Hindawi
Advances in Human-Computer Interaction
Volume 2022, Article ID 9701739, 13 pages
https://doi.org/10.1155/2022/9701739

Review Article

User Experience Practices in Software Startups: A Systematic Mapping Study

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Received 29 January 2022; Revised 16 March 2022; Accepted 14 April 2022; Published 28 April 2022

Academic Editor: Christos Troussas

Software startups work in an uncertain environment with limited resources. Thus, user experience (UX) practices can help startups in their product development process and provide greater chances of survival for these companies. It is necessary to know what UX practices software startups have used, how they are using them, and their effects on the organization. Therefore, this paper aims to present a systematic mapping study (SMS) conducted through search engines and snowballing to identify UX practices used in software startups. The papers' analysis identified thirty-six UX practices used by startups for product validation, design, and evaluation. However, the most emergent result extracted from the analysis was that only two of these practices were specified for software startups; in contrast, the others could be applied to various company types. In addition, several functions and ways of generating customer value through UX were identified.

1. Introduction

In the 1990s in Silicon Valley, startups emerged in the context of analyzing and supplying a market demand to enable a sustainable, innovative, and efficient solution without requiring many resources, whether financial, human capital, or physical space. Startups work in a volatile market that comprises lean teams and agile deliveries [1]. According to Sutton [2], software startups have little or no operating history, limited resources, multiple influences, and work with dynamic technologies in a dynamic market. According to Giardino et al. [1], startups are businesses in a highly volatile environment with increasing evolutions, seeking to solve an existing market problem. For Blank and Dorf [3], startups are transitional solutions for creating innovative models. This concept is also characterized by Hokkanen et al. [4], who cite the fact that there is a lot of pressure and a need for survival in a resource-constrained environment. However, for Gupta et al. [5], startups seek to scale their business model and attract new users to their products.

Several systematic mapping studies (SMS) have been done over the years on software startups. For instance, Paternoster et al. [6] conducted an SMS to structure and analyze the characteristics of the software development process in startups and the practices and technologies. The main result was the identification of fifteen themes linked to the software development process in startups, such as lack of resources, high reativity, and innovation. Besides, Silva et al. [7] conducted an SMS to analyze the impacts of lean startup, agile methodologies, and customer development on the growth of software startups. As the main contribution, the authors proposed a series of research questions related to integrating methodologies and proposition of new models, the impacts on the organizations, and critical success factors. Moreover, Gupta et al. [5] conducted an SMS to verify the

state of the art of requirements engineering in startups and showed a lack of research in the area, particularly the introduction of approaches recognized in laboratories. Besides, the authors analyzed that the studies lack essential practices, such as the case of requirements documentation.

Regardless of the focus of SMS studies, the startup community has dedicated efforts to contribute to the survival of these companies, since many startups fail in the early stages [8]. Some factors, which differentiate startups from traditional companies, contribute to the challenging context in which startups operate, such as small teams, lack of resources, and little margin for error [6, 9]. Thus, the literature addresses some topics that can help startups in their development processes, such as risk management, technical debt management, and investment in user experience (UX) [10]. According to ISO 9241-210 [11], UX is the "user's perceptions and responses that result from the use and/or anticipated use of a system, product or service." UX is important for software startups to add value to users and generate a competitive advantage [10].

Studies in the literature show the importance of UX practices in the software development process [12, 13]. For the startup scenario, the implementation of UX can occur in the early stages and focus on enhancing human actions, creating test environments with the intention that the final product will generate interest for users and be differentiated in the market [10]. The study by Saad et al. [14] identified some themes surrounding the context of UX work in startups, such as the challenges, attributes, and approaches. However, the authors mention several open questions in the literature, some of them related to the UX practices used by startups (e.g., what are the best UX practices to be applied in the context of startups? and which impacts do startups face while using informal UX practices?). Besides, it is inferred that because startups operate in an uncertain context, with small teams and a lack of resources, there must be practices that consider these factors and reduce the margin of errors and wrong decisions taken by startups.

Therefore, this work aims to investigate in the literature the practices of UX in software startups through an SMS, covering research in search engines and the use of the snowballing technique. Fourteen papers were identified, and thirty-six UX practices used in startups were identified. However, it was found that only two practices were explicitly targeted at startups. In addition, our study identified several roles that UX can perform in startups, such as assisting in product validation and evaluation and supporting user-centered design.

2. Materials and Methods

The protocol for this SMS was based on the guidelines presented by Kitchenham and Charters [15] and discussed by Petersen et al. [16], in addition to the snowballing methodology presented in Wohlin [17]. The SMS steps were divided into planning, execution, and reporting, discussed in the following sections.

2.1. Planning

2.1.1. Research Questions. The research questions were elaborated based on the paper of Unterkalmsteiner et al. [10]: an agenda with 70 research questions related to engineering activities in startups, the evolution of startups, human aspects in software startups, and other subjects. In the area of engineering activities in startups, more specifically in UX, the authors proposed three questions that contemplate this line of study, which were adapted and served as a basis for developing this research.

(i) RQ1: What are the methods, practices, and tools of UX used in startups?

(ii) RQ2: What is the role of UX during the life cycle of a startup?

(iii) RQ3: At what points are UX, products, and services linked in the development of customer value?

In RQ1, the objective was to verify the practices, methods, and UX tools used by startups since there are several used by the software industry, such as persona, questionnaire, mind mapping, prototyping tools Attrakdiff, and others [18]. Then, in RQ2, the intent was to verify the authors' intention when using the UX practices and tools identified in RQ1, such as involving the user in the development process or identifying new functionalities for their product. Finally, in RQ3, the objective was to verify how the authors benefit from the practice's results to generate value for their customers, that is, how the UX practices and methods are used to improve the vision that the customer has about the product.

2.1.2. Data Sources. The research was performed using advanced search engines in digital libraries of expressive relevance in computing and software engineering. The libraries chosen were Scopus, IEEE Xplore, ACM Digital Library, ScienceDirect, and Engineering Village. The search for papers identified by snowballing was done through Google Scholar.

These data sources were chosen: (1) for providing an efficient search engine, (2) for allowing the use of similar terms in the search strings, and (3) for returning a relevant number of papers due to the breadth of the databases used. In addition to these criteria, the relevance of these repositories to our work's research area was crucial to the choices.

2.1.3. Search String. The search string was formed by keywords referring to the PIO (population, intervention, outcome) criteria [15]. The population was represented by words related to "startup," and we used words previously used in other SMSs on this topic [6, 19].

For intervention, words related to practices, techniques, methods, and others used in the literature were used [20]. We used the terms from Veermeren et al. [20] in the search string to then perform a mapping of the contributions of each paper based on the intervention used. Finally, the terms "user experience" and its acronym [21] were used for the outcome. Table 1 demonstrates the final composition of the search string used in this SMS.

Table 1: Terms used in the search string.

Population	Startups OR start-up OR startup	AND
Intervention	Method OR practice OR instrument OR tool OR questionnaire OR approach OR technique OR scheme OR framework OR model	AND
Outcome	"User experience" OR UX	AND

2.1.4. Inclusion Criteria. Papers selected for the study should present at least one of the following inclusion criteria (IC):

(i) IC1: Publications about startups that mention UX work in these companies

(ii) IC2: Publications that present a novel UX practice with a focus on software startups

(iii) IC3: Publications that discuss the UX strategy model for startups

2.1.5. Exclusion Criteria. Papers that fall into one of the following exclusion criteria (EC) were removed from the final analysis:

(i) EC1: Publications that are not related to software startups

(ii) EC2: Publications that do not portray/do not present a UX practice (novel or not) in startups

(iii) EC3: Publications that are called events

(iv) EC4: Publications that were not peer-reviewed (e.g., grey literature, books)

(v) EC5: Publications with language other than English

(vi) EC6: Obsolete publications (published before 2011, considering the contemporaneity of the topics used in the research)

(vii) EC7: Duplicate publications (the same paper returned in different search machines), being considered only the first occurrence of the publication

(viii) EC8: Non-open access publications—paid papers that even if we searched other sources (e.g., authors' websites, Research Gate, Google), we could not find a free version

2.1.6. Quality Assessment. Assessing the quality of studies allows for verifying individual studies' importance during the synthesis of the results, guides recommendations for future research, and interprets and determines the results [16]. Therefore, for quality assessment, the selected studies were verified, in the data extraction process, according to the questions below through "yes" or "no" answers [22]:

(1) Is the paper based on research (or is it just a report of lessons learned based on expert opinion)?

(2) Is there a clear statement of the research goals?

(3) Is there an adequate description of the context in which the research was conducted?

(4) Was the research design adequate to address the research goals?

(5) Was the recruitment strategy appropriate to the research goals?

(6) Was there a control group with which to compare the treatments?

(7) Was the data collected in a way that addressed the research question?

(8) Was the data analysis sufficiently rigorous?

(9) Was the relationship between the researcher and the participants adequately considered?

(10) Is there a clear statement of the results?

(11) Is the study of value to research or practice?

To measure the quality of the studies, the questions were partitioned under the criteria of rigor (1–8) and relevance (9–11). Rigor represents the study's precision in its research method and the way the study is presented. Relevance represents the study's value to the research community and industry [23].

2.2. Execution

2.2.1. Study Selection of Search Engine. Our study began in December 2020, and the last round of search string was in January 2021. Table 2 demonstrates the returns obtained from the databases used and the number of papers identified in snowballing.

The papers extracted in the search engines had their metadata imported into a spreadsheet (year, title, abstract, keywords, authors, and DOI) and went through the following selection steps:

(i) Step 1: Papers whose publication year was before 2011 were marked with the exclusion criterion EC6 (obsolete publications). Besides, through the paper's title and the authors' names, duplicates were identified and assigned the exclusion criterion EC7 (duplicate publications). The order of the search engines used in this step and throughout the SMS was Scopus, IEEE Xplore, ACM, ScienceDirect, and Engineering Village.

(ii) Step 2: At this step, the second and third authors randomly divided the remaining papers into two groups and, by analyzing the title, keywords, and abstract, classified the papers concerning the other inclusion or exclusion criteria. After that, the first author reviewed the analysis performed. For those papers with a divergence of opinion or doubt in the classification, all authors discussed to decide a consensus on the paper's final classification. Between the discussion, if any doubt remained, the paper was automatically included for the next complete reading step.

Table 2: Papers returned in the initial search.

Search engine	Returned
Scopus	110
IEEE Xplore	41
ACM Digital Library	119
ScienceDirect	23
Engineering Village	122
Total (search engine)	**415**
Snowballing	**303**
Total	**718**

(iii) Step 3: The papers selected in the previous step with the inclusion criteria were submitted for a complete reading. In this step, papers that did not contribute to the research context or were not accessible (EC8) were excluded and reclassified with an exclusion criterion. Papers that had data related to the context of this SMS, on the other hand, were extracted.

Figure 1 illustrates the entire selection process through the search engines and the number of papers selected in each step.

2.3. Study Selection of Snowballing. After the selection of papers returned to the search engines, the following snowballing techniques were performed:

(i) Backward: selection of publications that were cited by the papers extracted in the search engine phase;

(ii) Forward: selection of publications that cited the papers extracted in the search engine phase

Snowballing rounds were performed only on the papers selected for extraction into the search engines. Therefore, we tabulated all papers referenced by the papers selected for extraction in the search engine process (backward). Besides, we tabulated all papers that cited the papers selected for extraction in the search engine process (forward). This process generated 303 new papers for analysis, and we used the same inclusion and exclusion criteria of the study's selection of search engines. The selection process occurred as follows:

(i) Step 1: Application of criteria EC6 (obsolete publications) and EC7 (duplicate publications) on the papers returned by snowballing. After this phase, 229 papers remained.

(ii) Step 2: Reading the title, abstract, and keywords and applying the other exclusion criteria. After this phase, 72 papers remained for a complete reading.

(iii) Step 3: Complete reading and application of exclusion criteria. After reading, 4 papers were selected for extraction.

Figure 2 illustrates the stages of snowballing and the number of publications selected in each step.

2.4. Data Extraction. We created a data extraction table in Microsoft Excel to do the data extraction. For each selected paper, we extracted the metadata, such as the title, authors, year, and venue of publication. Then we looked for the answers to each RQ. In this way, the answers to the RQs emerged as the selected papers were read. For RQ1, we identified the UX practices, methods, and tools proposed or used in each paper. In RQ2, we identified the definitions used by the authors when they mentioned the term UX. Finally, for RQ3, we checked according to the benefits linked to the customer cited by the authors of the papers after using UX practices, methods, or tools. In addition to extracting answers for each RQ, we extracted data related to the classification scheme, which is a way to provide an overview of the investigated topic [6]. Thus, for the classification schema, we extracted the following:

(i) Research type conducted in the paper [24]

  (i) Lab studies: context created for the execution of the experiment.
  (ii) Field studies: an examination of UX in a real context of use.
  (iii) Survey: questionnaires (online or offline) answered by users to collect feedback in a short time.
  (iv) Expert evaluation: use of UX/interface specialists to identify problems in the product.

(ii) Contribution type of research [20]:

  (i) Terms identified in papers reviewed by Vermeeren et al. [20], which are method, instrument, tool, questionnaire, approach, technique, system, scheme, framework, or model.

(iii) Focus of UX usage [25]:

  (i) Validation: using UX techniques to discover what you are building and whom you are building it for.
  (ii) Design: using UX techniques to prototype/build the product.
  (iii) Product evaluation: using UX techniques to evaluate, understand and improve the customer's experience with the product.

(iv) Study significance [6]:

  (i) Total: totally related (main focus) to UX activities in software startups.
  (ii) Partial: partially related to UX activities in software startups. The main research focus is related to UX activities in general.
  (iii) Marginal: marginally related to UX activities in software startups. The main focus of the research is different from UX activities.

Then, based on the selected papers, data extraction was performed as the files were read. Next, the same data extraction was applied for papers selected by search engines and snowballing. Finally, with the help of an electronic spreadsheet, the data were tabulated for analysis.

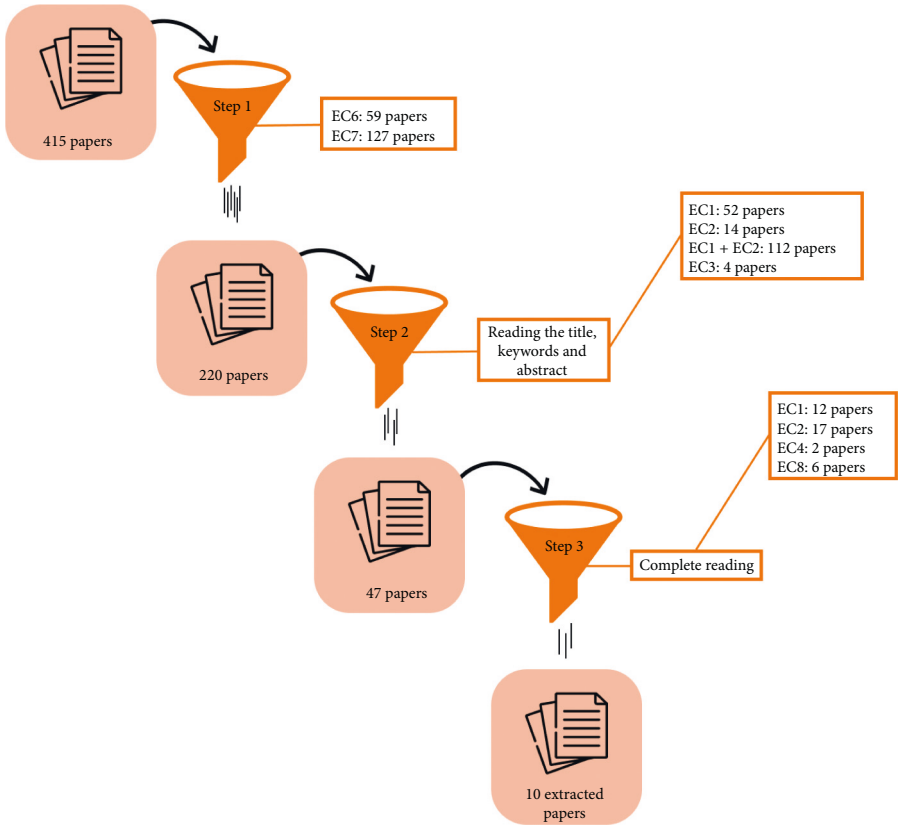

Figure 1: Papers selection process with the search engine.

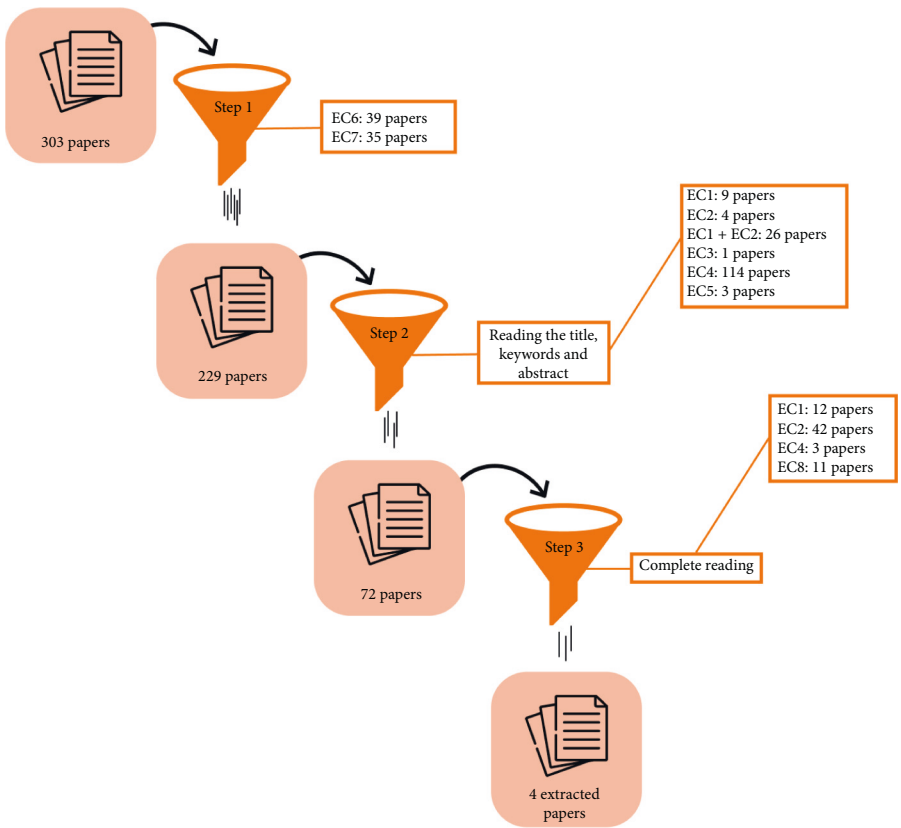

Figure 2: Papers selection process with snowballing.

3. Results and Discussion

With their respective IDs, titles, and authors, the extracted papers are listed in Table 3. Following the descriptive analysis of the final 14 papers, it was possible to analyze the year and venues of the publications, answer the three research questions, perform the classification schema, and evaluate the quality and rigor of each paper.

Regarding the publication year, the timeline of publications is shown in Figure 3.

In Figure 3, we noted an oscillation in the return of paper. This oscillation suggests that the theme's interest remained throughout the decade even if some papers were not returned. Also, we observed an increase in the number of papers in the years 2015 and 2019.

Considering the publication venues of the extracted papers, some come from journals and others from conferences, as described in Table 4.

In all, papers were returned from one journal and ten conferences. The only journal return was from the Journal of Physics, and the most returned conferences were HCI International and International Conference on Agile Software Development.

3.1. RQ1. Methods, Practices, and Tools of UX Used in Startups. A total of 36 methods, practices, or tools of UX used in startups were identified. The findings are described in Table 5.

Through the analysis, we noticed that most of the methods, practices, or tools used by startups for UX creation are the same as those used by traditional companies, such as usability testing, prototyping, personas, AttrakDiff, and questionnaires. These are UX practices, methods, or tools also cited by Kashif et al. [18] when mentioning the UX concepts used in the software companies generally. Mockups, usability testing, persona, and user journey were also UX practices and methods mentioned in Øvad and Larsen's study [39], which included some big companies with thousands of employees.

The most widely used practice was usability testing, mentioned in seven papers. In usability testing, the researcher (or researchers) observes users performing a specific task on the product to be tested. The primary purpose of usability testing is to help developers produce more useable software by identifying problems to be solved [40]. For example, in S11, the authors used usability testing to verify an open marketplace's interface problems for listing and renting meeting rooms. The test result showed evidence of a good UX, but that improvement should be made in the future.

The second most mentioned practice was prototyping, returned in three papers. Prototyping consists of creating interactive versions of the product to be evaluated by users. According to Nielsen [41], prototypes help since they can be developed quickly and at a low cost and are evaluated with users and modified as the design team gains a better understanding of the problems, aiming to offer an adequate solution. In S4, the authors used prototyping to build a clear view of the previously selected ideas in the product ideation phase. In addition to these mentions of prototyping, we also observed a case of paper prototyping. In this case, with the help of pens and paper, the researcher invites the users to perform some tasks with the system's support simulated on paper [42]. Finally, in this case, in S7, the authors mention the fact that the startups investigated in their study use paper prototyping as a start point and to present the idea when interviewing their potential business partners.

Only papers S6 and S12 mentioned practices with specific directions for startups, the minimum viable user experience (MVUX) and lean UX, respectively, considering the differentiated context these companies experience. MVUX is a framework that supports product design at the early stages of startups. It is divided into four main elements: attractiveness, approachability, professionalism, and selling the idea. In startups, these elements can guide the UX design of early product versions. Lean UX, in turn, is an approach to rapid and user-centered software development. Gothelf and Seiden [43] show that lean UX is a combination of design thinking [44], lean startup [45], and agile methodology [46]. Lean UX's idea is to incorporate user testing at the end of each development sprint. Instead of one significant user test being conducted, several small tests will be aimed at any new features built in the sprint. These tests require that essential features of the MVP are prioritized so that the user testing focuses on the product idea.

Regarding the methods, practices, or tools used to create UX in startups, we observed that 94.44% ($N = 34$) could be used in any company, that is, there is no specific focus on startups. Since they are consolidated methods, both academic and industrial, startups choose to use and replicate the ideas adapted to their context. However, startups are present in a unique context because it involves several issues, such as lack of resources, time pressure, uncertainties, and reduced development team [1].

One of the challenges identified by the authors of S9 when applying UX practices was related to time. The authors report that they had to skip some methods' steps to deliver on time. Another difficulty reported by some authors is engaging users to participate in UX practices. Some practices, such as interviews, surveys, and usability tests, require users to provide answers and provide insights. However, some studies (S3 and S4) report low participation and difficulty identifying these users.

Another difficulty reported when using UX practices in a startup is the lack of skilled users to work with the practices, as reported in S8 and S12. For having a meager budget and often a reduced team, startups usually prefer to focus on developers who will build the functional product. Therefore, it is necessary to have a change of mentality in those responsible for having specific professionals to work with the UX practices or training to qualify the professionals in the company.

3.2. RQ2: Roles of UX during the Life Cycle of a Startup. According to the extracted papers' analysis, the authors consider that UX can assist customer acquisition to product

Table 3: List of papers extracted.

ID	Title	Citation
S1	Evaluation and efficient measurement I-canang digital startup in bAli with questionnaire user experience and lean startup machine validation board	Ardyanti et al. [26]
S2	Designing software products with Google Ventures design sprint framework in startup	Nashrulloh et al. [27]
S3	User expectations and implications for designing the user experience of shared vehicles	Khamissi and Pfleging [28]
S4	Information systems strategic planning: using design thinking method at a startup company	Suroso et al. [29]
S5	Challenges of lean customer discovery as the invention	Batova et al. [30]
S6	Minimum viable user experience: a framework for supporting product design in startups	Hokkanen et al. [4]
S7	UX work in startups: current practices and future needs	Hokkanen and Väänänen-Vainio-Mattila [31]
S8	Startup rio: user experience and startups	Renzi et al. [32]
S9	Applying lean startup: an experience report-lean and lean UX by a UX veteran: lessons learned in creating and launching a complex consumer app	May [33]
S10	Software project management combining agile, lean startup, and design thinking	Ximenes et al. [34]
S11	Lean design for a good user experience	Gasik and Lamas [35]
S12	Lean UX—the next generation of user-centered agile development	Liikkanen et al. [36]
S13	Focusing on user experience and business models in startups: investigation of two-dimensional value creation	Hokkanen et al. [37]
S14	Three patterns for user involvement in startups	Hokkanen and Leppänen [38]

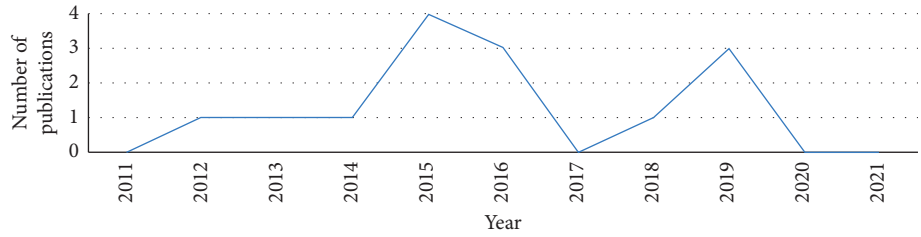

Figure 3: Time view of the extracted publications.

Table 4: Publication venues of the extracted papers.

Venue	Paper ID
Journal	
Journal of Physics: Conference Series	S1, S2
Conferences	
International Conference on Agile Software Development	S6, S7
HCI International	S8, S10
Automotive User Interfaces (AutomotiveUI)	S3
International Conference on Computer Applications and Information Processing Technology (CAIPT)	S4
IEEE International Professional Communication Conference (IPCC)	S5
Agile Conference	S9
Conference on Human Factors in Computing Systems (CHI)	S11
Nordic Conference on Human-Computer Interaction (NordiCHI)	S12
International Academic Mindtrek Conference	S13
European Conference on Pattern Languages of Programs (EuroPLoP)	S14

design and evaluation. The role of UX according to each paper is described in Table 6.

When UX methods focused on validating the startup idea, we highlighted the use of personas and the usability testing shown in the previous section. Persona is a method for representing end users to developers, designers, and stakeholders [47]. The authors of S4 used this technique to improve communication between the target users and the designer team. The authors of S9 also used personas to architect their product based on the experience of its users.

For UX methods that support product design for startups, the main one was prototyping highlighted earlier. Besides it, we can also mention the use of mock-ups, sketches, and wireframes. These methods are linked to low-fidelity prototyping, that is, when the designer wants to understand the interface elements' architecture and layout. For example, the authors of S11 used these practices for the proposition of their MVP. The authors report that creating the MVP by low-fidelity prototyping was necessary for user verification and validation.

Table 5: Methods, practices, and tools of UX used in startups identified.

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14
UX questionnaire (UEQ)	✓													
Google venture design sprint		✓												
Delft design method			✓											
Design thinking				✓						✓				
Personas				✓					✓					
Empathy map				✓										
Mock-ups				✓										
Prototyping				✓					✓				✓	
Validation questionnaire				✓										
Five-second test					✓									
User shadowing					✓									
Ethnography					✓									
Direct observation					✓								✓	
Indirect observation					✓									
Artifact analysis					✓									
Think aloud					✓									
Usability testing					✓		✓		✓		✓	✓	✓	✓
Interviews					✓		✓							
Minimum viable UX (MVUX)						✓								
Paper prototyping							✓							
Google Analytics							✓							
Mix panel							✓							
User journey map							✓							
The self-use UX document								✓						
Diagramming of product									✓					
Sketch											✓			
User research									✓					
Wireframe									✓		✓			
Roleplaying											✓			
User scenarios											✓			
AttrakDiff											✓			
Prioritization matrix											✓			
Lean UX												✓		
Proto-personas												✓		
Data analysis													✓	
User feedback													✓	

Another role of UX in returned startups is to assist in evaluating the developed product. For this, the authors mention some techniques for product evaluation, such as the use of the user experience questionnaire (UEQ) [48] and Attrakdiff [49] questionnaires. This evaluation type allows the users who tested the product to express their feelings about the actions performed. After analyzing the results, designers and developers can get some insights to evolve the product.

According to the several roles of UX in the life cycle of the startups identified in our study, we can infer that the concept varies according to the startup's need and phase. For example, UX can assist in market and user research for startups in the customer discovery phase to identify needs, opinions, priorities, and even customers. On the other hand, for startups that already have a defined product idea, UX can help in the design phase generate a product that provides a good user experience and meets the demands. Also, UX can assist in evaluation research, checking users' feedback to improve and evolve the product for startups that already have a product created. According to the results, UX can be present from the beginning of the startup until its consolidation in the market. In each phase, it will have specific functionality.

3.3. RQ3: Points Where UX, Products, and Services Are Linked in Developing Customer Value. For generating customer value through UX, the returned papers showed a variation according to the definition of the UX role shown earlier. Thus, the points of value generation described in each paper are shown in Table 7.

Several points were identified as generating value for the customer through UX. For example, research to identify user needs, user-centered design, active user participation in product development, and prototyping points out to add value.

For example, the authors of S12 argue that UX practices for extracting user needs are more efficient and spend fewer resources than performing a lengthy requirements elicitation and specification process from the users' point of view. Thus, according to the authors, using the practices can make the user more efficient and productive by identifying the functionalities that the user needs while generating value.

Table 6: Roles of UX identified in the extracted papers.

Role	Paper
Assist in user-centered product design	S9, S10, S13
Enable users to understand and gain value already from the first product versions	S6, S14
Discover the public's opinion about what they thought of the developed product	S1, S11
Identify user priorities and problems in software development in the early product phase	S2
Identify different users to propose context-specific experiences	S3
Enable a good user experience while using the application	S4
Research to assist in customer discovery	S5
Assist in identifying user needs, gathering feedback, and designing the product	S7
Assist in conducting research and product user-centered design	S8
Assist the startup to develop as quickly as possible and with minimal resources a product that meets the customer's needs	S12

Table 7: Points identified in the papers where UX, products, and services are linked in developing customer value.

ID	Points of value generation
S1	Use UX to investigate public opinion about the product, obtaining data on product attractiveness, efficiency, insight, dependability, stimulability, and novelty
S2	Validate the product by involving the development team and users, obtaining artifacts that drive prototyping and development
S3	Focusing on UX creates a better product proposition, creating new opportunities for designers and developers to create more diverse experiences for different contexts and users
S4	Use design thinking in planning to have reasonable satisfaction and experience while using the application
S5	Select well-defined research methods, conduct customer research, establish validity, and consider ethnic aspects to create value for the customer
S6	Create products that are attractive (visual, human, novel, and hooking), accessible (intuitive, easy, and simple), and professional (credible, functional, and efficient)
S7	Identifying user needs, collecting feedback, and focusing on user-centered design increase the chances of success for startups
S8	The UX practice helps the startup rethink and test its products with the user as the ultimate focus
S9	Ensure that UX planning, design, and customer validation are early in the process and be ready for negative feedback in early user testing
S10	The relevance of the mindset and design thinking techniques adds value because it allows an accurate perception of the users' needs
S11	The startup can develop a product through UX techniques where the user understands the concept, knows how to perform the tasks, and finds it credible and attractive enough
S12	Using the UX approach avoids a long specification and development process that eventually leaves the user unsatisfied; therefore, the work process must be highly efficient and involve the least wasted resources
S13	When companies are oriented toward strategies that put UX at the center of their customer offerings, they can benefit from business value through differentiation, scalability for the mass market, and customer loyalty
S14	Involving the users in the product design and development process helps create value by providing important product improvement feedback

Furthermore, according to S3, UX practices allow designers and developers to create solutions for different contexts and users, which they had not considered creating before. Therefore, by involving the user in building a startup's product, professionals can get a possible view from a perspective that they did not have before. Thus, creating the product's functionalities goes from a simple opinion of the startup's creators to solving problems evidenced by users.

Another point that is important to highlight in this issue is the use of UX to gain value for the product in the early stages. S6 and S14 mentioned this early approach and the design and development team. The authors show that collecting user feedback from the first version of the product is significant since users understand and do not abandon it. In any case, the results of this question show that bringing the user closer during the entire product development process is a benefit of investing in UX that allows for generating value for the customer.

Regarding value generation, we verified that UX provides defined practices, methods, processes, and approaches to create customer value; this will depend on what role UX is playing in the startup. For example, UX methods can be used with customers to give feedback on the product proposal, highlight their needs, and approve or disapprove decisions made by the development team. As a result, those responsible for the product can make decisions that leverage their ideas and direct their product.

Another way of generating value is through UX design practices, where the main focus of development is end-user satisfaction. In this way, the entire prototyping and development process is focused on the user, who can give their opinion and validate or disapprove of the idea in the early stages of the product. Furthermore, providing methods for evaluating the product with the user can generate value for the product. From the results of this evaluation, the startup can align its idea with the users' opinions. Based on our results, it can be inferred that UX, as it is user-focused, has a

high potential to generate value for startups through its practices, whether through validation, design, or product evaluation.

Our results highlighted the need to focus on UX methods and practices directed to startups, that is, that consider the significant emergencies of this type of company, such as lack of time and reduced development team [1]. Thus, besides the UX practice generating value for the product by definition, it would also fit into the uncertain context that startups are inserted, supporting decision-making according to these companies' needs and reducing the risk of misuse of methods and practices.

3.4. Classification Schema. In addition to each research question's answers, data were extracted regarding the classification schema: research types, contribution, focus, and significance. The results for this schema are shown in Table 8.

The most used was the laboratory study, presented in five papers regarding the type of research. Next, the survey and the field study were used by four. Only one paper used the evaluation of experts. The high use of lab and survey studies highlights the recent exploration of UX and startups' intersection. The studies are still initial and are seeking to identify the gaps present. Field studies and expert evaluation, on the other hand, address UX practices that are generally not directed solely at software startups. The authors, in these cases, used consolidated practices to test or create a product in a startup and reported their experiences through scientific publications.

Concerning the type of contribution, nine papers provided UX methods; five papers mentioned approaches; three papers showed questionnaires; one paper provided a framework; and one paper reported an instrument. The high use of methods is also evidenced by UX methods already consolidated in the literature, such as usability testing, personas, and journey maps. We also highlight that the only framework returned was MVUX, in S6, one of the only ones directed to startups.

Regarding the focus of UX practice, the highest return was directed to design, presented in ten papers. Six papers returned validation practices, and evaluation methods appeared in four papers. Finally, a large part of the practices had partial significance, as they only focused on UX in general, without considering the context of startups. Only two papers returned practices of total significance, that is, focus on both UX and startups, which was the case of MVUX (S6) and Lean UX (S12). Besides, the row of "marginal" papers is not in Table 8 because no papers were classified in this category.

3.5. Quality Assessment Results. Questions 1 to 8, shown in Section Quality Assessment, are related to rigor, and questions 9 to 11 are related to relevance. Each "yes" answer has a value of 1, and each "no" answer has a value of 0. Thus, the maximum value for the rigor criterion is 8, and the maximum value for the relevance criterion is 3. Figure 4 illustrates the results found.

Note that most papers ($N = 11$) are located on the right side of the graph, which denotes the high rigor of the studies developed. Nine papers are in the upper part regarding relevance, which denotes the studies' good relevance. However, it is possible to observe some papers with low rigor ($N = 3$) or low relevance ($N = 5$). This result illustrates a balance of studies concerning their contributions. Finally, it is worth noting that the papers that obtained total significance reached 6 of rigor and 2 of relevance (S6) and 4 of rigor and 2 of relevance (S12). This result demonstrates the need to continue investigating UX practices for startups, submitting them to empirical studies toward consolidation in the literature.

Importantly, we did not exclude papers with low rigor or relevance because, according to Petersen et al. [16], quality assessment should not impose too many requirements on the selected studies since mapping aims to provide an overview of the topic.

3.6. Threats to Validity. This section aims to perform a discussion about the search process performed during the work, as well as data validation and research validity, evaluated according to the criteria and defined by Ampatzoglou et al. [50]. In addition, the description of the threats to feasibility is essential to cover the entire project construction cycle.

One of the threats is related to the search string, which may have inconsistencies during the execution of search engines, although it was minimized by using the PIO criterion. Another action taken to mitigate this threat was using and comparing search strings used in other SMS or systematic literature reviews involving startups or UX. One limitation of our search string is related to the use of only the terms "UX or user experience" without using related terms such as "usability" or "user-centered design." We decided only to use "UX or user experience" to mitigate interpretation bias when reading the papers since some authors may use similar terms but not mention UX.

Therefore, several calibration tests were performed on the search engines to ensure that the expression formulated returned relevant works for the theme. Besides, the research protocol was forwarded for evaluation by two other researchers with experience in the subject to ensure better adherence to the methodology.

Statistical analysis instruction is one of the most satisfactory methods in designing a project. However, if the extraction data is incorrect, it can lead to inconsistency between the result and expected results. In this respect, incorrect classification of papers may have occurred. We conducted an SMS that studied a subject related to several science areas. Since we analyzed a large volume of publications and, in some cases, studied specific contexts to analyze their viability with the SMS's inclusion criteria, there may be failures of interpretation concerning UX in some contexts of startups. Furthermore, to mitigate a possible bias in data interpretation, we used the terms provided by the authors of the extracted papers when naming the UX practices used (usability testing and prototyping, among others).

Table 8: Results obtained for the paper classification schema.

		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14
Research type	Lab study		✓	✓	✓				✓		✓				
	Field study					✓				✓		✓	✓		
	Survey	✓					✓	✓						✓	
	Expert evaluation														✓
Contribution	Questionnaire	✓			✓							✓			
	Approach		✓		✓					✓	✓		✓		
	Method			✓	✓	✓		✓		✓		✓	✓	✓	✓
	Framework						✓								
	Instrument								✓						
Focus	Validation		✓	✓	✓	✓		✓	✓						
	Design		✓		✓		✓	✓		✓	✓	✓	✓	✓	✓
	Evaluation	✓			✓							✓	✓		
Significance	Total						✓						✓		
	Partial	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓

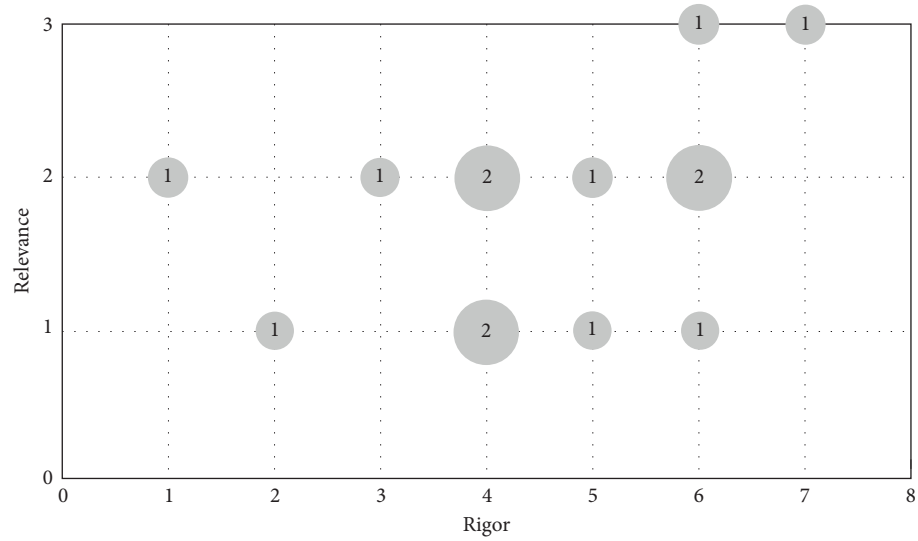

Figure 4: Assessment of papers quality based on rigor and relevance.

The comprehensiveness of the studies may have created some information generalization during the reading of the first phase of data extraction. However, this fact is less reckless since one of the researchers made an additional reading of the data and resolved all the discrepancies with the other researchers.

Besides, a limitation of our study is related to exclusion criterion 6 (EC6 – obsolete publications) since we selected only publications from 2011 onward. This decision was made in conjunction with the authors, aiming to find answers to our research questions that have been used more recently in the literature. However, we point out that there is a possibility that publications involving UX and software startups published before 2011 may have been excluded.

4. Conclusions

UX for startups is presented as a service fundamental to building an excellent final product. By definition, UX is user-focused and contributes to customer value for all companies. However, for startups, it is still necessary to have practices adjusted to the uncertain context in which this type of company operates.

The execution process of this SMS returned in the initial searches of 718 papers and ended with 14 accepted papers, which produced results relevant to the research questions. It was concluded that the UX field is in a heterogeneous context in methods, practices, and tools. However, due to the emergent character that startups are inserted into, there is no exploration for the construction of tools specific to their context.

In summary, the significant gap was the lack of practices for creating UX specific to the uncertain context in which a startup operates. Furthermore, this gap extends to UX's three focuses: validation, design, and evaluation. Thus, it is necessary to investigate further what startups understand UX and how they practice this concept within the company: (i) are the practices that startups use the same as the ones identified in this SMS? (ii) Are there any practices that are specific to startups? (iii) What does the top management of

startups understand by UX? What is the company's investment in UX? (iv) How is the startup's UX process from the UX team's point of view? Does the result corroborate or disagree with the top management's point of view?

In future works, we hope to investigate the work for UX generation in startups more deeply through surveys and interviews with UX designers, UX researchers, and top management of these companies. In the long term, the goal is for startups to have UX practices specific to their context, helping create value for the client and supporting decision-making choices.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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