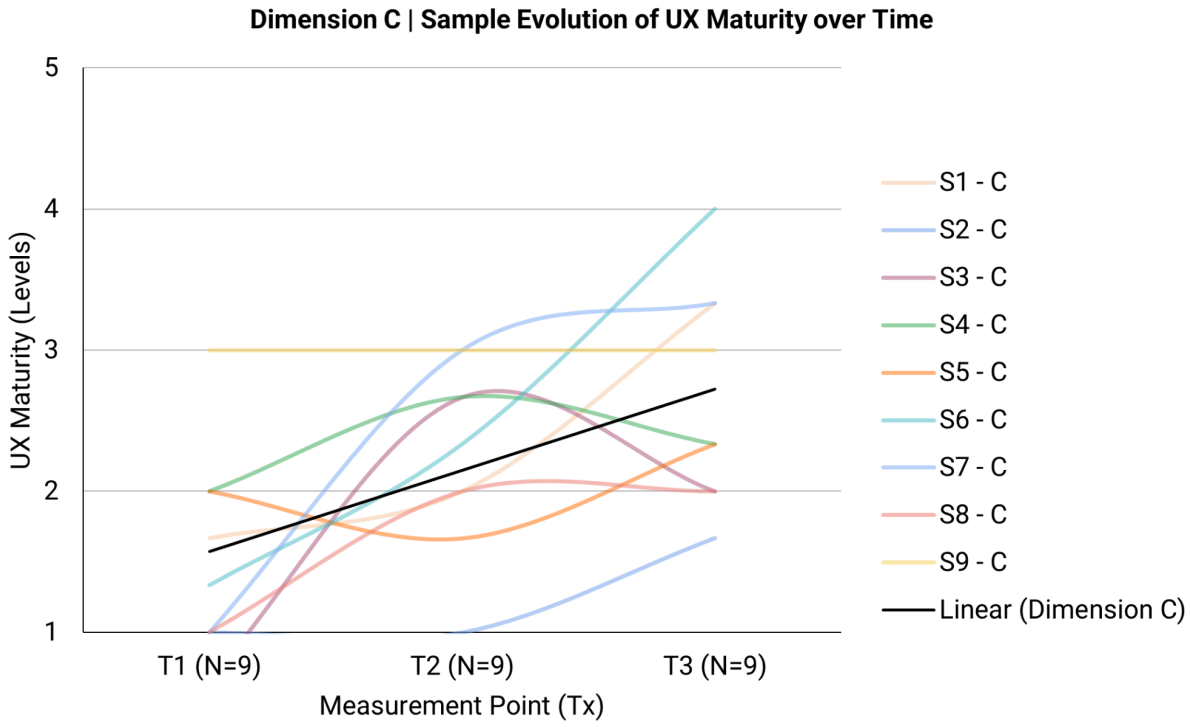

Figure 10. Dimension C (Process Embeddedness) - UX Maturity Evolution T1, T2, T3

Influence of Corpographics on UX Maturity

Considering Figure 11, where the size of the bubble represents the growth in UX maturity across between T1 and T3 (i.e. UX Maturity Growth Points), there does not seem to be an obvious connection between how much a startup grew in UX maturity and their respective startup age (in years of operation) and size (in terms of employees). The same can be inferred from Figure 12 and again in Figure 13: there does not seem to be an obvious connection between those characteristics and the progression made.

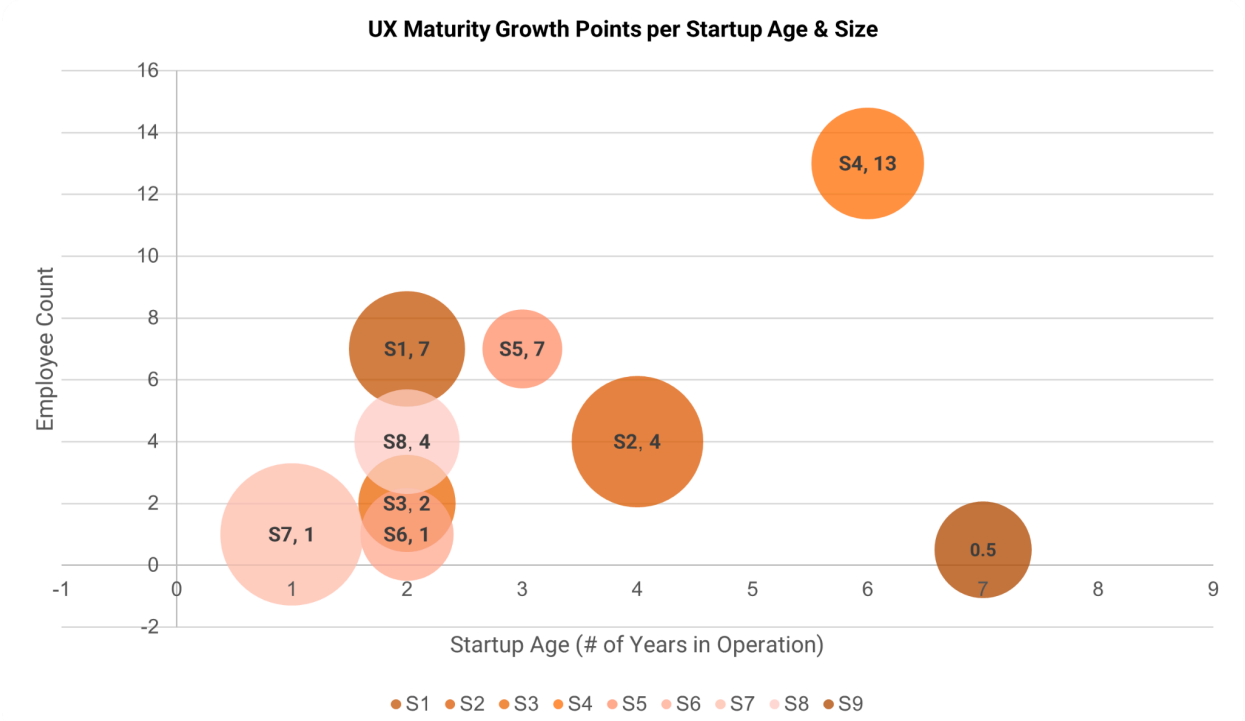

Figure 11. UX Maturity Growth Points per Startup Age & Size

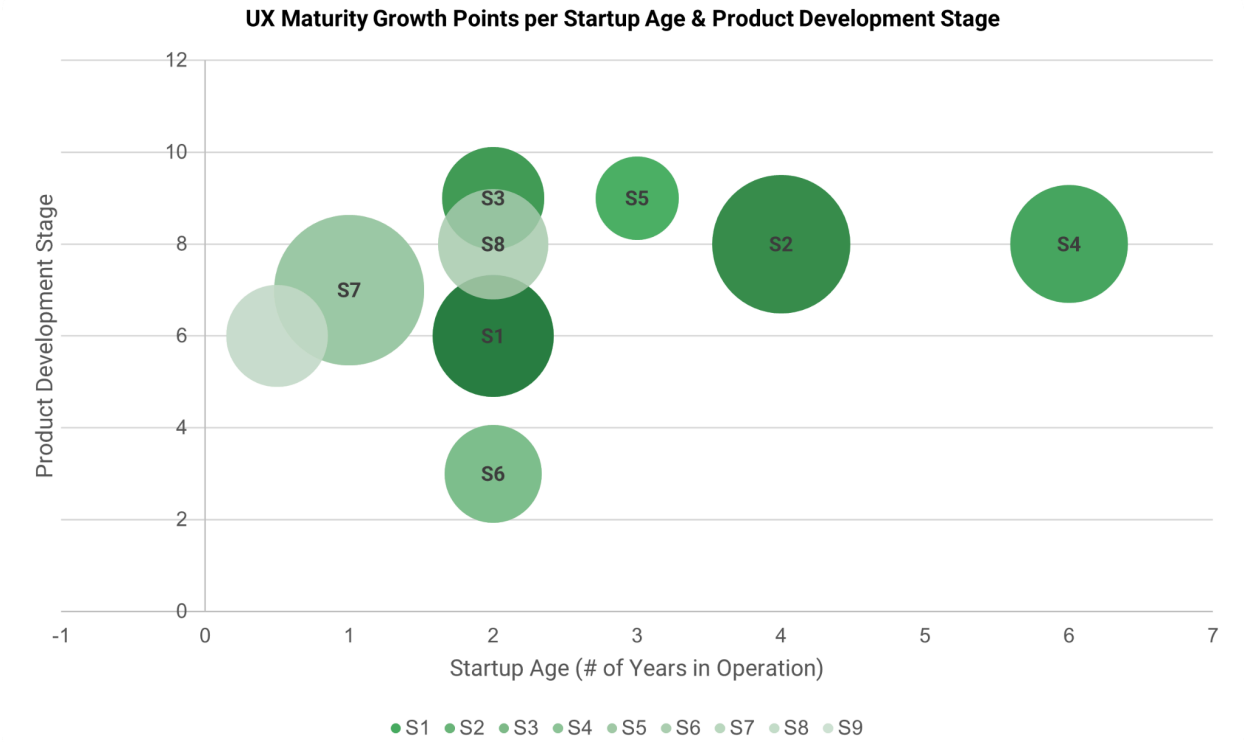

Figure 12. UX Maturity Growth Points per Startup Age & Product Development Stage

It is worth pointing out, however, that in Figure 13, S6 had a high maturity level, specifically by contrast of a lower product development stage. Additionally, S6 is run by one sole entrepreneur with no employees. This particular entrepreneur demonstrated proactive and creative attributes by consistently implementing feedback and reaching out to potential users that were representative of their target market. The fact that their target users are not the general population (i.e. are users with specific expertise on real estate) did not stop him, and he reached for these experts throughout his product development. One may note that S6 showed moderate growth in comparison to the rest of the sample when it comes to UX maturity. This is because S6 was already conducting user tests and calculating and testing user flows - even with little use of resources, but maximizing their capability through creative solutions and proactive behavior at T1 (i.e. S6 was already relatively mature).

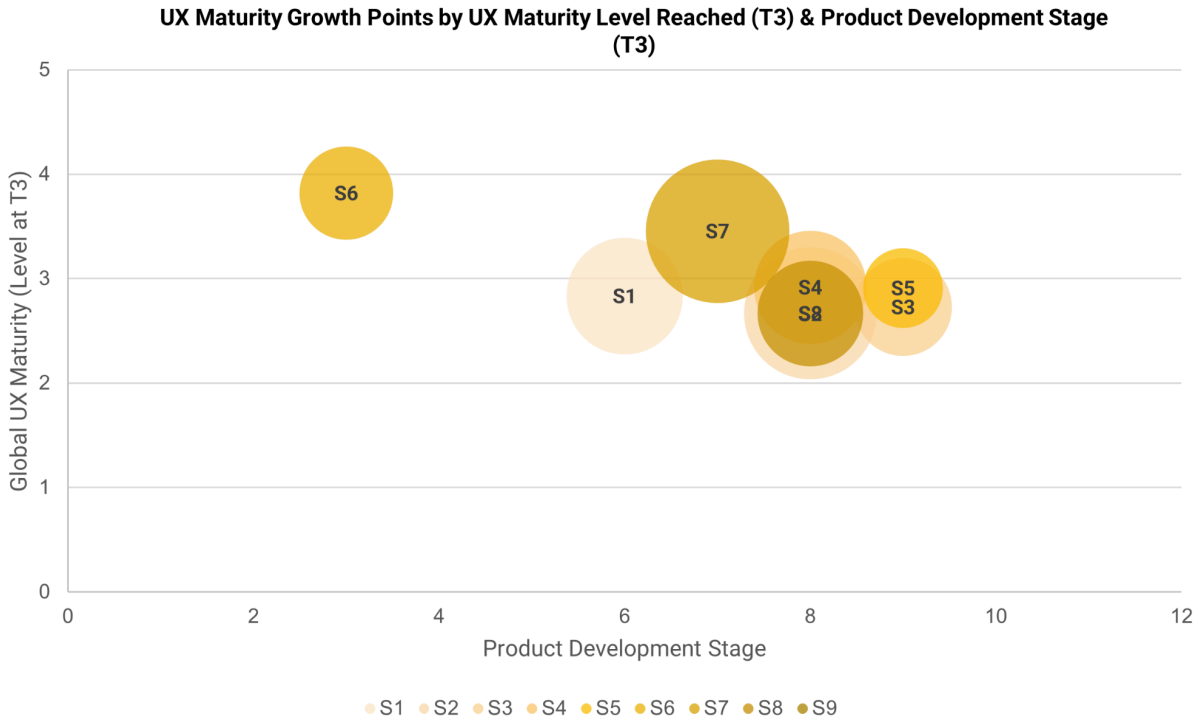

Figure 13. UX Maturity Growth Points by UX Maturity Level Reached (T3) & Product Development Stage

3.5. Discussion

The main research question of this study was concerned with increasing the relevance of existing UX maturity tools in the context of startups, ultimately helping startups in their efforts to improve their respective UX maturity. Specifically, we sought to evaluate the relevance of existing UX maturity dimensions and identify any missing elements (such as barriers and drivers). Phases 4 and 5 involved cross-comparing our empirical insights with the existing CIUXM Framework dimensions and, when necessary, confirming new insights with other theories not included in the framework.

3.5.1. Application to the CIUXM framework

Our analysis revealed barriers and drivers for improving UX maturity in startup managerial contexts (presented in Section 3.4.3.) In this section, we discuss how these findings relate to existing theories, as well as if - and if so, how - they affect the CIUXM Framework dimensions. The findings are discussed below, along with a summary of recommendations in Table 20, 21, and 22. In these tables, each indicator was labeled with one of three tags: 1) Not relevant, 2) Moderately relevant, 3) Relevant. These tags refer to our estimation of how relevant each of the indicators is based on our observations in this research.

Dimension A: Holistic & User-Centered Culture

User Involvement

Informal User Involvement

As mentioned, informal testing involved internal team members testing new features before their release (proactive). According to Nielsen Norman Group (2016), the last option should be to resort to internal staff to test a user interface or feature. This can introduce biases and lacks the rigor required for thorough UX evaluation (Nielsen Norman Group, 2016). With this in mind, informal user testing, as described in the results section, can be considered a characteristic of

lower UX maturity as opposed to more formal user testing. However, informal user testing is not all bad: informal testing is more flexible, with researchers using smaller sample sizes to achieve faster and less expensive results (Fox, 2015). If one is to engage in informal user testing, it is good to adhere to a sample size of 5-10 participants for qualitative tests (i.e., those focusing on finding problems or other qualitative data) (Fox, 2015). It appears that informal testing is better than no testing at all, especially when one aims for at least 5 participants in these informal tests.

Observation and Documentation

Observation is a critical and foundational method in usability testing (Thompson, 2003). For that reason, those tests that are designed to be observed should be assigned a higher UX maturity than those unobserved. Similarly, documentation is important to facilitate tracking, comparison and collaboration with colleagues (Keirnan *et al.*, 2002). Although it can be time-consuming in the moment, this can lead to time-efficiencies and avoiding costly mistakes in the future (Keirnan *et al.,* 2002). Hence, engaging documented and observed tests are other key characteristics of more mature startups.

Table 19. Evaluation of Dimension A (CIUXM Framework) - Adapting to Startups

A	**HOLISTIC USER-CENTERED CULTURE**			
Code	**Indicator**	**Description**	**Recommendation**	**Relevance in Startup-Context**
A1	STRATEGIZING			
A1.1.	***Prioritizing***	*The importance placed on user needs and input*	*Adapt*	*Relevant*
A1.2.	***Decision-Making***	*How decisions are made regarding UX*	*Adapt*	*Relevant*
A2	GOAL SETTING			
A2.1.	***UX Goals***	*The clarity and measurability of UX goals*	*Adapt*	*Moderately relevant*
A3	PROTOTYPING & TESTING			

A	**HOLISTIC USER-CENTERED CULTURE**			
A3.1a.	***Prototyping***	*The use and integration of prototypes in the design process*	*Keep as is*	*Relevant*
A3.1b.	*Timing*	*The timing of prototyping*	*Keep as is*	*Relevant*
A3.2a.	***Testing***	*The extent and methods of testing*	*Keep as is*	*Relevant*
A3.2b.	***Timing***	*The timing of testing activities*	*Keep as is*	*Relevant*
A4	INVOLVING USERS			
A4.1.	***Type of User Feedback***	*How user feedback is utilized in the design process*	*Keep as is*	*Relevant*
A4.2.	***Evaluating User Feedback***	*The critical evaluation and implementation of user feedback*	*Keep as is*	*Relevant*

*as estimated by the researcher, based on this research

Dimension B: Stakeholder Engagement

Startups have small teams, highly inconsistent teams, or consist of just one individual: penalizing, or rewarding a startup based on team-dynamics seems inappropriate. This prompts for removal of those assessment parameters that overly rely on the presence of team-dynamics. In the case of the CIUXM Framework, this refers to indicators *awareness* (B1.1.), *consensus* (B1.2.)*, valuing* (B3.1.) and *advocating* (B3.2.). Rather than assessing team dynamics, our study revealed that asking whether or not a startup's developers' team engages in UX initiatives and whether these developers have UX expertise are more pertinent questions and can lead to a more nuanced assessment.

Instead of assessing whether or not there is awareness of UX across the organization, the entrepreneur's mindset should be assessed. Referring back to Figures 11, 12 and 13 where there did not seem to be an obvious connection between relative growth in UX maturity and certain startup characteristics (startup age, size and product development stage) - there was one attribute that remains undiscussed: the entrepreneurs' mindset and background. In Figure 13, S6 showed elevated UX maturity levels despite being in the earlier phases of product development. Although this would need additional research, S6 was one of the entrepreneurs with the most user-centric mindsets and proactive behavior. This further supports the relevance of the entrepreneur's mindset and prompts for further research regarding the entrepreneurs' background knowledge and its influence on UX maturity growth. Additionally, the ability to point out user pain points should be rewarded on the UX maturity assessment scale, as this shows UX awareness:

- "(...) the user experience on the computer is a pain point." - P7

Regarding *Subject* (B2.1), leveraging those principles demonstrates an in-depth understanding of UX, and solely asking "how aware are you of the importance of UX?" or "how skilled are you at UX" does not cut it, as this opens the ways for interpretation bias (self-assessment bias). However, testing the skills by asking whether they understand a list of set UX activities and concepts, is a more accurate way of assessing their level of understanding.

Table 20.Evaluation of Dimension B (CIUXM Framework) - Adapting to Startups

B	STAKEHOLDER ENGAGEMENT			
	Indicator	**Description**	**Recommendation**	**Relevance in Startup-Context***
B1	ALIGNING			
B1.1.	***Awareness***	*The level of awareness of UX across the organization*	Remove this indicator in the context of startups as its parameters overly rely on the presence of teams and team-dynamics.	*Not relevant*
B1.2.	***Consensus***	*The degree of consensus on the importance of UX*	Remove this indicator in the context of startups as its parameters overly rely on the presence of teams and team-dynamics.	*Not relevant*
B2	COMMUNICATING			
B2.1.	***Subject***	*The subject of UX discussions*	Focus on the entrepreneur's mindset and proactivity in engaging and learning about UX process integration	*Moderately relevant*
B2.2.	***Frequency***	*The frequency of UX discussions*		*Moderately relevant*
B3	CONVINCING			
B3.1.	***Valuing***	*The recognition of the added value of UX*	Replace the parameters involved in this indicator with entrepreneurs' mindset.	*Not relevant*
B3.2.	***Advocating***	*The presence of UX advocates within the organization*	Remove this indicator in the context of startups as its parameters overly rely on the presence of teams and team-dynamics.	*Not relevant*

*as estimated by the researcher, based on this research

Dimension C: Process Embeddedness

UX Budgets & ROI

We know that the lack of resources is a factor that significantly hinders UX work in early-stage startups and with small teams (Choma *et al.,* 2022). This was also the case in our research, however, when conducting UX maturity assessments, penalizing startups for not dedicating UX budget will reduce the quality (i.e. insightfulness) of the assessment. To paint a more nuanced picture, it would seem more relevant to assess entrepreneurs based on the extent to which they are proactive in seeking user feedback, regardless of their budget. In our study, startups showed creative ways of circumventing budget limitations in order to obtain user feedback by offering free trials in return for feedback, motivating volunteers with a potential prize, and utilizing social channels. All these initiatives can foster user-centered culture and drive user-centered decision-making, ultimately driving UX maturity. Referring back to existing theories, we found that Sauro *et al.* (2017) had already found that having a dedicated UX budget might not be an important differentiator of perceived maturity, even in larger organizations (Sauro *et al.*, 2017). By extension, *Tracking ROI* (C1.3.) would also not be feasible for startups, considering that the prerequisite for that is to have a dedicated budget (i.e. investment) and return - another far from common occurrence in startups (Silveira *et al.*, 2021; Choma *et al.,* 2022).

The fact that Dimension C came out to be the smallest growth is not surprising considering the results obtained in the qualitative interviews. This further reinforces the idea that Dimension C is not as relevant for young organizations. S. Martinelli *et al*., (2024) had already reported that, in startups, there is a reluctance to invest effort in UX practices since they have limited financial and human resources for conducting user research and evaluation. In our sample, we found that the situation is more nuanced and that rather than being reluctant, which implies unwillingness on the part of entrepreneurs. Instead, although some may indeed simply be reluctant, other entrepreneurs were willing, but simply limited, hence their resortment - in the majority of the startups - to creative alternatives.

Dedicated UX Roles & Team

The reality in startups is that employees have multi-roles. In our sample, this was the case for the majority of the startups (6/9 startups reported that their UX employee had multiple roles beyond UX), see Table 15. Since this is indeed common practice (Marcon & Ribeiro, 2021) across the startup industry, it is irrelevant to hold on to this indicator as a relevant assessment parameter.

It is also inappropriate to penalize a startup for not having a dedicated UX team, as penalizing startups leaves the assessment less meaningful for these startups. Let's recall that, in our sample 3/9 startups consisted of just one employee - and none of the startups had a dedicated UX team. At most, startups in our sample had access to informal UX contributors, hired an external UX firm or consultant, or a developer with UX knowledge. Rather than assuming a startup can achieve a dedicated UX team, it would be more suitable to assign higher maturity to those who have in-house over external experts, or who have consistent access to (ways to improve their) UX expertise compared to those who had a one-time interaction with UX contributors.

On that note, the participants in our study showed that hiring an external firm or consultant, even if it's just one-time, can have a lingering positive effect on UX maturity as internal employees employ the practices applied by the external firm or consultant by copying them (learn by example) or by using the resulting artifacts (i.e. personas, prototypes,…) beyond the contract-duration. Of course, it is preferable to have more consistent access to UX expertise to drive maturity, as the lack of in-house skills remains a barrier (Giardino *et al.*, 2014; S. Martinelli *et al.*, 2024). Additionally, it seems more pertinent to assess UX maturity based on whether or not these employees have access to UX training, the content of this training and who is involved in this training.

UX Processes

The challenges faced by startups in developing and maintaining structured (UX) processes calls for more agile tools if the aim is to present implementable solutions to improve startup UX maturity. This also suggests that 'established processes' is not an appropriate assessment parameter when it comes to assessing startups.

Table 21. Evaluation of Dimension C (CIUXM Framework) - Adapting to Startups

C	PROCESS EMBEDDEDNESS			
	Indicator	**Description**	**Recommendation**	**Relevance in Startup-Context***
C1	INVESTING			
C1.1.	***Investing [resources]***	*The allocation and systematic use of tools and space dedicated to UX activities*	Adapt, recognizing and praising the creative and informal resource investments over those startups who are simply unwilling and lack effort in their (informal) UX investments.	*Relevant, if adapted (see recommendation).*
C1.2.	***Investing [budget]***	*The presence of a dedicated budget for UX*	Consider evaluating based on alternative ways of investing resources	*Not relevant*
C1.3.	***Tracking ROI***	*The tracking of return on investment for UX activities*		*Not relevant*
C2	DELEGATING			
C2.1.	***Dedicated UX Team***	*The establishment and structure of UX teams*	Consider evaluating based on the involvement of (external) UX expertise.	*Not relevant*
C2.2.	***Defining***	*The extent to which UX roles and activities are clearly defined*		*Not relevant*
C3	EMBEDDING			
C.3.1.	***Documenting***	*The documentation of UX activities*	Adapt so as to recognize startup context.	*Moderately relevant*
C3.2.	***Integrating***	*The integration of UX roles, activities, and artifacts into processes*		*Moderately relevant*

*as estimated by the researcher, based on this research

3.5.2. Recommendations for Adapting the CIUXM Framework to Startups

In assessing UX maturity in startups, it is important to consider the distinct organizational structure that differentiates them from larger companies. Startups in our sample heavily relied on intuitive decision-making and creative, ad hoc solutions due to their limited resources and constrained departmental and labor capacities. Unlike larger organizations, which tend to adopt similar processes and structures as they grow, there is no one-size-fits-all approach for startups (Giglio *et al*., 2023).

Given the reliance on ad hoc and intuitive decision-making in startups, it is evident that they need guidance toward UX maturity that aligns with their operational behavior. A detailed framework that requires extensive tracking, likely managed by a dedicated person or department, is less applicable to startups. Since this research aims to address the general lack of applicability of existing UX maturity tools, a different solution is called for.

Based on our findings, we propose an agile UX maturity assessment and guidance tool tailored to the needs of startups. Incorporating a binary axial system design based on UX maturity drivers and barriers uncovered in this research, it leverages the intuitive and flexible nature of startups while providing necessary guidance. Also known as a choice-box, entrepreneurs or other stakeholders can adopt this system as an informal and flexible roadmap. A conceptual example is provided in Figure 14 below. By delineating "good" versus "bad" practices through the predefined axes (based on the identified barriers and drivers for UX maturity in startup-context) arranged perpendicularly (to create a choice-box), this classic design-methodology could aid them with their UX-related decision-making with greater confidence and efficiency, allowing users to reflect consciously on the strength of their ideas or business decisions (van Doorn, 2020). Although such a tool may lack the detailed dissection and tracking of more extensive frameworks, this is a conscious design choice reflecting startups' operational realities. In the fast-paced environment of startups, software development demands flexibility to accommodate frequent changes. Agile methodologies are a logical choice for managing software development in startups because they embrace change while allowing the development process to adapt to the business strategy (Choma *et al., 2022).* Considering this, the advantage of this agile tool (over a

complex framework) lies in its effectiveness and speed, supporting intuitive thinking without requiring precise tracking or detailed descriptions, which is aligned with startup culture (van Doorn, 2020).

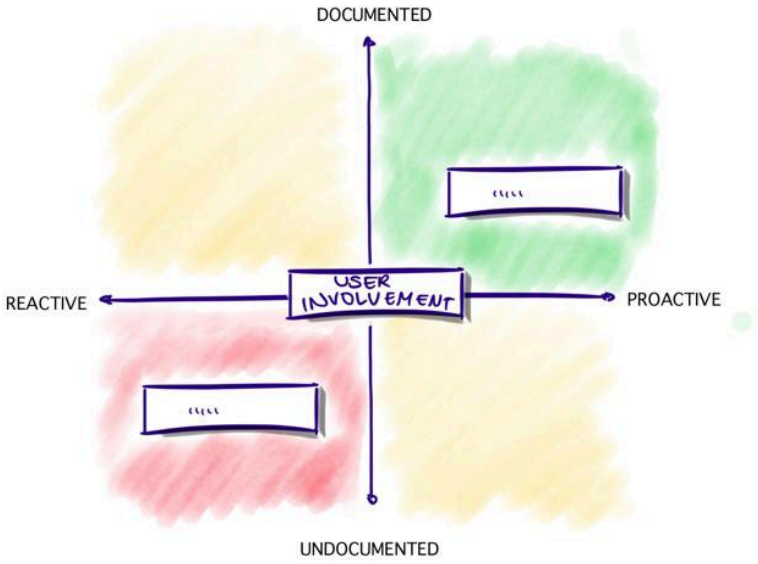

Figure 14a. Example of Application Agile UX Maturity Choice-Box

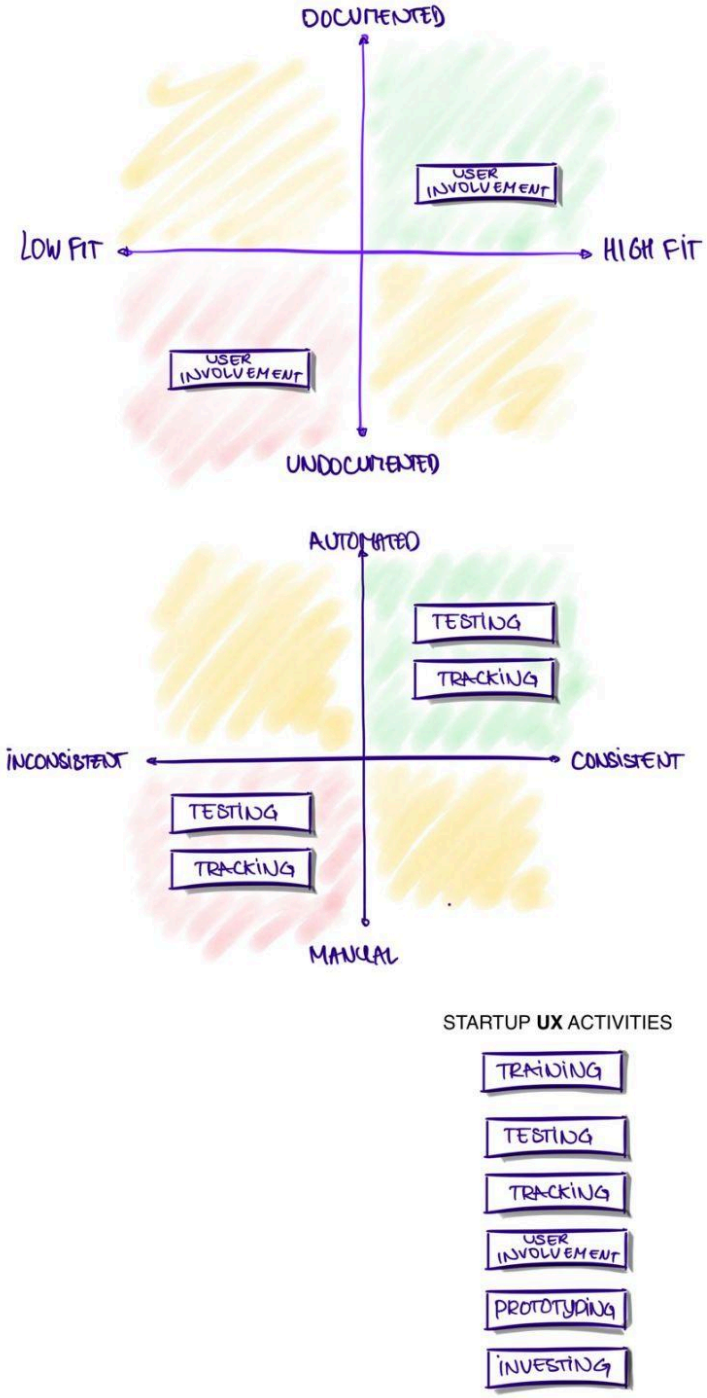

Figure 14b. Example of Application Agile UX Maturity Choice-Box

3.5.3. Recommendations for Startup UX Training Programmes

Based on the drivers and barriers identified, with regards to UX training programmes, we can infer: future (research) UX training- and collaboration programmes should focus on several key areas to enhance the learning experience and effectiveness of UX techniques in real-world scenarios - which are described in the form of recommendations (R) in Table 22 below. First of all, increasing the number of practical, hands-on activities (R1) is crucial to improve the applicability of UX skills. Additionally, fostering a more collaborative environment (R2) through ongoing dialogue and interaction between participants and consultants, especially after activities like heuristic reviews, can greatly benefit participants. Providing a clear schedule and timeline of activities in advance (R3) will help startups better plan their development processes around key program events. Emphasizing practice over theory (R4) by incorporating more action-oriented content can make the program more relevant and reduce the perceived burden of theoretical sessions. Enhancing support for implementation (R5) through additional guidance in interpreting and applying user test report findings will address skill gaps. Presenting a framework or roadmap (R6) can assist startups in planning, prioritizing, and measuring their efforts for long-term impact and increased applied knowledge. Moreover, increasing the emphasis on immersive and collaborative activities (R7), such as lab visits and interactive workshops, will foster deeper engagement. Finally, tailoring content to the various stages of product development (R8) by segmenting it to address different needs more effectively will ensure its relevance to startups at different development phases.

Table 22. Recommendations for UX Training and Collaboration

Recommendation (R)	Description
R1	Increase the number of practical, hands-on activities to enhance the learning experience and applicability of UX techniques in real-world scenarios
R2	Foster a more collaborative environment by facilitating ongoing dialogue and interaction between participants and consultants, particularly after activities like the heuristics review
R3	Help startups plan their development processes around the programme's key events by providing a clear schedule and timeline of activities
R4	More action-oriented content to make it more relevant and applicable to the startup context and reduce the perceived heaviness of theoretical sessions.
R5	Offer additional support and guidance in interpreting and applying (user test) report findings to address skill gaps
R6	Help startups plan, prioritize, and measure (which metrics to track), for longer-term effect (something they can implement right away) and increased applied knowledge

R7	Increase the emphasis on immersive and collaborative activities, such as lab visits and interactive workshops
R8	Make sure the content is relevant to startups at various stages of product development, possibly by segmenting the content to address different needs more effectively

3.5.4. Theoretical Contributions

The theoretical contributions of this study enhance existing UX maturity frameworks and introduce new dimensions relevant to startups. The research adapts the CIUXM Framework to include startup-specific dimensions and indicators, addressing the unique challenges and opportunities faced by these organizations. This refined framework provides a more accurate and relevant assessment of UX maturity for startups. Our research shows that these new dimensions account for the informal investment in UX, proactive feedback-seeking behaviors, and the significant role of multi-role team members in startups, extending the work of Giardino et al. (2014) and Martinelli et al. (2024) by tailoring UX maturity models to the specific needs of smaller organizations.

The study also applies Multi-Grounded Theory (MGT) to UX maturity assessment research. This approach integrates empirical data, theoretical constructs, and internal consistency to develop a robust and validated framework applicable to various contexts beyond startups. By grounding our framework in empirical data and established theories, we address the methodological shortcomings and theoretical inadequacies highlighted by Lasrado et al. (2015). Additionally, the research identifies and categorizes key barriers and drivers affecting UX maturity in startups, contributing to the broader understanding of UX maturity progression and informing future research and framework development. This effort builds upon the foundational work of Chapman & Plewes (2014) and MacDonald et al. (2022) by providing a nuanced perspective on the specific UX challenges faced by startups.

Employing a longitudinal study design to track the evolution of UX maturity over time is another theoretical contribution. This design highlights the importance of monitoring changes and progress in UX practices, providing a dynamic view of maturity progression. This approach is informed by the gaps in empirical validation and practical relevance noted by Lasrado et al. (2015) and extends the dynamic assessment methods in UX research. Furthermore, the study

introduces new dimensions and indicators specific to startups, such as informal investment in UX, proactive feedback-seeking, and the impact of multi-role team members. These additions enrich the theoretical landscape of UX maturity assessment, offering a more nuanced understanding of UX practices in small organizations. By incorporating these startup-specific elements, our research extends the findings of Guseva et al. (2023) and Schreiber et al. (2017), highlighting the critical role of UX in the financial sustainability and revenue generation of startups.

3.5.5. Managerial Implications

This study provides managerial contributions by developing UX maturity assessment tools specifically tailored for startups. Firstly, the adaptation of the CIUXM Framework addresses the unique characteristics and constraints of startups. By eliminating irrelevant dimensions and incorporating new ones, such as informal investments in UX and proactive feedback-seeking methods, the framework becomes more suitable for small organizations.

Secondly, the study introduces an effective UX training program designed to address the financial and human resource limitations typical of startups. The training program emphasizes practical, hands-on activities over theoretical sessions and incorporates iterative, early, and frequent user testing sessions, making it highly relevant and applicable to startups' needs.

Moreover, the research offers insights into how startups can integrate UX into their processes despite resource constraints. This includes leveraging existing tools, hiring temporary UX experts, and using informal feedback mechanisms to maintain a focus on UX. Additionally, the study provides guidance on how startups can prioritize UX activities in their business strategies, emphasizing the importance of understanding and meeting user needs even with limited resources. The long-term benefits of early UX integration are highlighted, underscoring the strategic value of such practices.

Finally, the study emphasizes the importance of iterative improvement and continuous user feedback for developing user-centered products. By providing practical examples and methodologies, the research aids startups in implementing these essential practices effectively.

3.5.6. Limitations and Future Research

As in any research, this study has several limitations that need to be acknowledged. Firstly, the sample size of nine startups is relatively small, which may limit the generalizability of the findings. The diversity in terms of industry, startup size, and years in operation within the sample enhances the validity of the findings, but it remains uncertain if these results can be universally applied across all startup contexts.

Secondly, the research design involved an iterative approach to refining the CIUXM Framework, which affected the consistency of the data collection. As new dimensions and indicators emerged during the study, some questions were not covered consistently across all measurement periods. This led to gaps in the data, as certain aspects were only addressed in later stages of the research. While efforts were made to fill these gaps retrospectively, this inconsistency could impact the robustness of the findings, particularly when it comes to reporting the progression in UX maturity.

Another limitation is the potential for researcher bias. The qualitative nature of the study, particularly the semi-structured interviews, means that the researcher's interpretation played a prominent role in data analysis. Although measures were taken to minimize bias, such as using verbatim quotes, cross-verification in existing literature, the subjective nature of qualitative analysis could not be entirely eliminated.

Self-reported data from startups also presents a limitation. Participants might have provided socially desirable responses, particularly in areas where they believed the interviewer had specific expectations. This self-report bias can have led to overestimation or underestimation of UX maturity levels and the impact of the training program, as well as incomplete pictures regarding UX maturity barriers and drivers.

Additionally, the lack of a control group means that it is challenging to attribute changes in UX maturity solely to the UX training program. External factors, such as market dynamics, internal

organizational changes, or other concurrent initiatives, could have influenced the startups' UX maturity progression. The study reports a trend towards positive growth, but causality cannot be firmly established.

Furthermore, the longitudinal design, while offering valuable insights into the evolution of UX maturity, also presents timing-related challenges. Variations in the time frames of the interviews could have influenced the startups' responses and the subsequent analysis.

Lastly, the agile methodology presented in the recommendations is conceptual and has not been tested for validity, which could be tackled in future research.

Despite these limitations, we believe that this study provides a good foundation for future research and practical application in the field of UX maturity assessment for startups. Future studies could address these limitations by employing larger and more diverse samples, establishing control groups, and refining data collection methods to ensure consistency and reduce bias.

3.6. Conclusion

This article highlighted the necessity for tailored UX maturity assessment tools for startups, as standard models often penalize them for lacking established processes. Our longitudinal study, using Multi-Grounded Theory, revealed insights specific to startups: they face significant resource constraints, often engage in informal UX practices, seek proactive user feedback, and demonstrate high adaptability. Startups typically lack dedicated UX roles, necessitating more nuanced assessments that reflect their unique needs and growth stages. Tailored tools can uncover subtle characteristics crucial for startups, encouraging UX integration without heavily relying on resources. Consequently, this research advocates for adaptable frameworks that align with startups' dynamic environments and rapid growth potential.

Our second research question sought to understand the impact of the UX training programme on UX maturity progression, considering that this would eliminate commonly-stated barriers (lack of financial resources, lack of in-house experts, expertise, and time) to UX maturity. We also sought to discover which particular elements of training were perceived as better-suited for startups. In this section, we discuss our findings.

Appendices

Appendix 8 | Effects of Training - Qualitative Insights

About the programme

Overall, the UX training programme had a positive influence on the startups. P4 highlighted its significant impact on their startup, improving their junior designer's practices. P3 stated that the networking aspect of the programme was appreciated, while P4 stated that the discrepancy between the product development stages was too large, making the content sometimes less relevant for some startups.

Observing user tests was considered very useful by the majority of the startups, providing an immersive experience and practical insights into how UX tests should be conducted. One startup (P5) did note that the learnings of UX techniques in the lab would not be applicable in their environments.

Knowledge Improvement

Participants noted some progress in their knowledge of UX practices. P6, for example, acknowledged an increase in knowledge compared to earlier stages, stating that their ability to introduce UX into processes had significantly advanced.

Theoretical Aspects

The theoretical introduction was found useful by some participants, particularly the explanation of accessibility criteria (1/9), which provided clear guidance on what to look for in UX. However, 3/9 startups noted that the theory was too theoretical and too ‘scientific’ and suggested a more action-oriented approach would be beneficial to increase the applicability of the content in startup-context.

Hiring Decisions The training program influenced hiring decisions, with P6 noting that good UX knowledge would be a decisive factor in hiring software engineering students The majority of companies did not hire a UX expert as a result of the program, with only one hiring internally and one hiring part-time externally.

"I'm in the process of meeting with software engineering students (...) good UX knowledge is going to be a deciding factor in the person." - P6, T3

Feedback and Interaction

Participants suggested more interaction and follow-up, especially after the Heuristics Review activity. They felt the process could be more collaborative, with ongoing dialogue rather than a simple report and fix approach.

Testing Sessions

Earlier and more frequent testing sessions were suggested by multiple participants, to enhance the program's benefits.

User Test Reports

Two participants (with startups more advanced in their UX maturity) noted having challenges in implementing user test report findings due to a lack of skills and understanding, as noted by P6. This highlighted the need for more support in interpreting and applying the results.

Needs for Roadmap

Three startups communicated the need for some kind of roadmap to help them choose which UX activities to do at which stage and which UX metrics to keep track of.

“Some kind of framework you know, so it doesn't feel all over the place.” - P1, T2

Hiring UX Staff

Have you hired a UX expert as a result of the UX training programme?	avg. (N=9)
Yes, internal	1
Yes, external/part-time	1
No, but I/we will shortly	0
No	7

Appendix 9 | Thematic Content Analysis

Dimension	Code	Open/Closed Coding	Total Occurrences
A	Decision Making	Closed Coding	33
A	Strategic Priority	Closed Coding	26
A	UX Goals	Closed Coding	6
A	Prototyping	Closed Coding	19
A	Timing	Closed Coding	14
A	Product Development	Closed Coding/Mixed	33
A	User Testing	Closed Coding/Mixed	43
A	UX metrics	Open Coding	7
A	Evaluating User Feedback	Open Coding	22
A	Implementing User Insights	Open Coding	20
A	Knowledge of Pain Points	Open Coding	8
A	Type of User Feedback	Open Coding	34
B	Advocates	Closed Coding	1
B	Awareness of Value of UX	Closed Coding	15
B	Communication	Closed Coding	14
B	Consensus with Team	Closed Coding	4
B	Conversations - Frequency	Closed Coding/Mixed	2
B	Conversations - Subject	Closed Coding/Mixed	3
B	Entrepreneur's Mindset	Open Coding	27
C	Documenting	Closed Coding	32
C	Integrating Processes	Closed Coding	39
C	Process	Open Coding/Mixed	52
C	Dedicated Resources	Closed Coding	35
C	Dedicated Roles	Closed Coding	12
C	Dedicated Team	Closed Coding	11
C	Tools	Open Coding	26
C	Tracking	Open Coding	13
C	UX Expert	Open Coding	14

Observation	Barrier	Description	Example Quote
Resource Constraints	Time & Access to Users	It takes a long time to access users, it is faster to do it yourself	“It’s a long process to access users” - P4, T2
Resource Constraints	Time & Lack of UX Skill	It takes a long time to develop features the way users want them and sometimes we don’t have the skills	“...we want round corners, but if [it] takes 5 hours to make, well, I don't care about round corners, we'll move on to something more important.” - P3, T1
Resource Constraints	Lack of UX knowledge	Not knowing what to measure when conducting a test	“[regarding UX KPIs, maybe...] the average time to complete a task...” - P6, T2
Resource Constraints	Lack of UX knowledge	Intuitive decision-making as a result of lack of in-house skills	“I don't really have any UI-UX knowledge, so everything I've done, I've done by intuition.” -P6, T1
Resource Constraints	Lack of UX knowledge	Lack of UX knowledge leading to unfamiliarity with UX terminology	
Processes	Manual	Manual testing takes more time and is not scaleable	“There's manual testing, but there's never been automated testing.“ - P2, T1
Decision-making	Intuitive	Lack of awareness of the importance of UX	“[We launched our product] without putting it in the hands of users. Big rookie mistake.” - P4, T2
User-Feedback	Reactive	Asking for feedback after launch	“The feedback we've received has always been as [functionalities] came up” - P3, T1

Observation	Characteristic	Description	Example Quote
Informal Investment	Investing Time	To conduct user tests, to reach out to potential customers, to develop prototypes, to create surveys/reviews/report a bug button or other user-centered functionalities	“I'm the one investing time, but in terms of other resources, we didn't spend that much on UX.” - P5, T1
Feedback - Seeking	Proactive	Offer free-access in return for feedback; attract volunteers with a draw; share a link with potential users; utilize social channels and engage group members to vote	“Most of the tests we did were voluntary. And then, we did run campaigns with the possibility of winning a $20 gift card.” - P5, T1
Feedback - Seeking	Proactive	Reaching out to potential customers to test and develop	"It's important for us to go and validate how we [can] support these 2 parties so that we don't increase the burden on healthcare professionals." - P4, T3
Feedback - Seeking	Proactive	Designing for receiving user feedback:	

Observation	Characteristic	Description	Example Quote
Feedback - Seeking	High End-User Fit	End user matches test-user	“I [sent] the president of the [university] real estate club [the test link]...they may have more knowledge than the average person.” - P6, T2
Testing & Product Development	High End-User Fit & Collaborative Approach	End user matches test user and is involved in the product development	"We're currently testing with [a hospital], but we're at the brainstorming stage on the next features to develop." - P4, T3
UX Expertise	Informal & External	Informal, external contributors	“(...)there isn't really a UX team, but we have [name] informally as an employee, we'll say informally as a contributor” - P3, T1
UX Expertise	Informal & External	Informal, external contributors	"We have hired a dev that has the UX [knowledge]. So we'll probably also ask him for his input on some stuff." - P1, T3
Decision-Making & User Feedback	Informal & Documented	Informal yet documented feedback	“I write down the things they tell me, but I integrate them into the features.” - P6, T1
Decision - Making	Inspired & Documented	Documented feedback stemming from inspiring products	“Very often, there are good ideas, but poorly implemented. So, we're going to (...) take the good side, find the problems and create a design (...)" - P8, T1
User Feedback	Consistent, Undocumented	Consistent involvement in UX activities, yet undocumented	“It's like a living organism. It's never really complete. I'm always adding things that are reported to me.” - P6, T1
User Testing / User Feedback	Informal, Internal	Informal feedback/internal feedback	“When I've finished a feature, I send the link to a different part of the team so that they can test it, so that they can give their final feedback (...)” - P2, T1 (developer)
User Testing	Informal, External, documented & Unobserved	Informal, documented, unobserved test with external test-user	“I called the president of the HEC real estate club...to send [the test link] to them...they may have more knowledge than the average person.” - P6, T2
User Testing	Formal, External, Documented & Observed	formal user tests, with external test users, documented user tests, observed user tests	“We made, yes, a series of mini-tests to be carried out on the application, a test plan to be tested by each user. That's about it. We measured the time it took to do each test, then took notes on each of them. ” - P5, T1
User Testing	Formal, External, Documented & Observed	formal feedback, documented feedback, observed testing, external test-user	“We did tests, so we gave objectives to each person who was in front of us in an online meeting.” - P3, T1
User Testing	Consistent	Consistent involvement in UX activities	“Each time there was a new [functionality], we did tests (...)” - P3, T1
User Testing	Formal, Documented & Observed	Formal user tests, documented and observed user tests	“They shared their screen with us and we watched them achieve the [test] objective [and observe how they] would react in relation to their experience, their journey, the path they had taken” - P3, T1

Appendix 10 | Description of UX Training Programme

UX Training Programme - Description of Activities

Step 1: Selection of Startups

1. Call for Applications (June)
   - Criteria decided by the team.
   - Announcement and opening of the application process.

2. Application Submission (June)
   - Startups submit their applications.
   - Deadline at the end of June.

3. Initial Online Selection (Early July)
   - Committee reviews applications online.
   - Selection of startups for interviews.

4. Interviews and Final Selection (July)
   - Startups pitch their projects in 10-minute sessions.
   - The team discusses and decides on final selections.
   - Startups receive responses a few days later.

Step 2: Training and Initial Evaluations

1. Selection of Student Consultants (Mid-August)
   - Team selects student consultants.
   - Students receive risk evaluation training for about a week (4 days).

2. Heuristic Evaluation Training (Late August)
   - Students conduct heuristic evaluations on startup prototypes.
   - Training includes workshops and hands-on evaluations.

3. Startups Prepare Prototypes (September)
   - Startups update and refine their prototypes based on initial feedback.

Step 3: Programme Kick-off - Events and Iterations

1. First Event - Program Kickoff (Early October)
   - Introduction to Tech3Lab.
   - Overview of user research and heuristic evaluation.
   - Small group sessions for personalized feedback.

2. Second Event - Conference on User Research (October)
   - Training session on user research and experience.
   - Low participation rate from startups.

3. Third Event - User Test Preparation (December)
   - Workshop on experimental design and types of tests.
   - Startups develop their user tests and conduct internal trials.

Step 4: Laboratory Testing

1. Preparation for Testing (January)
   - Ensure prototypes are bug-free and stable.
   - Individual follow-ups with startups to address issues.

2. User Testing Phase (February)
   - Divided into desktop and mobile testing over two weeks each, with a pause in between.
   - Low attendance from startups during the testing phase.

Step 5: Report and Final Presentation

1. Report Compilation (March-April)
   - Students and team compile detailed evaluation reports.
   - Some delay in report delivery due to workload.

2. Report Presentation (Late April)
   - Individual meetings with startups to present findings.
   - Detailed explanations and feedback sessions.

Step 6: Final Events

1. Fireside Chat on Digital Entrepreneurship (April-May)
   - Broader discussion on digital entrepreneurship.
   - Intended to reorient startups back to entrepreneurial focus.

2. Final Networking Event (May)
   - Social and networking event to conclude the program.
   - Opportunity for informal discussions and connections.

Appendix 11A | Interview Guide T1

Part 1: Introduction
"Hi, before we introduce ourselves... Is it still okay for you if I record and transcribe this conversation?"

[if 'yes' press record]

".. Ok, we are recording now. Let's start by introducing ourselves."

[moderator + participant(s) introduce themselves]

"This interview will take approximately one hour, and it is in no way a performance evaluation or test. Rather, it is a data collection session. There are no right or wrong answers. However, an essential part of this interview is letting you talk about the organization, so my role is to keep my intervention to a minimum.

The interview will take place in four sections. First, we will start with a warm-up consisting of general questions. Next, we will address more detailed questions. My goal is to allow you to express yourself as much as possible. I may interject from time to time, or some questions may seem repetitive, which is normal. Do you have any questions or concerns before we proceed?"

Part 2: Warm-up Questions
Q1.1 *Can you provide me with a brief description of your company (when was it started, the product, the industry, how many people, or anything else that might be relevant)?*

Q1.1.1 *What is the product phase?*
Q1.1.2 *Has it been tested/Is it already launched on the market?*

Q1.2 *How is your company's management team made up and what is each person's role?*
Q1.2.1 *(If talking to the founder) as the owner/founder of the company, what role do you play in it?*

Q1.3. *What is your understanding of the discipline of UX (User Experience)? (What are its goals, roles, activities?)*

Part 3: Diving in
Category 1: Presence of UX
Q2.1 *On a scale of 1 to 5 (5 being the highest), how well do you (and your management team) understand the field of user experience?*

Q2.1.1 *Can you give me concrete examples?*

Q2.2 *Who takes care of user experience in your organization?*
Q2.1.1 *How are they recruited?*
Q2.1.2 *If it is someone external: how are they recruited?*

Q2.3 *Is there a "UX champion" who effectively champions user experience?*
--> if "no", skip to Q2.4

Q3.2.1 *Is this an internal or external UX expert?*
Q3.2.2 *Do they have managerial influence in the organization?*

Q2.4 *Who is responsible for final user experience decisions? (e.g. interface changes, new features, new research studies)*

--> Only the entrepreneur(s), consensus with the whole team, etc.

Q2.5 *What is the degree of contribution of collaborators or employees who are not UX experts in key UX activities (such as user research, design and interface evaluation)?*

Q2.5.1 *To what extent are these results visible across the organization?*

--> Example: Do all team members have an initial understanding of UX and training is offered?

Category 2: Knowledge and Application of UX Good Practices

Q3.1 *Do you believe you have knowledge of UX Good Practices?*

--> If so, can you state some of them?

--> if "no", skip to Q3.4

Q3.2 *How often are UX best practices and UX research findings used to inform overall strategic decisions and priorities?*

Q3.3 *Do you follow best practices when there are changes to interface design or user-centered design?*

Q3.4 *Do you invest in iterative improvement of UX methods and processes within the organization?*

--> If so, how so?

Category 3: UX team

Q4.1 Do you have a designated UX team?

--> if "no", go to Q5.1.

Q4.2 What is the composition of the UX teams?

Q4.2.1 *How are UX specialist employees assigned to product teams?*

Q4.2.2 *Are UX roles well defined?*

Q4.3 *How is user experience work supervised?*

Q4.3.1 *What is the hierarchical structure?*

Q4.4 *What UX skills do UX specialist employees have?*

--> If in need for concrete examples: user research, prototyping and wireframing, user interface (UI) design, information architecture, user testing, accessibility. User psychology, cross-functional collaboration, design thinking, technological monitoring, communication etc.

Q4.4.1 *What are the professional development or career advancement opportunities for UX specialist employees in your organization?*

Category 4: Degree of Knowledge of User Satisfaction

Q5.1 *On a scale of 1 to 5 (5 being the highest), to what extent would you say that understanding and meeting user needs is a priority for your management team?*

Q5.1.1 *Can you give me examples?*

Q5.2 *How satisfied are the organization's users and customers?*

Q5.2.1 *What do you base this information on? (social networks, website, reviews, etc.)*

Q5.2.2 *Could you give a user satisfaction number of 1 - 5 (5 is high)?*

Q5.2.3 *Why this figure? (name (a) positive or negative example(s))*

Category 5: UX Processes in the organization

Q6.1 *How are the results of UX activities, such as user research and usable interface design, shared within the organization?*

Q6.1.2 *To what extent are these results visible across the organization? Example: Are decisions discussed during meetings? How often?*

Q6.2 *How are work processes related to user research and interface design integrated with other organizational processes and to what extent is this integration achieved? Example: software development, communication, all employees are aware*

Q6.3 *How are activities related to user research and interface design planned, planned and organized within the organization?*

Q6.4 *Does the organization have any concrete activities related to UX planned for the future? Are these short-term, long-term, or unplanned activities?*

Closing Questions

Q7.1 *What are your expectations from the AsterX program?*

Q7.2 *Do you have anything else to share?*

Reflection on Interview Guide T1

The majority of the companies interviewed were too young for the questions to be relevant. For instance, asking about budget allocation for UX was often unproductive since many lacked any budget allocation at all. It raises the question of whether it's fair to judge their UX maturity based on budget allocation. It might be fairer if they had budgets for other departments like finance, marketing, and HR, but not for UX. The quality of the responses varied greatly depending on the interviewee. Some participants focused more on their company rather than UX, despite the interview's emphasis on UX-related matters. To address this, it would be helpful to stress at the beginning of the interview that the primary focus is on UX, ensuring the interviewees understand the importance of providing UX-specific insights. This would help clarify that any gaps in answers are not due to the interviewers but rather the interviewees' lack of UX knowledge. For future interviews, it is crucial to pre-select participants who are directly responsible for product development rather than new hires or individuals not involved in product development. Additionally, for young companies, it might be beneficial to test their intent and views on UX, assessing whether they recognize its benefits. Including questions about the number of users they have and their users' pain points would also be valuable, as these aspects were not previously addressed.

Appendix 11B | Interview Guide T2

Set-Up

- [ ] Start the Teams meeting
- [ ] Ask Consent/Present Verbatim
- [ ] Turn the recording

Verbatim

"Thank you for taking the time to speak with me today. This session will take approximately 45 minutes and will focus primarily on how UX is being done in your organization. You might be familiar with some of the questions from the first round. As a reminder- there is no right or wrong answer—the best answer is whichever best reflects the actual situation. I also remind you that this information will remain confidential and that the data will be anonymized post-processing. I will now start the recording, do I have your consent to record and transcribe?"

[If participant approves, proceed - if not, stop].

Questions

- [ ] 1. How are you?
- [ ] 2. What is the current product phase?
- [ ] 3. Have you done any product development recently?
  - [ ] 3.a. Can you describe what that looks like for you?
- [ ] 4. What are the main changes in the organization lately?
- [ ] 5. Who currently takes care of UX?
  - [ ] 5.a. Is that their only role/responsibility?
  - [ ] 5.b. Why is it set up that way?
- [ ] 6. Any main challenges in terms of UX?
- [ ] 7. How iterative is your prototyping?
  - [ ] 7.a. Can you describe a recent prototyping activity?
- [ ] 8. What are the types of tools that you or your colleagues use (any of the tools related to UX)?
- [ ] 9. Do you have any UX metrics in place?
  - [ ] 9.a. If not, why not (probe: lack of knowledge, lack of resources, lack of perceived value, other reason)?
- [ ] 10. What does a test look like for you?
  - [ ] 10.a. What types of insights/how are insights collected?
  - [ ] 10.b. Who do you test on and how do you select these participants?
  - [ ] 10.c. How representative are they compared to your actual target market, and (if applicable) what do you attribute this discrepancy to?
- [ ] 12. What are the highlights of the UX training programme for you?
  - [ ] 12.a. Any major learnings/anything you wish you had gotten?
  - [ ] 12.b. What would be good to have in terms of UX training/tools/resources that weren't included in the UX training programme?

Appendix 11C | Interview Guide T3

Interview Guide T3

- [ ] Start the Teams meeting
- [ ] Ask Consent/Present Verbatim
- [ ] Turn the recording

Verbatim

"Thank you for taking the time to speak with me today. You might already be familiar with some of these questions, but this session will focus primarily on the impact of the training you have received in the past year. I won't take too much of your time, and -as a reminder- there is no right or wrong answer—the best answer is whichever best reflects the actual situation. I also remind you that this information will remain confidential and that the data will be anonymized post-processing. I will now start the recording, do I have your consent to record and transcribe?"

[If participant approves, proceed - if not, stop].

WARM UP

- [ ] 1. How are you?
- [ ] 2. Any relevant updates on the team, especially regarding UX?
- [ ] 3. How were the user test reports received? Did you and/or your team implement any changes?
- [ ] 4. If you were to conduct a test yourself, what does a test look like for you, types of insights/how are insights gathered etc.?

GENERAL EXPERIENCE

- [ ] 5. In what ways did the content of the training align with your current UX challenges and goals?
- [ ] 7. Can you give examples of how you have applied the skills or knowledge gained from the training in your work?
- [ ] 8. (If at all) how has the training impacted the UX maturity of your team or startup? Have you noticed any changes in how UX is integrated into projects?
- [ ] 9. What aspects of the training did you find most useful or effective? Which part gave you the biggest boost in UX?
    - [ ] Probe: interactive
- [ ] 10. What could be improved in the training program to better support your professional development and the UX maturity of your organization?

CHANGES

- [ ] 12. Do you feel that you and your Teams mindset regarding the value of UX has improved because of the programme? Are conversations easier?
- [ ] 13. Do you feel that your knowledge of UX good practices has improved because of the programme?
- [ ] 14. Do you feel that UX is more top of mind compared to the beginning of the programme 9 months ago?

FUTURE

- [ ] 15. Do you plan on hiring an external/internal full-time/part-time UX designer soon?
- [ ] 16. How do you see the skills and knowledge from this training impacting your future work? What additional support or resources would help you continue to grow in UX?
- [ ] 17. Questionnaire - feedback // which questions were difficult to fill-out?

Appendix 12A | Qualtrics Questionnaire T2

AsterX - Periodic UX Maturity Assessment T2

Start of Block: PRE-SURVEY QUESTIONNAIRE

What is the name of your startup?*

*This information will not be shared

_____

Please describe your role in your organization:

_____

When was the inception of your startup?

o 0-6 months (1)
o 6-12 months (2)
o 1-2 years (3)
o more than 2 years (4)

How long have you been working for your startup?

o 0-6 months (1)
o 6-12 months (2)
o 1-2 years (3)
o more than 2 years (4)

How many people belong to your startup?

o 1 (1)
o 2 (2)
o 2-5 (3)
o 5-10 (4)
o 10+ (5)

To which industry does your startup belong:

▼ Agriculture and Natural Resources (1) ... Other... (16)

End of Block: PRE-SURVEY QUESTIONNAIRE

Start of Block: D1

1.1.a. Where do most UX decisions originate in your startup?

o Primarily from product functionality priorities (1)
o Mainly from external sources like conferences or articles (2)
o Increasingly from successful projects (3)
o Integrated into overall corporate strategy (4)
o Led by leadership supporting a holistic user-centered design process (5)
o Other (please specify) (6) _____

1.1.b. How much priority does UX have in your startup's overall strategy?

o Low priority, with focus on product functionality (1)
o Emerging priority, gaining visibility and success (2)
o Integrated into overall strategy (3)
o Supported by leadership, fostering a strategic UX culture (4)
o Fully prioritized, with senior leaders accountable for UX (5)
o Other (please specify) (6) _____

Page Break

1.2.a. What is your company's situation regarding current UX goals?

o No defined UX goals (1)
o UX goals are unclear or not well-defined (2)
o Some UX goals, but not consistently followed (3)
o Clear UX goals, but not always achieved (4)
o Consistently meeting or exceeding UX goals (5)
o Other (please specify) (6) _____

1.2.b. UX Goals How are UX goals integrated into your company's processes?

o UX goals are not integrated (1)
o Sometimes considered but not consistently integrated (2)
o Integrated into some processes but not all (3)
o Generally integrated into processes (4)
o Fully integrated into all processes and decisions (5)
o Other (please specify) (6) _____

1.2.c. UX Goals How is the achievement of UX goals measured and evaluated?

o UX goals are not measured or evaluated (1)
o Measurement and evaluation are sporadic or inconsistent (2)
o Some efforts to measure and evaluate UX goals (3)
o Regular measurement and evaluation, with room for improvement (4)
o Consistent measurement, evaluation, and adjustments to UX goals (5)
o Other (please specify) (6) _____

Page Break

1.4.a. Prototyping How would you describe prototyping activities in your company?

o No prototyping (1)
o Sporadic prototyping towards the end of development (2)
o Occasional lo-fi prototyping, inconsistently (3)
o Regular use of both lo-fi and hi-fi prototypes (4)
o Prototyping is fundamental, with thorough testing and refinement (5)
o Other (please specify) (6) _____

1.4.b. Prototyping How do you handle testing and feedback during prototyping?

o No testing or feedback (1)
o Sporadic testing and feedback (2)
o Testing and feedback with room for improvement (3)
o Regular testing and feedback (4)
o Multiple rounds of feedback and testing emphasized (5)
o Other (please specify) (6) _____

1.4.c. Prototyping What role does prototyping play in your product development?

o Not essential (1)
o Somewhat beneficial but not fully integrated (2)
o Significant role, with room for improvement (3)
o Integral to product development (4)
o Crucial for iterative design and testing (5)
o Other (please specify) (6) _____

Page Break

1.5 User Involv Does your startup involve users in the product development process?

o No (1)
o Yes (2)

Display This Question:
If 1.5 = Yes

1.5.a. Users How would you describe the frequency of user involvement?

o Rarely or never (1)
o Occasional, with limited or sporadic feedback (2)
o Consistent, though not always timely or effectively (3)
o Regular, but with room for improvement in methods and timing (4)
o Extensive, with user needs prioritized in strategy and project prioritization (5)
o Other (please specify) (6) _____

Display This Question:
If 1.5 = Yes

1.5.b. How timely and effective are the methods for user consultation?
o Not timely or effective (1)
o Sometimes timely and effective (2)
o Generally timely and effective, though improvements are needed (3)
o Mostly timely and effective, with some room for enhancement (4)
o Always timely and effective, with a robust approach to user research (5)
o Other (please specify) (6) _____

Display This Question:
If 1.5 = Yes

1.5.c. Users How robust is the user research conducted during product development?
o No user research is conducted (1)
o Limited user research is conducted (2)
o User research is conducted throughout the development cycle (3)
o Robust user research continues across the development cycle (4)
o Extensive user research drives strategy and project prioritization (5)
o Other (please specify) (6) _____

End of Block: D1

Start of Block: DIMENSION 2: PERCEPTION & ADVOCACY
Display This Question:
If Number of Employees != 1

2.1.a. In your perception, how well do team members understand UX concepts and principles?
o Limited understanding; team members are not fully informed (1)
o Some understanding, but it varies among team members (2)
o Moderate understanding, with most having a basic grasp (3)
o Generally high understanding, with team members well-informed (4)
o Extensive understanding, with all deeply knowledgeable (5)
o Other (please specify) (6) _____

Page Break

Display This Question:
If Number of Employees != 1

2.1.b. From your observations, how would you rate the level of agreement among team members on UX goals and strategies?
o Strong disagreement; views are divergent (1)
o Some agreement on certain aspects, but disagreement on others (2)
o Moderate agreement on most goals and strategies (3)
o Generally high agreement on the majority (4)

o Strong consensus with unanimous agreement (5)
o Other (please specify) (6) _____

Display This Question:
If Number of Employees != 1

2.1.c. Based on your experience, how effectively are UX decisions made considering team awareness and consensus?
o Decisions made without considering team input (1)
o Occasionally considered but not consistently factored in (2)
o Generally informed by team input, but improvements needed (3)
o Team input plays a significant role in decisions (4)
o Decisions always based on thorough team understanding and consensus (5)
o Other (please specify) (6) _____

Display This Question:
If Number of Employees != 1

2.2.a. How would you rate the current level of communication regarding UX within your startup?
o Minimal or non-existent communication about UX (1)
o Communication about UX is sporadic or inconsistent (2)
o UX communication occurs regularly but could be improved (3)
o UX communication is generally effective, with consistent sharing among team members (4)
o UX communication is excellent, with clear and open channels established for discussing UX matters (5)
o Other (please specify) (6) _____

2.2.b. How does your startup prioritize and invest in UX communication tools and processes (e.g. collaboration tools, wireframing tools, user research tools, ...)?
o No prioritization or investment in UX communication tools and processes (1)
o Minimal effort is made to prioritize UX communication (2)
o UX communication is prioritized to some extent, but more investment is needed (3)
o UX communication is a priority, with resources allocated to improve tools and processes (4)
o UX communication is a top priority, with significant investment in advanced tools and streamlined processes (5)
o Other (please specify) (6) _____

2.3.a. How do you view the importance of UX within your startup?
o UX is often overlooked and not seen as valuable (1)
o The value of UX is recognized but not consistently prioritized (2)
o UX is considered valuable, but there's room for improvement in prioritization (3)
o UX is generally acknowledged and prioritized in decision-making (4)
o UX is highly valued and seen as crucial for the startup's success (5)
o Other (please specify) (6) _____

End of Block: DIMENSION 2: PERCEPTION & ADVOCACY

Start of Block: DIMENSION 3: OUTCOME-DRIVEN ALLOCATION OF RESOURCES & RESPONSIBILITY

3.1.a. How much do you invest in UX design and development within your startup?

o No investments are made in UX design and development (1)
o Minimal resources are allocated to UX design and development (2)
o Resources are allocated, but they are limited (3)
o Adequate resources are invested in UX design and development (4)
o Substantial resources are dedicated to ensure high-quality user experiences (5)
o Other (please specify) (6) _____

3.1.b.Does your startup have a dedicated budget for UX?

o No, there's no dedicated budget for any of our departments (1)
o No, there's no dedicated UX budget, but we do have dedicated budgets for other departments (e.g. marketing, operations, …) (2)
o Yes there is a dedicated budget for UX, but it's not prioritized and therefore inconsistently allocated. (3)
o Yes, there's a dedicated budget for UX, and efforts are made to integrate UX tasks into projects. (4)
o Yes, there's a dedicated budget for UX, and UX work effectively serves business goals. (5)
o Other (please specify) (6) _____

3.3. Has your startup hired a dedicated UX designer?

o No, there's no dedicated UX designer. (1)
o Some people take up some UX designer tasks, but there is no dedicated designer. (2)
o Yes, a UX designer has been hired, but it's not a permanent position. (3)
o There is a dedicated UX designer or team, but they do not have full decision-making power and/or budget (4)
o There is a dedicated UX designer or team, and they have their own budget, department and decision-making power (5)
o Other (please specify) (6) _____

Page Break

3.1.b. ROI How aware are you (and your team) of the impact of UX on your startup?

o Limited awareness (1)
o Some awareness (2)
o Starting to recognize the impact (3)
o Seeing benefits from UX methods used by some teams (4)
o Recognizing the effectiveness of UX in serving business goals (5)
o Other (please specify) (6) _____

3.1.c. To what extent is UX integrated into your startup's projects?

o No integration (1)
o Some integration (2)
o Starting to integrate with a dedicated budget (3)

o Partial integration with some teams using UX methods (4)
o High integration, with UX effectively serving business goals (5)
o Other (please specify) (6) _____

3.2.a. Who is responsible for UX within your startup?
o No one specifically handles UX (1)
o UX responsibilities are unclear or shared among team members (2)
o There is a designated person/team for UX, but this person/team has multiple roles within the startup (3)
o There is a designated person/team for UX with defined roles, and full focus on UX (4)
o UX responsibilities are clearly assigned to a dedicated team or individual (5)
o Other (please specify) (6) _____

Display This Question:
If Number of Employees != 1

3.3.a. How do UX roles impact your startup's success?
o UX roles have little to no impact on success (1)
o Minimal contribution to success from UX roles (2)
o Moderate contribution to success from UX roles (3)
o Significant contribution to success from UX roles (4)
o UX roles are essential and critical to startup success (5)
o Other (please specify) (6) _____

End of Block: DIMENSION 3: OUTCOME-DRIVEN ALLOCATION OF RESOURCES & RESPONSIBILITY

Start of Block: DIMENSION 4: EMBEDDED UX PROCESSES

4.1.a. How does your startup currently handle documenting and managing UX efforts?
o Efforts are undocumented and reactive, driven by user dissatisfaction (1)
o Some documentation exists, but user suggestions or complaints are not fully reviewed (2)
o Newly introduced UX activities are inconsistently repeated across projects (3)
o UX roles, activities, and artifacts are partially integrated into processes (4)
o Some UX processes are consistent, with documented standards and oversight (5)
o Other (please specify) (6) _____

4.1.b. How do you ensure consistency in UX processes across projects within your startup?
o UX processes are not consistent or standardized across projects (1)
o Newly introduced UX activities are inconsistently repeated for all projects (2)
o UX processes are integrated into some projects but not consistently repeated (3)
o Some UX processes are consistent, but there's room for improvement in standardization (4)
o UX processes are standardized and repeated across projects with oversight (5)
o Other (please specify) (6) _____

4.1.c. How do you track and improve UX processes in your startup?

o No specific goals for improving UX processes (1)
o Goals are set but progress is limited (2)
o Some progress is made but not continuous (3)
o Continuous improvement in UX processes is emphasized, with method innovation (4)
o Continuous improvement is prioritized, with innovation and contributions to the UX field (5)
o Other (please specify) (6) _____

End of Block: DIMENSION 4: EMBEDDED UX PROCESSES

Appendix 12B | Qualtrics Questionnaire T3

UX Maturity Assessment 3

Thank you very much for participating in this questionnaire. Please note that it consists of **27 questions** and will take between **10 minutes** to complete. Your responses will contribute to your organization's UX maturity assessment and support our research.

Rest assured, the information you provide will be kept **confidential**, and all data will be **anonymized**.

Remember, there are **no right or wrong answers** - we are seeking an accurate representation of your situation.

Thank you again!

Q1 What is the **name of your organization**?*_____

*this information will not be shared

Q2 When was the **inception of your organization**? (e.g. march 2022)_____

Q3 What is your organization's **current development phase**? Pick the answer that suits best.

- ○ **1. Ideation:** Generating and refining product ideas based on market needs and opportunities. (1)
- ○ **2. Concept Development:** Elaborating on the idea to create a detailed product concept, including defining the target market and user needs. (2)
- ○ **3. Feasibility Analysis:** Assessing the technical and economic feasibility of the product, including market analysis and financial projections. (3)
- ○ **4. Design and Prototyping:** Creating detailed product designs and prototypes to visualize and test the product concept. (4)
- ○ **5. Development:** Building the product, including software development, hardware production, and integration of components. (5)
- ○ **6. Testing and Validation:** Conducting rigorous testing to ensure the product meets all requirements and standards, including user testing and quality assurance. (6)
- ○ **7. Market Launch:** Introducing the product to the market through marketing and sales efforts, often starting with a soft launch or pilot program. (7)
- ○ **8. Post-Launch Evaluation:** Monitoring the product's performance in the market, collecting feedback, and making necessary improvements or iterations. (8)
- ○ **9. Scaling:** Expanding production and distribution to meet growing demand, optimizing operations for efficiency, and entering new markets. (9)

Q4 How many 'real' users are using your product (approximately)? (e.g. '50') _____

Q5 How **many permanent employees** does your organization count? (e.g. '6')

▼ 1 (4) ... 25+ (28)

Q6 What is **your role** in your organization? (e.g. 'Product Owner')_____

Q7 Are you **the main employee responsible for UX**?

- ○ Yes, and it's my only role (1)
- ○ Yes, but I also have other roles (2)
- ○ Someone else is mainly responsible (please explain): (3) _____
- ○ Everyone is responsible (4)
- ○ No one is responsible (5)

Q8 Have you hired a **UX expert** as a result of AsterX?

- ○ Yes, internal (1)
- ○ Yes, external/part-time (2)
- ○ No, but we will shortly (3)
- ○ No (4)

Q8 **How often** are these artifacts used in your organization?
Reminder: there is no right or wrong answer.

	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Always (5)	***I don't know how often*** (6)	***I don't know this artifact*** (7)
Customer Journey Map (1)	○	○	○	○	○	○	○
Service Blueprint (2)	○	○	○	○	○	○	○
Persona (3)	○	○	○	○	○	○	○
Work Models (4)	○	○	○	○	○	○	○
UX Goals (5)	○	○	○	○	○	○	○
Affinity Diagram (6)	○	○	○	○	○	○	○
Concept Map (7)	○	○	○	○	○	○	○
Card Sort (8)	○	○	○	○	○	○	○
User Scenario (9)	○	○	○	○	○	○	○
User Story or Epics (10)	○	○	○	○	○	○	○

Task Models (11)	○	○	○	○	○	○	○
Hi-Fidelity Prototypes (12)	○	○	○	○	○	○	○
Lo-Fidelity Prototypes (13)	○	○	○	○	○	○	○
Design Principles (14)	○	○	○	○	○	○	○

Page Break

Q9 **Who is currently performing UX Activities** in your organization? *If applicable, check multiple boxes.*

- ▢ Nobody (1)
- ▢ Developers (2)
- ▢ Other (3) _____
- ▢ UX Consultants (External) (4)
- ▢ UX Experts (Internal) (5)

Page Break

Q10 What is the range of **duties that concern UX** in your organization? *If applicable, check multiple boxes.*

- ▢ Information Architecture Design (1)
- ▢ Interaction Design (2)
- ▢ Interface Design (8)
- ▢ Prototyping (3)
- ▢ User Testing (4)
- ▢ Visual Design (5)
- ▢ I don't know (6)
- ▢ Other (please specify) (7) _____

Page Break

Q11 **How often does your organization use the following methods** with real end users?

Reminder: there is no right or wrong answer.

	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Always (5)	***I don't know how often*** (6)	***I don't know this method*** (7)

Group Interview: Brainstorming, Focus Groups, Stakeholder Interviews (1)	○	○	○	○	○	○	○
Individual Interview: In-Person, Remote (2)	○	○	○	○	○	○	○
Survey Research: Online Questionnaire (3)	○	○	○	○	○	○	○
Experience Sampling: Repeated Entry Diary (4)	○	○	○	○	○	○	○
Experiment: A/B Testing, Controlled/Remote Experiment, Think Aloud (5)	○	○	○	○	○	○	○
Instrument-Based Experiment: Biometric, Eye-Tracker, FaceReader, Sensors (6)	○	○	○	○	○	○	○
Observation: Field Observation (7)	○	○	○	○	○	○	○
Simulation: Paper-and-Pencil, Wizard of Oz (8)	○	○	○	○	○	○	○

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Q12 Rate the following statements between **1 (= low)** and **5 (= high):**

	1	1	2	2	3	3	3	4	4	5
How **aware** are you of **UX Good Practices**? ()										
How **skilled** are you on **UX Good Practices**? ()										
How **important** is UX for your organization right now? ()										
How **prioritized** is UX for your organization right now? ()										

Q13 Which statement best describes your organization's situation regarding **strategic priority:**

The strategic priority is...

- ...to prioritize product features based on functionality, with minimal consideration for user input. (1)
- ...(transitioning towards) a more user-focused approach, albeit not yet considered essential to the strategy. (2)
- ...moderate integration of user experience (UX) into the overall corporate strategy (3)
- ...placing a high importance on understanding user needs through extensive research efforts. (4)
- ...advocating for a comprehensive user-centered design process, with senior leaders accountable for fostering a strategic culture centered around UX. (5)

Q14 Which statement *best* describes your organization's situation regarding **strategic decisions:**

- Decision-making prioritizes functionality over user needs. (1)
- Decisions regarding UX stem from conferences, articles, or personal interpretations ('intuition') rather than user insights. (2)
- Decision-making for organizational strategy and project prioritization is driven by understanding user needs (3)
- Successful ad hoc initiatives prompt decisions towards a more user-focused approach, though not yet essential to strategy. (4)
- Decisions reflect the integration of UX into the overall corporate strategy, advocating for a holistic user-centered design process. (5)

Q15 Which statement is **most applicable** regarding each of the following UX Goals within your organization?

	Not part of our overall strategy (1)	Exists, but **not clear / not measurable** (2)	Clear & measurable, but **not properly tracked** (3)	Clear & measurable, but **inconsistently tracked** (4)	**Clear, measurable & consistently tracked** (5)	I don't know (6)
Improve User Satisfaction: Enhance the overall satisfaction of users with the product. (1)	o	o	o	o	o	o
Increase User Retention: Keep users engaged and returning to the product. (2)	o	o	o	o	o	o
Enhance Accessibility: Make the product more accessible to users with disabilities. (3)	o	o	o	o	o	o
Boost Task Efficiency: Reduce the time it takes for users to complete key	o	o	o	o	o	o

tasks. (4)						
Reduce User Errors: Minimize the number of errors users encounter while using the product. (5)	o	o	o	o	o	o
Optimize User Onboarding: Make the onboarding process smoother and faster for new users. (6)	o	o	o	o	o	o
Increase Conversion Rates: Improve the rate at which users take desired actions, such as making a purchase. (7)	o	o	o	o	o	o
Promote Feature Adoption: Encourage users to discover and use new or existing features. (8)	o	o	o	o	o	o
Improve Navigation: Make it easier for users to find what they are looking for. (9)	o	o	o	o	o	o

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Q16 Which statement is **most applicable** regarding each of the following UX KPIs within your organization?

	0 = KPI tracking is inconsistent or nonexistent.	KPI tracking is sporadic and unreliable.	KPI tracking is consistent but basic.	KPI tracking is well-organized and reliable.	5 = KPI tracking is exemplary & highly consistent.	I don't know.
	0	1	2	3	4	5
Task Success Rate: The percentage of successfully completed tasks by users. ()						
Time-on-Task: The amount of time users spend completing a task. ()						

User Error Rate: The frequency of errors made by users. ()	
Navigation vs. Search: The ratio of navigation usage to search function usage. ()	
System Usability Scale (SUS): A standardized score that measures overall usability. ()	
Net Promoter Score (NPS): Measures user loyalty and likelihood to recommend the product. ()	
Customer Satisfaction Score (CSAT): Measures user satisfaction with specific aspects of the product. ()	
Feature Adoption Rate: The rate at which users adopt new or existing features. ()	
Retention Rate: The percentage of users who continue to use the product over a period of time. ()	
Conversion Rate: The percentage of users who complete a desired action. ()	

Q17 What can be said about **UX prototyping** within your organization?

- **No prototyping** in place. (1)
- Prototyping has been implemented before, but **not recurrently** (2)
- **Occasional use** of either hi-fi or lo-fi prototyping (3)
- **Regular use** of both lo-fi and hi-fi prototypes (4)
- **Systematic use** of both lo-fi and hi-fi prototypes (5)

Q18 What can be said about the **timing of UX prototyping** across the product development cycle?

Prototyping is done...

- ...**at the end of product development cycle** (upon commercialization) (1)
- ...**during the product development cycle**, but not iteratively (2)
- ...**at the beginning of product development**, and iteratively across product development (3)

Q19 How proactive vs. reactive are you (and your team) when it comes to **user feedback**?

0= highly reactive, feedback consists of complaints after a feature is launched
5 = highly proactive, systematically reaching out to users before launching new features

Reactive	Proactive	Not Applicable

Seeking User Feedback ()	

Q20 At what **frequency** do you deal with **user feedback**?

0 = never
5 = very frequently (2/3 times weekly or more)

	Not Applicable					
	0	1	2	3	4	5
User Feedback Frequency ()						

Q21 Which statement *best describes* your organization's situation with regards to **using user feedback**?

User feedback is...

- generally **not critically evaluated**, either dismissed or implemented verbatim (1)
- critically evaluated & implemented **on a few instances** (2)
- critically evaluated & implemented **on some instances** (3)
- critically evaluated & implemented **on most instances** (4)
- **always** critically evaluated & implemented (5)

Q22 Which statement best describes your organization's situation with regards to **resources?**

The organization...

- **never** invests resources (time, free trials & discounts in return for user feedback, paid tools, external consulting, ...) (1)
- **rarely** invests resources (time, free trials & discounts in return for user feedback, paid tools, external consulting, ...) (2)
- **sometimes** invests resources (time, free trials & discounts in return for user feedback, paid tools, external consulting, ...) (3)
- **often** invests resources (time, free trials & discounts in return for user feedback, paid tools, external consulting, ...) (4)
- **systematically** invests resources (time, free trials & discounts in return for user feedback, paid tools, external consulting, ...) (5)

Q23 Which statement *best describes* your organization's situation with regards to **training**?

The organization...

- ○ does not (has never) engage(d) in any UX Training (1)
- ○ has engaged in UX Training before, but not recurrently (2)
- ○ occasionnally engages in UX Training (3)
- ○ regularly engages in UX Training (external programme) (4)
- ○ continuously engages in UX Training (internal programme) (5)

End of Block: Resources

Start of Block: Embedded Processes

Q24 Which statement best describes your organization's situation with regards to **documenting UX Activities**?

UX Activities are (...) documented...

- ○ Never (1)
- ○ Sometimes (2)
- ○ About half the time (3)
- ○ Most of the time (4)
- ○ Always (5)

End of Block: Embedded Processes

Start of Block: Testing

Q25 *Who* do you involve when testing?

- ○ I test it on myself (1)
- ○ We test within the team (2)
- ○ I/We use convenience sampling (friends, family,...) (3)
- ○ I/We test on a representative sample/potential users (4)
- ○ I/We test directly with our users (5)

Q26 *How* would you describe your testing approach? Pick the answer that best suits your organizations <u>current</u> situation.

- ○ Tests are exploratory, with no clearly outlined tasks. Participants have broad objectives and explore freely without specific

guidance. (1)

○ Tests have some outlined tasks, but they are general and lack detailed instructions. Participants are given general goals without step-by-step tasks. (2)

○ Tests have clearly outlined tasks with some success metrics. Instructions are provided, but the documentation is partial, and observation is occasional. (3)

○ Tests have well-defined tasks and success metrics. Instructions are detailed, documentation is thorough, and participants are regularly observed. (4)

○ Tests have clearly outlined tasks with success metrics. All aspects are meticulously documented, and participants are carefully observed throughout. (5)

Q27 How would you describe your testing approach, with regards to *observing*? Pick the answer that best suits your organizations current situation.

○ Tests are unrecorded and unobserved. Feedback is anecdotal and not systematically captured. (1)

○ Tests are occasionally recorded or observed, but not consistently. Feedback is collected but not systematically analyzed. (2)

○ Tests are usually recorded and participants are sometimes observed. Feedback is collected and some analysis is conducted. (3)

○ Tests are regularly recorded and participants are frequently observed. Feedback is systematically collected and analyzed. (4)

○ Tests are meticulously recorded, and participants are continuously observed. Feedback is thoroughly collected, analyzed, and used to drive improvements. (5)

End of Block: Testing

Start of Block: Questionnaire Feedback

Q48 Lastly, please indicate your feedback **about this questionnaire:**

	Strongly disagree (8)	Somewhat disagree (9)	Neither agree nor disagree (10)	Somewhat agree (11)	Strongly agree (12)
This questionnaire was **easy** to fill out. (4)	○	○	○	○	○
Filling out this questionnaire **took a lot of effort.** (5)	○	○	○	○	○

End of Block: Questionnaire Feedback

Appendix 13 | Suggested Axes, based on Identified Drivers & Barriers for UX Maturity in Startups

Appendix 14 | CIUXM (Comprehensive Integrated UX Maturity) Framework

Dimension A - Holistic User-Centered Culture

A	**HOLISTIC USER-CENTERED CULTURE**						
Code	**Indicator**	**Description**	**Level 1: Initial**	**Level 2: Managed**	**Level 3: Defined**	**Level 4: Integrated**	**Level 5: Optimizing**
A1	STRATEGIZING						
A1.1.	***Prioritizing***	*The importance placed on user needs and input*	Strategic priority is functionality over user input[A2;A9]	Transitioning towards a more user-focused approach[A2;A9]	Integration of UX into corporate strategy, but not prioritized as essential[A7;A10]	High importance on understanding user needs through research[A2;A7]	Comprehensive user-centered design; strategic UX culture[A2;A7;A9;A5]
A1.2.	***Decision-Making***	*How decisions are made regarding UX*	Decisions prioritize functionality over user needs[A2;A5;A9]	Decisions from external UX sources; conferences, articles, personal interpretation[A7; A9]	Decisions are driven by understanding user needs[A2;A7]	Decisions reflect UX integration into strategy[A1;A7]	User feedback consistently informs decisions[A5]
A2	GOAL SETTING						
A2.1.	***UX Goals***	*The clarity and measurability of UX goals*	No UX goals[A7]	Existing UX goals lack measurability and clarity	Some projects have measurable & clear UX goals[A7]	Almost all projects have measurable UX goals; included in corporate balanced scorecard[A7; A10]	UX goals are intricately linked to organization objectives[A2;A7;A20]
A3	PROTOTYPING & TESTING						
A3.1a.	***Prototyping***	*The use and integration of prototypes in the design process*	No prototyping in place[A9]	Some prototyping in place	Occasional Lo-Fi prototyping	Regular implementation of lo-fi and hi-fi prototypes[A3;A7]	Iterative design with thorough testing using lo-fi and hi-fi prototypes[A3 ; A7; A9]
A3.1b.	*Timing of Prototyping*	*The timing of prototyping*	Never	End of product development[A7]	Occasionally throughout development[A3 ;A7]	Regularly throughout development[A3; A7]	Systematically throughout the development cycle[A3;A7]
A3.2a.	***Testing***	*The extent and methods of testing*	No testing[A7]	Simple tests to assess UI and product features[A7;A9]	Expanded testing methods[A3]	Testing integral to design feedback[A3;A5]	Systematic testing and refinement throughout development[A7]
A3.2b.	*Timing of Testing Activities*	*The timing of testing activities*	Never	End of product development[A7]	Occasionally throughout development[A7]	Regularly throughout development[A7]	Systematically throughout the development cycle[A7]
A4	INVOLVING USERS						
A4.1.	***Type of User Feedback***	*How user feedback is utilized in the design process*	Confined to marketing input[A7;A9]	Feedback on design/functionality without impact	Needs improvement in methods/timing[A2;A3;A7]	Occasionally influences strategy/project prioritization	Consistently drives strategy/project

A	HOLISTIC USER-CENTERED CULTURE						
							prioritization[A2;A7;A9]
A4.2.	***Evaluating User Feedback***	*The critical evaluation and implementation of user feedback*	Not critically evaluated, dismissed[A10]	Critically evaluated, implemented occasionally[A10]	Critically evaluated, implemented sometimes[A10]	Critically evaluated, implemented most times[A10]	Always critically evaluated, implemented[A10]

Dimension B - Stakeholder Engagement

B	STAKEHOLDER ENGAGEMENT						
	Indicator	**Description**	**Level 1**	**Level 2**	**Level 3**	**Level 4**	**Level 5**
B1	ALIGNING						
B1.1.	***Awareness***	*The level of awareness of UX across the organization*	No awareness[A2; A7; A9]	Seen as a tool to improve UIs[A2; A9; A10]	Topic of discussion for some projects[A7]	Regularly debated and considered important[A2; A7]	Fully enlightened about user-centered design[A2]
B1.2.	***Consensus***	*The degree of consensus on the importance of UX*	Everyone agrees it's irrelevant[A2;A7;A9]	Some disagreement[A2; A9; A10]	High polarization on UX relevancy[A7]	Some agreement on importance[A2;A7]	Agreement that UX is important[A2]
B2	COMMUNICATING						
B2.1.	***Subject***	*The subject of UX discussions*	Limited to graphic/UI design/developers' tasks[A7; A9]	Initial interest in understanding user needs	Scattered but increased interest in understanding user needs & UX	Discussions on techniques, process improvement[A9; A10]	Leadership supports discussions about full integration, ongoing improvement[A2; A7;A10]
B2.2.	***Frequency***	*The frequency of UX discussions*	Rare or never[A7;A9]	Occasionally[A7]	Sometimes[A7]	Frequently[A7;A10]	Every time/on all projects[A7;A10]
B3	CONVINCING						
B3.1.	***Valuing***	*The recognition of the added value of UX*	Unaware of added value[A2; A9; A5]	Inconsistent awareness, buy-in[A2; A7; A9; A10]	Heuristic reviews, initial success, and/or expert input show value[A7; A9; A10]	Structured approach to UX, some departments adopt practices[A9; A10]	Fully integrated, UX value recognized in all aspects[A2; A5]
B3.2.	***Advocating***	*The presence of UX advocates within the organization*	No one or one individual[A9]	A few advocates[A2; A10; A5]	Some teams[A2; A10]	All levels, but missing some stakeholders[A2; A10]	All levels, strong leadership advocacy[A2; A9; A10]

Dimension C - Process Embeddedness

C	PROCESS EMBEDDEDNESS						
	Indicator	**Description**	**Level 1: Initial**	**Level 2: Managed**	**Level 3: Defined**	**Level 4: Integrated**	**Level 5: Optimizing**
C1	INVESTING						
C1.1.	***Investing [resources]***	*The allocation and systematic use of tools and space dedicated to UX activities*	No dedicated UX tools and/or space[A5;]	UX tools/space exist, lack systematic use[A5]	Dedicated UX tools/space[A5]	UX testing lab, tools, equipment used consistently[A5]	Comprehensive resource allocation, strategic investment in UX[A5]
C1.2.	***Investing [budget]***	*The presence of a dedicated budget for UX*	No dedicated UX budget[A7]	UX budget exists, lacks systematic allocation[A2; A7; A9; A10]	Dedicated UX budget: resources and tasks are being integrated[A7; A9; A10]	Dedicated UX budget allows for team formation, dedicated hires	Comprehensive budget allocation, strategic investment[A7; A9; A10]
C1.3.	***Tracking ROI***	*The tracking of return on investment for UX activities*	No tracking of UX activities for ROI	Basic UX activities tracked for ROI[A10]	More comprehensive tracking of ROI	ROI tracking becomes refined	Fully integrated, optimized ROI tracking[A2]
C2	DELEGATING						
C2.1.	***Dedicated UX Team***	*The establishment and structure of UX teams*	No dedicated UX roles[A9]	Late consultation, external experts hired[A2; A7; A9; A10]	Dedicated UX roles[A2; A7]	Official UX team, led by UX manager[A7; A9]	Well-defined roles, team collaboration[A7; A9; A10]
C2.2.	***Defining***	*The extent to which UX roles and activities are clearly defined*	No defined UX roles and no UX responsibilities allocated[A9]	Basic activities initiated by advocates, roles still undefined[A2; A7; A9; A10]	UX roles are clearer, but report to Marketing, Product Management, Engineering[A7; A9]	Defined responsibilities in the UX process[A9]	Well-defined roles, efficient outcomes, UX manager drives approach, strategic integration[A7; A9; A10]
C3	EMBEDDING						
C.3.1.	***Documenting***	*The documentation of UX activities*	Always undocumented, reactive[A7]	Mostly undocumented, reactive[A7]	Sometimes documented, proactive[A7]	Mostly documented, proactive[A7]	Always documented, proactive[A7; A9]
C3.2.	***Integrating***	*The integration of UX roles, activities, and artifacts into processes*	Never integrated into processes[A2]	Integrated into one or few processes	Integrated into some processes[A2; A10]	Integrated into most processes and repeatable[A5]	Integrated into all processes and repeatable[A5; A7]

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CHAPTER 4

Conclusion

In conclusion, this research aimed to conduct an in-depth analysis of the landscape of UX maturity assessment tools and contribute to the increased standardization and applicability of those tools. Through a systematic literature review, it was revealed that existing models suffered from inconsistencies and a lack of cross-validation, which led to the development of the CIUXM Framework. This framework was designed with the ultimate objective of providing tailored UX maturity assessment tools that consider the specific attributes of startups. Upon testing the CIUXM Framework with startups, it became clear that these organizations require customized tools due to their unique characteristics. The objectives of this research were to better adapt existing UX maturity assessment tools for startups, enhance consistency in terminology, scales, identity, and processes within the UX industry, identify specific drivers of UX maturity relevant to startups, and generate insights that would inform the refinement of existing UX maturity frameworks to facilitate the extraction of clearly defined UX maturity goals.

The study reviewed eleven papers, from which key findings were used to identify recurring themes, which were then categorized into three main dimensions: Holistic & User-Centered Culture, Stakeholder Engagement, and Process Embeddedness. This analysis revealed gaps and a lack of continuity in existing models, leading to the development of the comprehensive CIUXM Framework to address these issues and provide a standardized assessment of UX maturity. The research demonstrated that there is indeed nuance and room for improvement in UX maturity assessments specifically for startups. The CIUXM Framework aimed to bridge these gaps by integrating a comprehensive overview of UX maturity literature, thus enhancing the theoretical foundations of UX maturity assessment and offering a more nuanced and coherent framework.

From a managerial perspective, the CIUXM Framework serves as a practical tool for organizations aiming to assess and improve their UX maturity. It provides clear definitions, criteria, and stages of UX maturity, helping organizations identify their current maturity level and pinpoint areas for improvement. By including objective, measurable indicators and focusing on comprehensive coverage of key business domains, the framework enables organizations to

integrate user-centered design principles into their strategic planning and decision-making processes.

Additionally, the study adapted the CIUXM Framework to include startup-specific dimensions and indicators, addressing the unique challenges and opportunities faced by these organizations. The theoretical contributions of this study not only enhanced existing UX maturity frameworks but also introduced new dimensions relevant to startups. By developing UX maturity assessment tools specifically tailored for startups and introducing an effective UX training program, the research offered valuable insights into how startups can integrate UX into their processes despite resource constraints.

Despite the limitations of this research, such as the small sample size and potential for researcher bias, it provides a solid foundation for future research and practical application in the field of UX maturity assessment for startups. Future studies could address these limitations by employing larger and more diverse samples, establishing control groups, and refining data collection methods to ensure consistency and reduce bias. We hope that our research has contributed to equipping startups with the tools necessary to achieve high UX maturity and succeed in today's competitive digital landscape. This effort is crucial for the success of individual startups and for the broader goal of advancing UX standards and contributing to global economic development.

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