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Research Article

The Critical Role of Product Managers and Their Responsibilities in Software Startups: A Systematic Literature Review

Frederic Pattyn[*] [ID]

Department of Business Informatics and Operations Management, Ghent University, Ghent, Belgium

Abstract

In the high-paced, uncertain, and resource-constrained environment of software startups, achieving product–market fit and acquiring initial customers are critical yet challenging tasks. These challenges are often exacerbated by the absence of strategic planning, inefficient requirements selection processes, inadequate resource allocation, and insufficient market research, leading to an alarming 63% failure rate among software startups. The Product Manager (PM), responsible for product strategy, planning, and results monitoring, plays a pivotal role in navigating these complexities; however, the PM role is often undervalued and lacks a universally accepted definition. This study aims to enhance the understanding of the PM's role within software startups by conducting a comprehensive Systematic Literature Review (SLR). Employing a rigorous selection methodology, we reviewed 134 studies and identified 662 distinct PM tasks across 122 activities. Notably, only 7 studies (5.73%) specifically addressed the software startup context, revealing a substantial gap in the literature. Our findings indicate that while product planning and requirements prioritization are dominant topics, many critical activities remain underrepresented, underscoring the need for targeted research in these areas. By addressing the unique challenges faced by software startups, we pave the way for more targeted and effective PM strategies. Future research should consider adopting mixed-method approaches to deepen the understanding of PM practices and investigate underexplored areas such as go-to-market strategies, roadmap creation, and requirements selection within the startup context.

Keywords

Product Management, Startups, Requirements Engineering, Product Manager

1. Introduction

Software startups often face a high-paced, uncertain, and resource-constrained context [1], which can lead to premature scaling and an increased risk of business failure because of cash flow challenges. They jump headlong into their early product decision-making tasks, without knowing which ones will generate the value for their early stage venture. Which means that many of them have no strategic plan for product development [2], with an inefficient requirements selection process [3], with critical resource allocation [4], without enough prior market research, business case analysis [5], or allocating too many resources to solutions that do not serve any market need [6]. It may result in a failure to achieve

product-market fit [7], and difficulty acquiring their first paying customers [1], negatively impacting the startup's runway and likelihood of success. Therefore, improving the early product [8] decision-decision making processes could have significant implications [9] for the future performance [10, 11], and probability of success of these ventures.

Despite the importance of the PM role, a universally accepted definition is lacking. The general consensus is that there needs to be an owner of the product [2] responsible for the product strategy, planning, and monitoring results [12]. Colloquially, this role is frequently referred to as the PM.

In order to enhance the understanding and implementation of product management processes, specifically the allocation of product manager resources, and thereby improve the likelihood of success for software startups, the development of a unique and academically rigorous framework is imperative. The framework will serve as the foundation for refining product management practices within the context of software startups. To achieve it, an extensive and systematic literature review [3] will be conducted to comprehensively explore all relevant activities pertaining to the role of product managers. The resulting framework will be referred to as the "Pragmatic Framework for Product Managers" (PFPM) [13]. The framework will then be subjected to further refinement taking into account the software startup context.

The PFPM holds substantial value for individuals occupying product management roles, particularly within startup environments [14]. Moreover, the findings of the presented research can potentially contribute to future research in the domains of requirements engineering (RE), software product management (SPM), and startup studies. The ultimate objective is giving guidance to product managers and founders holding the duo role to significantly inform them on what specific activities to focus on, and therefore consequently indirectly enhancing the survival prospects of startups [15] and potentially improve their valuation outcomes [16] by minimizing costly early decisions through the adoption of contextually appropriate product management practices.

2. Related Work

In the last forty years, the role of the Product Manager (PM) has emerged as a driving crucial factor of company success (Table 1). Consequently, applying proper product management processes have shown to improve resource management efficiency [17], to lead to increased business growth [18, 19], better budget control [20, 21], higher user satisfaction [18, 22], increased release predictability [18], less delays [24, 25] and faster release cycles [21, 23, 26]. All of these values are positively associated with startup success [12].

Table 1. Success of proper product management processes.

Reference	Positive impact
Höst, Regnell [17]	18% improvement in resource management efficiency of the engineering process.
Ebert [19, 20]	There's an cost efficiency gain to be noted of 20%.
Souder, Buisson [21]	New products sales meet or exceed our expectations in 86% of the times.
Cooper and Kleinschmidt [22]	77% success rate when introducing new products. 67% of a firm's sales are generated by new products.
Ebert [23]	There are 20% less delays when a new product needs to get released.
Maglyas, Nikula [24]	The release cycle times improve by 36%, as well does the quality of the releases.

In order to move towards creating an early-stage venture friendly framework, one needs to understand the full scope of the domain, and that's where the presented SLR sets itself apart from the other SLR studies in its domain. Specifically, Hujainah, Bakar [10], Ma [25] both emphasize the selection variables and methods employed within requirements engineering (RE) while not addressing the role of the PM, nor the startup context. On the other hand, Gupta, Fernandez-Crehuet [31] demonstrates a strong focus on the startup context, yet it remains descriptive and does not link back to the perspective of practitioners, who are predominantly PMs. The next step is building on this research towards the described goal.

Research Methodology
Research Questions
The objective of the study is first getting a bird's eye view on the applicable research field through some formulated research questions. These can be found in Table 2. The next step is doing a systematic literature review (SLR) to comprehensively gather and synthesize as much as possible of relevant, existing trace evidence in the academic literature pertaining to activities associated with the role of the PM. Particular emphasis is placed on the body of research that addresses the software startup domain, aiming to complement the currently available non-academic frameworks with more flexible and adaptable approaches. To fulfill this objective, a

set of research questions (RQs) is formulated and presented in Table 2.

Table 2. Research Questions for SLR.

N°	Research questions	Rationale
RQ1	*What are the characteristics of software startups?*	*The influence of this research question is of paramount importance for assessing the features of software startups and the factors that contribute to success and relevant strategies for investors, businessmen, and authorities. It also seeks to augment the existing knowledge on the relations within the up and growing software industry.*
RQ2	What are the specific tasks commonly associated with the responsibilities of a product manager, and how can we demonstrate the distribution of them across publications?	It is crucial to emphasize that numerous tasks, grouped to activities, are aimed directly at the responsibilities of a product manager and defining their role in developing and providing products. Providing an example of how these activities are distributed in publications will show patterns, the best practices, and focal areas indicated by the literature to future study and application.
RQ3	Which studies of the literature consider the context of software startups?	This specific research question seeks to establish major studies in relation to software startups in order to understand the nature of challenges and strategies in this typology. Knowledge of this context is critical for academic work and application in the startup environment.
RQ4	What tasks are important for product managers in software startups?	Knowledge of the main responsibilities of PMs in software startups is important to define their role in product creation and development. The present research contributes to the development of these guidelines and assists in training and staffing in the industry.

RQ1: What are the characteristics of software startups?

Researching the characteristics of software startups involves exploring their common traits, challenges, and strategies for success. Identifying the key characteristics of software startups can help managers avoid failure and steer their startup towards success. Previous literature on the characteristics of software startup can guide managers in understanding these characteristics, ultimately leading to the success of their software startup.

RQ2: What are the specific activities commonly associated with the responsibilities of a product manager, and how can we demonstrate the distribution of these identified activities across publications?

Understanding the specific activities associated with the role of product managers is essential for defining their responsibilities and contributions within organizations. By identifying these activities, the SLR can inform not only the creation of the envisioned framework, but also hiring practices, training programs, and organizational structures, ultimately improving the efficiency and effectiveness of product management processes. Given the results of the sub questions, the first main question should be answered.

Analyzing the frequency distribution of identified activities across publications helps determine the relative emphasis and importance assigned to different aspects of product management. By quantifying the prevalence of specific activities, the SLR can identify the dominant themes and areas of focus within the literature. The information is valuable for researchers, practitioners, and educators seeking to prioritize and allocate resources effectively in product management

endeavors. The input could in future research be contrasted against what practitioner's would emphasize as important, which in its own right would again be an interesting basis for future studies.

RQ3: Which studies of the literature consider the context of software startups?

Investigating studies that consider the software startup context within the broader literature on product manager activities provides valuable insights into this specific niche. By identifying studies that address the unique challenges and requirements of software startups, the SLR can offer specialized knowledge and recommendations tailored to these contexts. The subset analysis contributes to bridging the gap between general product management practices and the specific needs of startups.

RQ4: What tasks are important for product managers in software startups?

Identifying the activities that are particularly relevant to the product manager role within the software startup context allows for a focused understanding of the key responsibilities and challenges faced by product managers in this setting from an academic point of view. By elucidating these activities, the SLR can provide insights into the unique demands and considerations associated with product management in the fast-paced, resource-constrained environments of software startups. This knowledge assists practitioners and researchers in developing tailored strategies and best practices, and inform possible future research allowing for the practitioner's point of view.

Undertaking a systematic review takes considerably more

effort than a conventional literature review. One of the main differences is the design of the review protocol [26]. A review protocol outlines the methods that are planned for use in conducting a specific systematic review. This documentation of the search strategies and methodologic processes add substantially to the rigor and completeness of the research, consequently reducing the possibility of researcher bias [26]. Our review protocol methodology illustrated by Figure 1.

When it comes to the first step of planning, identifying the necessity for a SLR, defining the research questions and their value have already been discussed.

Design of Search Strings

The final goal of both defined search strategies is compiling a master list of studies that will be considered to be part of the systematic literature review. The unfiltered search results should be saved and retained for possible reanalysis. The top papers of the first strategy will be used as input for the second strategy.

For the systematic literature review, only relevant studies will be considered (journal papers and conference proceed-

ings). It means that publications from grey literatures, books, research registers, internet (blog posts, website …) and professional journals get excluded.

To comprehensively search for related studies, our search strategy began with an online search of digital libraries. Studies that are related to the review were extracted from seven main electronic database resources, namely, Google Scholar, IEEE Xplore, ScienceDirect and Springer. These digital libraries and databases are relevant resources for conducting a SLR [27].

(1) Search Strategy 1: Based On Specific Search Terms

Research studies will be found through the use of specific terms and abbreviations (Table 3). The terms that will be used to limit the domain of interest are: "software startups", "software start-ups", "tech startups", "characteristics", "traits ", "features", "attributes, "product manager", "responsibilities", "tasks", "activities", "literature", "studies", "publications", "context", "case studies", "literature review", "systematic review", "product management", "key tasks", "imp", "tant tasks", "essential tasks", "responsibilities".

Table 3. Search strings.

("software startups" OR "software start-ups" OR "tech startups") AND (characteristics OR traits OR features OR attributes)
("product manager" OR "product management") AND ("software startups" OR "tech startups") AND (responsibilities OR tasks OR activities) AND (literature OR studies OR publications)
("software startups" OR "tech startups") AND (context OR case studies OR literature review OR systematic review)
("product manager" OR "product management") AND ("software startups" OR "tech startups") AND (key tasks OR important tasks OR essential tasks OR responsibilities)

(2) Search Strategy 2: Reference Based

Once the full research protocol has been executed for search strategy 1, the referenced papers [28] of the 5 papers having the highest combined (inclusion + quality + exclusion values) score are ones that form the input for the search strategy. When there's an equal score, the number of citations (highest wins) get used as a tiebreaker. One of these must be the highest scoring systematic literature review, unless its score is below 10 out of the possible 15.

(3) Define Inclusion And Exclusion Criteria

Required to limit the research domain because there's al-

ready written a lot on the topic [29]; it is advisable to limit and structure the presentation. The following inclusion criteria (Table 4) are considered to validate the research studies against that are currently in the master list.

Hujainah, Bakar [10] opted to only include papers that reach a score of 50% - our benchmark before a pilot study will be the same. It means setting the bar at a score of 1.5 out of 3.

When it comes to the exclusion criteria, opted not to include the language of the primary study [26], and selects the criteria represented in Table 5.

Table 4. Inclusion criteria.

	Inclusion criteria	Link with RQ	1	0,5	0
1	Reporting on expected value.	RQ1	Explicitly	Superficially	Not mentioned
2	Reports on the activities (processes).	RQ2	In-depth	Superficially	Not mentioned
3	Addressing involved roles and titles	RQ2	Product manager ex-	Involved roles and	Not mentioned

Inclusion criteria	Link with RQ	1	0,5	0
within the domain.		plicitly mentioned	titles are mentioned.	

***Table 5.** Exclusion criteria.*

|	Exclusion criteria	1	0,5	0
1	Year of publication before 1983	>= 1983	N/A	Before 1983
2	There is no PDF file available	PDF available	N/A	No PDF found

When it comes to the exclusion criteria; when the sum is less than 2, the paper gets excluded.

Define quality assessment criteria

An initial difficulty is that there's no agreed definition of "quality". Overall quality relates to the extent to which the study minimizes bias and maximizes internal and external validity. The main goal is to increase the confidence level that the study is actually relevant and methodologically solid. In order to make sure that the outcome of the study makes it possible to guide future research recommendations. Only the papers that have survived the previous hurdle (the inclusion and exclusion criteria) are in scope to have their quality assessed.

In software engineering, usually all levels of evidence get accepted. The only threshold that might be viable would be to exclude level 5 evidence when there's a reasonable number of primary studies at a great level [26]. Because the used primary sources that are taken into account are academic publications and not books or magazines, the requirement is considered automatically fulfilled in most cases, and therefore will not consider it a separate criteria. Table 6 gives an overview of the final QAC that are going to be used.
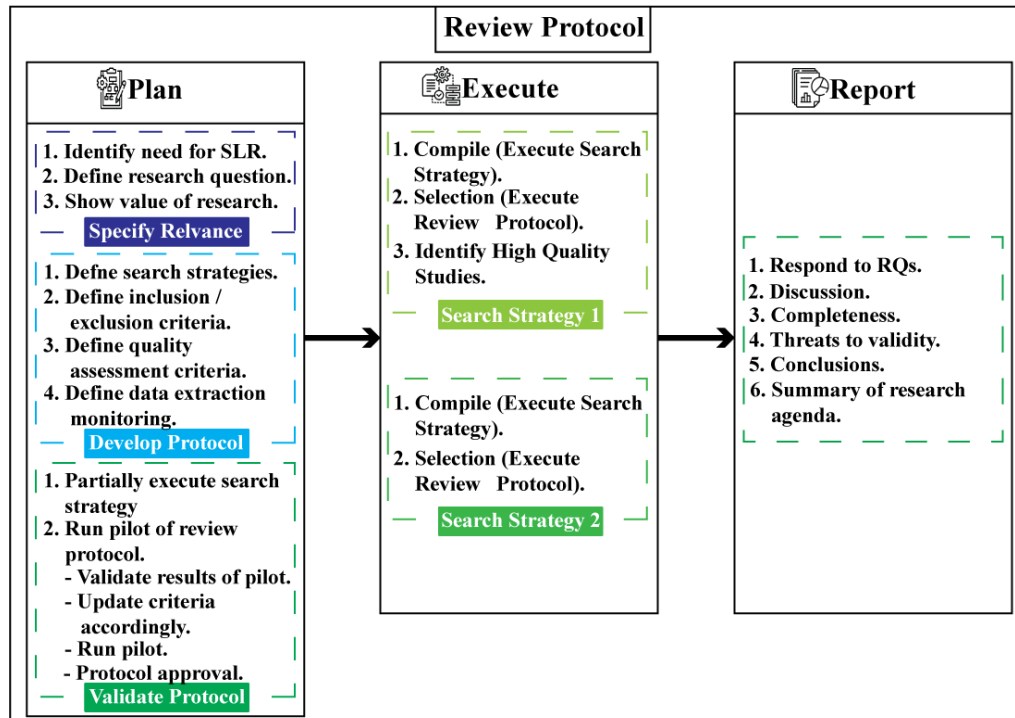
***Figure 1.** Overview of review protocol.*

QAC1: Citations

According to Scott [30] regardless the year of the publication, having over 100 citations can be considered impactful, while having fewer than five makes the paper part of the lower half. This is also a tactic used by Krishnan and Ulrich [28]. The number of citations is based on Google scholar, or

Research Gate depending on availability of the data.

QAC2: References

Ucar, López-Fernandino [31] sees an increase in the number of references in academic papers, with median of 25 references per engineering journal papers in 2013.

QAC3: Proposed methodology

To insure that the quality of the paper meets scientific rigor, it's a must to include a criteria that evaluates the used methodology (technique or solution) of the study [10].

QAC4: Reference data

Besides purely the methodology, it's relevant to check whether or not the results could be of any value based on the amount of underlying data [10]. Having done a preliminary literature study within the field of Requirements Engineering, and it's remarkable to observe that most of the papers are done based on limited case studies.

Most papers within the field of research cover each time only a limited number of case studies [32]. According to Rodriguez, Urquhart [33] it's because of the often confiden-

tiality issues regarding the sensitive topic, also one of the validity threats mentioned by Barney, Aurum [9] with his paper having below 5 case studies; due to the too low number of use cases, the results have a low statistical power. For those papers that opt for the use of case studies, the total number of used case studies (companies) is most frequently rather few; below 5 [33, 34]. According to Klotins [35] it highlights the difficulty of getting in-depth access to live startups. There are a couple to be found between 5 and 10 [36-40]. There are only a handful of papers that go over 10, never reaching 20 [23, 49, 50]. A low number of case studies in papers should be considered a validity threat according to Barney, Aurum [9].

QAC5: Stated result

When the methodology and the research data are at par, the final element regarding to study structure that deserves some additional scrutiny is how clearly the study results are stated [9, 51].

Table 6. Quality assessment criteria.

	Quality assessment criteria	2	1	0
QAC1	Citations	Citations >= 100 (top 2%)	C between 100 AND 5	C < 5 (lower 50%)
QAC2	Number of references	#ref >= 25	#ref between 25 AND 10	#ref < 10
QAC3	Is the proposed methodology (technique/solution) clearly explained?	Yes	Moderate	No
QAC4	Is the evaluation of proposed technique performed on adequate case studies, subjects or project data sets?	Subjects >10	Subjects between 10 and 4	Subjects <4
QAC5	Is the result of the study clearly stated?	Yes	Moderate	No

Although it's not a commonly supported practice to use basic arithmetic to decide whether or not the quality of a paper is good enough, it does get done somethings Hujainah, Bakar [10], Achimugu, Selamat [41]. So here the maximum score that's possible is 5 times 2, making 10. Papers scoring below 5 get excluded from the study.

Define Data Extraction Monitoring

To reduce the opportunity for bias, data extraction forms

should be defined. The design of the Data Extraction Forms (DEF) depends on the data that's required or interesting to provide an answer to the research questions [42] (Table 7). The data could be numerical (important for any attempt to summarize the results of a set of primary studies), descriptive (context, population, sample size, outcomes …) or meta (journal, year, domain, author, country…) data.

Table 7. Data extraction monitoring.

Data extraction field	Link with RQs	Link with criteria
Reporting on expected value (Y/N/null)		
Result (description)	RQ1	Inclusion
Result (summary)		

Data extraction field	Link with RQs	Link with criteria
Reference id to paper		
Year of publication		Exclusion
Source of publication	RQ1	
References		QAC
Citations		
Roles (PM)	RQ1, RQ2	Inclusion
Tasks (Y/N/null)		
Name (description)	RQ2, RQ4	Inclusion
Linked to role (explicitly or not)		
Reference id to paper		
Type (hardware/software)		
Startup context (Y/context/N)	RQ3	Exclusion
Exclusion reason (No PDF, book …)		

Validate Review Protocol

a) Partially execute search strategy 1

In order to make it possible to run the pilot to validate the review protocol, search strategy 1 gets initiated, up to having identified the first one hundred studies.

b) Run pilot of review protocol

Once the first one hundred studies as a result of search strategy 1 are collected, a pilot study gets performed to see the impact of the selected inclusion, exclusion and quality assessment criteria. When these are calibrated, it doesn't need to be revisited in relation to the search strategy 2.

When the pilot results in a minimum acceptance rate of 11%, the criteria are approved as long as there are more than 1.000 studies considered, otherwise, when below 500, the required acceptance rate needs to revised upwards to 25% to move forward [9, 20, 36, 51]. Table 8 shows the results of the pilot study [42].

Table 8. Results of pilot.

Process	Studies remaining	Conclusion
Select 100 studies	Total = 100	
In correct format	'- 9 studies = 91	
Deduplication	'- 6 studies = 85	
Inclusion criteria	27/85 = 27	31,76% acceptance rate
Exclusion criteria	27/27 = 27	
QAC	26/27 = 26	96,29% acceptance rate
Qualification rate	26/100	26% qualification rate

The results of the pilot are positive, and therefore no changes or updates to the protocol are required. Consequently it got reviewed and approved [32, 52], and can be applied to all the identified studies uncovered via one of the search strategies.

Execute Search Strategies

Figure 2 shows that both search strategies combined have resulted in a total of 1.087 papers, of which 134 have survived the review protocol. Which gives a positive acceptance rate of 12,33%. Considering that the median number of qual-

ified papers is 57 in SLRs published in top-tier Software Engineering (SE) journals [43], can be considered a solid foundation to inform on the posed research questions.

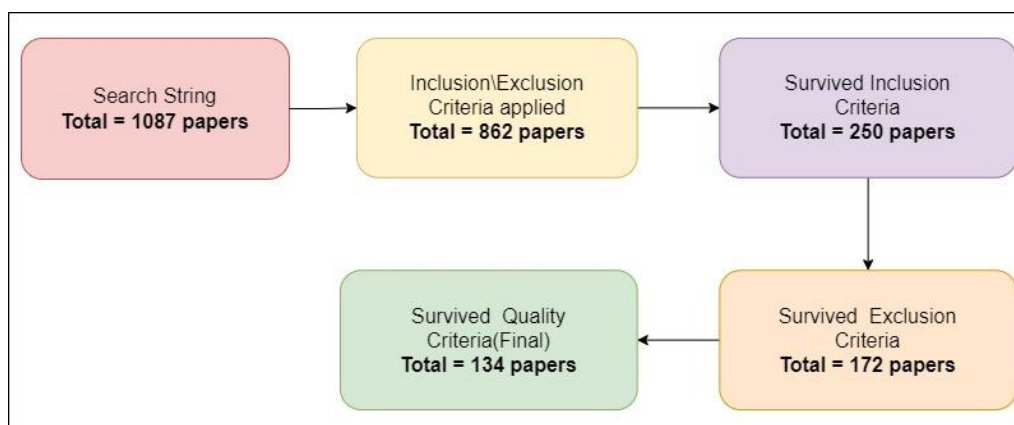*Figure 2. Protocol result across both search strategies.*

Figure 3 shows the results of search strategy 1, while figure 4 shows the results of search strategy 2. Table 9 provides the overview of the 3 high-quality papers that have been retained from search strategy 1, as input for search strategy 2.
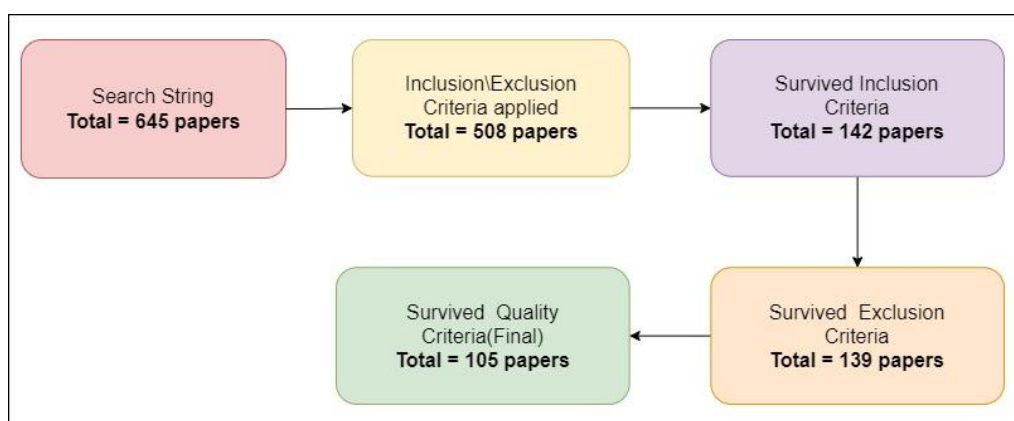

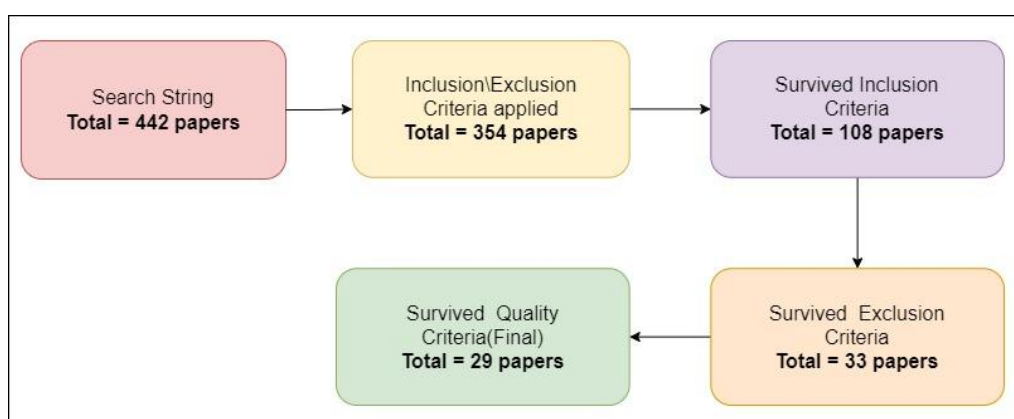
Figure 3. Protocol result search strategy 1.

Figure 4. Protocol result search strategy 2.

***Table 9.*** *Foundational papers for search strategy 2.*

Ref.	Title
[19]	The impacts of software product management
[18]	A model of requirements engineering in software startups
[10]	Software requirements prioritisation: a systematic literature review on significance, stakeholders, techniques and challenges

3. Results

A. RQ1: What are the Characteristics of Software Startups?

Recent literature highlights the pivotal role of agile methodologies and lean operations in software startups, fostering rapid development and resource optimization. Customer-centric innovation and adaptability drive success, aiming for scalability and industry disruption with innovative solutions. External funding, notably venture capital, fuels growth, while speed and agility enable quick adaptation to market shifts and customer needs. These traits emphasize the dynamic, competitive landscape, emphasizing innovation and efficient operations for success in the technology sector. Table 10 and Figure 5 shows the characteristics from collated studies, where it's two thirds are journal publications.
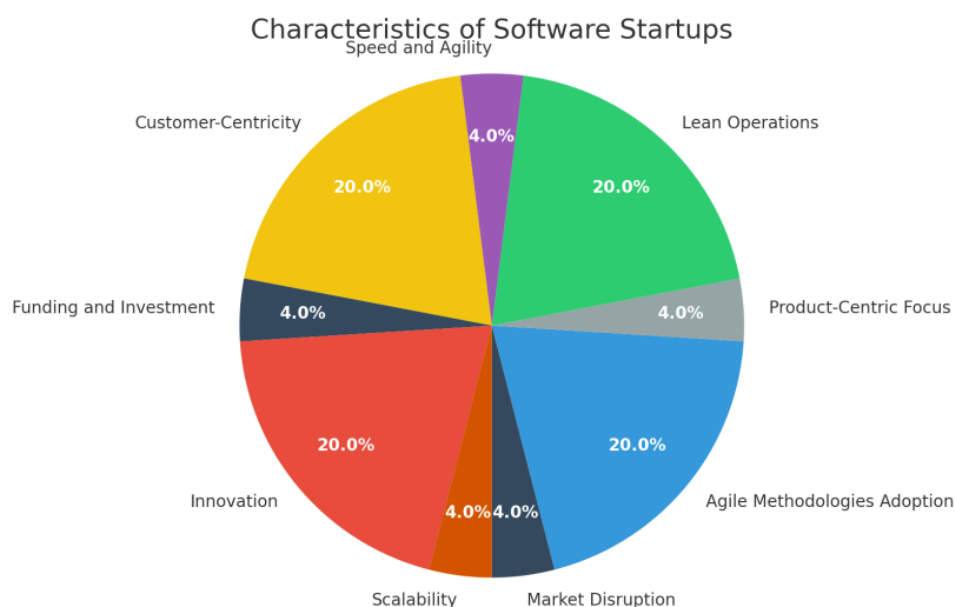
Figure 5. *Characteristics of software startups.*

Table 10. *Characteristics of software startups from previous literature.*

Characteristics	%	Ref	Description
Agile Methodologies Adoption	6.1%	[44, 45]	Many software startups adopt agile methodologies to facilitate rapid development and iteration cycles
Lean Operations	6.3%	[46, 47]	Software startups often prioritize lean principles to optimize resource allocation and maximize value delivery
Customer-Centricity	6.2%	[48, 49]	Understanding and meeting customer needs are fundamental to the success of software startups
Innovation	6.1%	[50, 51]	Software startups thrive on innovation, constantly seeking to

Characteristics	%	Ref	Description
			develop new technologies and features
Scalability	1.3%	[52]	Successful software startups aspire to achieve scalability, efficiently growing their customer base and operations
Market Disruption	1.2%	[1]	Software startups often seek to disrupt established industries through innovative technology solutions
Funding and Investment	1.2%	[53]	External funding sources, such as venture capital, are crucial for the growth and scale of software startups
Speed and Agility	1.2%	[54]	Startups operate in fast-paced environments, aiming to quickly bring products to market and iterate based on feedback
Product-Centric Focus	1.2%	[55]	The core of many software startups is their product or technology, which they prioritize in development and innovation

B. RQ2: What are the specific activities commonly associated with the responsibilities of a product manager, and how can we demonstrate the distribution of these identified activities across publications?

During the analysis 662 unique tasks got identified, many of them similar to one another, which means that they needed to be cleaned up in order to increase the usability and transparency. A basic topical analysis was applied, yielding 122 activities (Table 11). ChatGPT 4.0 was used to improve consistency and inter-validity [56], re-analyzing and generating 850 new pairs with the original tasks and newly assigned activities. To increase further output confidence, the following steps got executed: (1) leave pairs empty if than 40% certain, (2) consider a software product management and requirements engineering context and (3) updates got requested every 100 pairs. The prompt used (29/04/2023): "Consider all combinations that you've validated so far, if you take them all into account, are there any combinations of which you would like to change the output value of the third column to further improve internal consistency and validity? If so, also provide the reason why in the fourth column." All 17 found inconsistencies found by ChatGPT got approved.

Table 11. ChatGPT inconsistency validations.

Type of inconsistency	#
Inconsistency found by ChatGPT (approved)	17
Typo found by ChatGPT	32
Total	49

Table 12 presents a comprehensive list of 122 identified activities along with their corresponding relative frequencies in and references to the qualified papers. Notably, the activity garnering the most significant attention is product planning (including releases), accounting for 7.51% of the discussions. However, the most intriguing observation arises from the fact that more than half of the activities (69 out of 122) are referenced merely up to two times, indicating considerable untapped potential for further and in-depth scholarly exploration. The finding underscores the existence of various unexplored avenues within the field of product management, presenting exciting opportunities for future research endeavors to delve into and elucidate these lesser-explored aspects.

Table 12. Distribution of identified activities across publications.

Activities	%	References	Description
Product planning (incl. releases)	7,51%	[57, 19, 8, 58, 59, 60, 9, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 24, 73, 74, 75, 76, 77, 78, 79]	Product planning encompasses the strategic scheduling of product development and releases to align with market demands and achieve business objectives.
Requireme [19] nts prioritization	4,11%	[19, 80, 17, 81, 18, 59, 10, 60, 82, 9, 83, 62, 61, 64, 84, 85, 67,	Requirements prioritization entails ranking project requirements by importance and impact to guide resource allocation and project planning decisions.

Activities	%	References	Description
		68, 72, 74, 75, 76, 86, 87, 88, 89]	
Requirements selection	3,87%	[57, 19, 80, 90, 91, 17, 92, 9, 93, 94, 61, 64, 95, 67, 68, 69, 70, 96, 74, 76, 79, 90]	Requirements selection entails the deliberate choice of feature requirements from a set of identified needs, considering their relevance, feasibility, and alignment with project objectives.
Market research	3,64%	[61, 64, 67, 68, 72, 24, 97, 98, 99, 77, 100]	Market research entails collecting, analyzing, and interpreting data about target markets and consumers to guide business decisions and strategies.
Create roadmap	3,52%	[57, 8, 81, 101, 20, 62, 61, 63, 64, 102, 66, 68, 24, 73, 74, 98, 76, 86, 103]	Creating a roadmap involves outlining a strategic plan or vision to guide the development and implementation of a project or product over time.
Requirements gathering	3,40%	[19, 104, 60, 9, 94, 20, 61, 105, 64, 84, 106, 67, 71, 72, 24, 98, 76, 86, 103]	Requirements gathering involves collecting and documenting the needs and expectations of stakeholders to inform the development of a product or project.
Product lifecycle management	3,40%	[19, 60, 93, 101, 20, 62, 61, 64, 65, 67, 68, 107, 72, 97, 98, 103, 99, 77]	Product lifecycle management involves overseeing the entire lifespan of a product, from its initial conception and design through development, distribution, and eventual retirement or disposal, to maximize efficiency and profitability.
Portfolio management	3,05%	[57, 19, 70, 93, 20, 62, 61, 63, 64, 66, 67, 68, 72, 74, 97, 98, 77]	Portfolio management involves strategically managing a collection of projects, investments, or assets to achieve organizational objectives and optimize resource allocation while minimizing risks and maximizing returns.
Manage software development	2,82%	[60, 93, 62, 68, 72, 24, 97, 99, 77, 100]	Managing software development involves overseeing the planning, execution, and delivery of software projects while ensuring alignment with business goals and stakeholder requirements.
Product strategy & vision	2,46%	[19, 58, 60, 9, 94, 62, 65, 68, 71, 72, 24, 76, 86]	Product strategy and vision involve setting long-term goals and direction for a product to guide its development and market positioning.
Sales execution	2,35%	[93, 71, 72, 24, 76, 99, 77]	Sales execution involves implementing strategies and tactics to effectively convert leads into customers and drive revenue generation.
Product ideation	2,11%	[58, 19, 62, 108, 71, 72, 21, 73, 97, 76, 100]	Product ideation involves generating, brainstorming, and conceptualizing ideas for new products or product enhancements.
Internal stakeholder management	2,00%	[100, 93, 68, 72, 77, 97, 126, 100, 87]	Internal stakeholder management involves effectively communicating and collaborating with individuals or groups within an organization to align interests, address concerns, and achieve product goals.
Monitor & control results	2,00%	[9, 19, 62, 97, 99, 77]	Monitoring and controlling results involve tracking product progress, assessing performance against goals, and implementing corrective actions as needed to ensure product success.
Sales planning	2,00%	[71, 97, 99, 77]	Sales planning involves developing strategies and tactics to achieve sales objectives and targets within a specified period.
Pricing	2,00%	[21, 98, 99, 77, 126]	Pricing involves determining the monetary value of a product or service based on market dynamics, costs, and perceived customer value.
Resource allocation	1,76%	[102, 43, 71, 72, 86]	Resource allocation involves distributing available resources such as finances, personnel, and materials efficiently to meet product or organizational goals.
Marketing planning	1,76%	[97, 99]	Marketing planning involves developing strategies and tactics to achieve marketing objectives and goals within a specified time frame.
Marketing execu-	1,76%	[72, 97, 99, 77, 126]	Marketing execution involves implementing the strategies and tactics outlined

Activities	%	References	Description
tion			in the marketing plan to reach target audiences and achieve marketing objectives.
Project management	1,76%	[105, 72, 97]	Project management involves planning, organizing, and overseeing the execution of tasks and resources to achieve specific project goals within constraints such as time, budget, and scope.
Go to market (GtM)	1,64%	[19, 62, 72, 21, 97, 77]	Developing and executing strategies to introduce products or services to the market effectively.
Financial management (incl. funding)	1,41%	[62, 72, 77, 126]	Managing financial resources and securing funding to support business operations and initiatives.
Requirements elicitation	1,29%	[92, 58, 82, 109, 94, 64, 85, 65, 68, 74]	Gathering and documenting stakeholder needs and expectations for a project or product.
Write user stories	1,29%	[60, 83, 105, 85, 68, 21, 100, 87]	Crafting concise descriptions of desired functionality from the end user's perspective to guide development.
Requirements analysis	1,29%	[92, 68, 70, 72, 98, 76]	Analyzing gathered requirements to understand their scope, complexity, and impact on product objectives.
Stakeholder management	1,17%	[62, 72, 74]	Engaging and collaborating with stakeholders to ensure their needs are addressed and their expectations are managed.
Stakeholder communication	1,06%	[19, 61, 102, 72, 75, 86]	Establishing clear and effective channels of communication with stakeholders to disseminate information and gather feedback.
Product validation	1,06%	[92, 94, 61, 67, 70]	Testing and verifying that a product or service meets the specified requirements and delivers the intended value to customers.
Requirements management	1,06%	[57, 61, 63, 67, 74, 76]	Organizing, documenting, and tracking changes to feature requirements throughout the development lifecycle.
Strategic planning	1,06%	[81, 60, 99]	Setting long-term goals and defining the overarching direction and priorities for the organization.
Tactical planning	0,94%	[68, 72, 126]	Developing detailed plans and actions to implement strategic initiatives and achieve specific objectives.
Business case analysis	0,94%	[61, 97, 99, 100]	Evaluating the potential benefits, costs, and risks of a proposed project or investment to inform decision-making.
Positioning	0,94%	[96, 98]	Defining the unique value proposition of a product or service relative to competitors in the market.
Competitive research	0,94%	[61, 64, 68, 21, 97]	Conducting analysis and gathering intelligence on competitors' products, strategies, and market positioning.
Create business case	0,82%	[9, 62, 98, 76, 103]	Developing a comprehensive justification for a proposed project or investment, outlining its potential value and benefits.
Evaluate new requirements	0,82%	[60, 110]	Assessing the feasibility and impact of newly identified requirements on project scope and objectives.
Risk management	0,82%	[111, 68, 98]	Identifying, assessing, and mitigating potential risks that could impact product success or business objectives.
Resource management	0,70%	[62, 68, 72, 98]	Allocating and optimizing resources such as personnel, budget, and equipment to support project activities.
Innovation management	0,70%	[93, 112, 98, 77]	Fostering a culture of creativity and innovation to generate new ideas and drive continuous improvement.
Partnership management	0,70%	[61, 64, 67, 68, 112, 98]	Cultivating and nurturing relationships with external partners and vendors to leverage their expertise and resources.
Product value	0,70%	[40, 93, 83, 62]	Articulating the unique benefits and value that a product or service offers to its

Activities	%	References	Description
proposition			target market.
Quality assurance	0,70%	[85, 99, 87]	Implementing processes and procedures to ensure that products or services meet defined quality standards and customer expectations.
Budget management	0,70%	[77, 94]	Planning, tracking, and controlling financial resources to ensure projects are completed within budget constraints.
Distribution management	0,59%	[99, 77, 78]	Managing the logistics and operations involved in delivering products or services to customers efficiently and cost-effectively.
Cost estimation	0,59%	[72, 74, 98]	Estimating the expenses associated with development activities, resources, and deliverables to develop accurate budgets and forecasts.
Environmental scanning	0,59%	[61]	Monitoring and analyzing external factors and trends that could impact the business or industry.
Advertising execution	0,59%	[99]	Implementing advertising campaigns and initiatives to promote products or services and reach target audiences effectively.
Packaging	0,59%	[99, 77]	Designing and creating packaging solutions that protect, preserve, and present products attractively to consumers.
Scope change management	0,59%	[18, 61, 64, 67, 72]	Scope change management involves controlling changes to the scope to ensure that objectives are met while minimizing disruptions and maintaining stakeholder satisfaction.
Release management	0,59%	[60, 20, 62, 103]	Release management involves planning, coordinating, and overseeing the deployment of software releases to ensure smooth and efficient delivery of new features or updates to end users.
Communicate with development	0,47%	[85, 72, 87]	Communication with development involves facilitating clear and effective dialogue between stakeholders and development teams to ensure alignment and understanding of feature requirements and objectives.
External stakeholder management	0,47%	[72, 126]	External stakeholder management involves building and maintaining relationships with individuals or groups outside of the organization to ensure their needs, expectations, and concerns are addressed effectively.
Lead	0,47%	[20, 72]	Lead involves guiding and directing a team or organization towards achieving its goals and objectives.
Product marketing	0,47%	[93, 68]	Product marketing involves promoting and positioning products in the market to attract customers and drive sales.
Strategic management	0,47%	[68, 70, 72]	Strategic management involves setting goals, formulating strategies, and making decisions to steer an organization toward its objectives and long-term success.
Marketing strategy	0,47%	[99, 77]	Marketing strategy entails developing a plan of action to achieve marketing objectives and goals, aligning with broader business objectives.
Evaluate business case	0,35%	[20]	Evaluating a business case involves assessing the viability, potential return on investment, and alignment with strategic objectives of a proposed project or initiative.
Value chain management	0,35%	[93, 20, 62]	Value chain management involves optimizing the process of activities within a company to maximize value creation and minimize costs throughout the production and delivery of goods or services.
Communication	0,35%	[9, 83, 62]	Communication involves the exchange of information, ideas, and messages between individuals or groups to convey meaning and facilitate understanding.
Marketing research	0,35%	[97, 126]	Marketing research involves systematically gathering, analyzing, and interpreting data about markets, consumers, and competitors to inform marketing strategies and decision-making.
Requirements	0,35%	[113, 72, 99]	Requirements validation involves verifying and ensuring that the requirements meet the needs and expectations of stakeholders and align with product

Activities	%	References	Description
validation			objectives.
Advertising budget	0,35%	[97, 99]	Advertising budget refers to the allocated funds specifically designated for promoting products or services through various advertising channels.
Collect customer feedback	0,35%	[114, 72]	Collect customer feedback involves gathering input and insights from customers regarding their experiences, preferences, and satisfaction with a product or service.
Marketing budget	0,35%	[99]	Marketing budget involves allocating financial resources to various marketing activities and initiatives to achieve business objectives and maximize return on investment.
Negotiate re-quirements	0,35%	[113, 9, 87]	Negotiate requirements involves collaborating with stakeholders to reach agreements on product feature specifications, goals, and deliverables.
Write product initiation docu-ment	0,35%	[72]	Write product initiation document involves creating a comprehensive document outlining the objectives, scope, stakeholders, and initial requirements for a new product development project.
Customer support	0,35%	[68, 126]	Customer support involves providing assistance, guidance, and resolution to customers' inquiries, issues, and concerns regarding a product or service.
Product research	0,35%	[83]	Product research entails conducting thorough investigations to gather insights, data, and feedback necessary for developing, refining, or improving products.
Advertising planning	0,35%	[99]	Advertising planning involves developing strategies and tactics to effectively promote products or services to target audiences and achieve marketing objectives.
Update roadmap	0,23%	[72]	Updating roadmap involves revising and refining the strategic plan for product development and release based on changing priorities, feedback, and market conditions.
Service manage-ment	0,23%	[20, 62]	Overseeing the effective delivery and optimization of services to meet customer needs and expectations.
Data analysis	0,23%	[72]	Examining data to derive insights and guide decision-making processes.
Supplier man-agement	0,23%	[105]	Cultivating relationships with suppliers to ensure the punctual delivery of goods and services.
Recruitment	0,23%	[99]	Identifying and onboarding qualified candidates to fulfill organizational roles.
Forecasting	0,23%	[97]	Anticipating future trends and results based on historical data and market analysis.
Legal and IP rights manage-ment	0,23%	[98]	Safeguarding and administering intellectual property rights while ensuring adherence to legal requirements.
Research and Development	0,23%	[86]	Engaging in research and experimentation to foster innovation and enhance products or services.
Approve roadmap	0,23%	[19, 93]	Reviewing and endorsing the strategic blueprint for product development and launches.
Marketing com-munication	0,23%	[99]	Devising and executing communication strategies to promote products or services to target demographics.
Performance management	0,23%	[98]	ssessing and supervising individual and organizational performance to achieve objectives.
Corporate strate-gy & vision	0,23%	[18, 98]	Formulating long-term goals and guiding the overall direction of the organization.
Use scenarios	0,23%	[68, 24]	Crafting hypothetical scenarios to evaluate potential outcomes and facilitate informed decision-making.

Activities	%	References	Description
Sales analysis	0,23%	[99]	Analyzing sales data to comprehend market trends, consumer behavior, and performance indicators.
Approve development	0,23%	[83, 72]	Reviewing and endorsing the progress and direction of development projects.
Brand planning	0,12%	[97]	Strategizing and outlining initiatives to establish and enhance the brand identity and presence.
Prototyping	0,12%	[72]	Creating preliminary models or versions of products or services for testing and evaluation.
Marketing copy	0,12%	[99]	Crafting compelling written content for marketing materials to attract and engage target audiences.
Release validation	0,12%	[64]	Release validation entails testing and verifying that a software or product release meets the specified requirements and quality standards before deployment to ensure its readiness for use.
Sourcing	0,12%	[98]	Sourcing involves identifying, evaluating, and acquiring the necessary resources, materials, or services to support business operations or project needs.
Create how-to-demo stories	0,12%	[105]	Creating how-to-demo stories involves developing narratives or scripts that illustrate step-by-step instructions or demonstrations for using a product or service.
Branding execution	0,12%	[99]	Branding execution involves implementing strategies and tactics to effectively communicate brand identity and values to the target audience.
Requirements re-prioritization	0,12%	[87]	Requirements re-prioritization involves reassessing and adjusting the importance of product feature requirements based on changing business needs, stakeholder feedback, or new information.
Technical support	0,12%	[99]	Technical support involves providing assistance and troubleshooting for technical issues encountered by customers or users of a product or service.
Define business model	0,12%	[72]	A business model defines the framework for how a company creates, delivers, and captures value, outlining its strategy for generating revenue and sustaining profitability.
Backlog grooming	0,12%	[83]	Backlog grooming involves reviewing, refining, and prioritizing items on a product backlog to ensure it is ready for development.
Define control criteria	0,12%	[77]	Define control criteria involves establishing specific standards or benchmarks used to evaluate the performance, quality, and compliance of processes, products, or services.
Evaluate business model	0,12%	[72]	Evaluate business model involves analyzing the structure, viability, and profitability of a company's approach to generating revenue and delivering value to customers.
Define delivery model	0,12%	[98]	Define delivery model involves outlining the approach and process for delivering products or services to customers, encompassing distribution channels, logistics, and customer interaction methods.
Negotiate priorities	0,12%	[72]	Negotiate priorities entails discussing and reaching agreements on the relative importance and sequencing of tasks, goals, or initiatives to optimize resource allocation and achieve strategic objectives.
Strategic communication	0,12%		Strategic communication involves crafting and delivering messages that align with organizational goals and objectives to effectively engage stakeholders and achieve desired outcomes.
Inspire	0,12%	[115]	Inspire involves motivating and energizing individuals or teams to achieve their goals and pursue excellence in their work.
Market research	0,12%	[97]	Market research communication involves conveying research findings,

Activities	%	References	Description
communication			insights, and recommendations to stakeholders within an organization to inform decision-making and strategy development.
Define market priorities	0,12%	[11]	Defining market priorities involves identifying and prioritizing key objectives and strategies to address market needs and opportunities effectively.
Branding planning	0,12%	[64]	Branding planning involves strategizing and developing initiatives to establish and enhance a brand's identity, perception, and recognition in the market.
Inventory management	0,12%	[99]	Inventory management involves overseeing the procurement, storage, and optimization of stock levels to meet customer demand while minimizing costs and maximizing efficiency.
Update strategic goals	0,12%		Updating strategic goals involves revising and refining organizational objectives to align with changing market conditions, emerging trends, and internal capabilities.
Define new product guidelines	0,12%	[71]	Defining new product guidelines involves establishing criteria and parameters to guide the development of innovative products aligned with business objectives and market demands.
User research	0,12%	[72]	User research involves gathering insights and feedback from target users to inform product development decisions and enhance user experience.
Sales training	0,12%	[99]	Sales training involves equipping sales professionals with the knowledge, skills, and techniques necessary to effectively engage with customers and drive sales growth.
Compensation & benefits	0,12%	[99]	Compensation and benefits refer to the rewards provided to employees in exchange for their work, including wages, salaries, bonuses, and non-monetary perks such as health insurance and retirement plans.
Define stakeholders	0,12%	[74]	Stakeholders are individuals, groups, or organizations who have an interest or are affected by the outcomes of a project, program, or business initiative.

C. RQ3: Which Studies Of The Literature Consider The Context Of Software Startups?

Software startups thrive in a dynamic environment, dedicated to creating and providing software-driven products or services. They prioritize scalability, maintaining a strong focus on their product, and employing lean practices to optimize efficiency. Customer feedback is central to their iterative approach, allowing them to adapt quickly to market demands. Securing funding, typically from venture capital or angel investors, is essential for their growth trajectory. Ultimately, their goal is to disrupt industries and introduce innovative solutions to meet evolving market needs. The examination of the PM's role within the startup domain reveals a notable scarcity of research. Out of 134 analyzed studies, merely 7 (Table 13) consider the software startup context, with 5 of them specifically addressing the role of the PM and their activities. Those papers will be taken into account when answering RQ3. Overall, this is a clear indication that the startup context, and the role of the PM therein, is of relative under-researched nature.

Table 13. Studies taking into account the software startup context.

Ref.	Title	PM activities?
[80]	Exploring how feature usage relates to customer perceived value: A case study in a startup company	x
[35]	Software engineering in start-up companies: An analysis of 88 experience reports	
[18]	A model of requirements engineering in software startups	x
[116]	An anatomy of requirements engineering in software startups using multi-vocal literature and case survey	
[59]	Towards prioritizing software business requirements in startups	x

Ref.	Title	PM activities?
[72]	The role of a software product manager in various business environments	x
[86]	Linking the business view to requirements engineering: long-term product planning by roadmapping	x

D. RQ4: What Tasks Are Important For Product Managers In Software Startups?

Only considering the 7 studies that both cover the software startup context and the PM activities, there are 11 activities (Table 14) to be identified. When all activity pairs get considered, 71% of them all find their origin with Springer and Miler [72].

Requirements prioritization involves ranking and organizing feature requirements based on their importance and impact to guide decision-making in resource allocation and project planning. Product planning, including releases, encompasses the strategic process of defining product features, functionalities, and timelines for development and deployment, aligning with organizational goals and market demands. Resource allocation involves efficiently distributing available resources such as budget, manpower, and technology to various projects or tasks based on their priority, urgency, and expected impact, ensuring optimal utilization and productivity. Requirements gathering entails systematically collecting, documenting, and analyzing stakeholder needs, expectations, and specifications for a project or product, serving as the foundation for successful development and implementation. Product management encompasses the planning, execution, monitoring, and control of product activities to achieve specific goals and objectives within defined constraints, ensuring successful delivery within scope, time, and budget constraints. Product strategy and vision involve defining the long-term direction and goals for a product, outlining how it will meet customer needs, differentiate from competitors, and create value for the organization, guiding decision-making and innovation efforts. Product ideation involves generating and developing creative ideas and concepts for new products or enhancements to existing ones, fostering innovation and addressing market opportunities or challenges to drive business growth. Managing software development involves overseeing the planning, execution, and delivery of software products, coordinating development teams, resources, and processes to ensure the timely and successful delivery of high-quality software products. Requirements analysis involves systematically evaluating and interpreting requirements to understand their scope, complexity, and implications, facilitating effective decision-making and solution design to meet stakeholder needs and expectations. Leading involves providing direction, guidance, and motivation to teams or individuals to achieve common goals and objectives, inspiring and empowering them to perform at their best and contribute to the success of the organization. Market research entails gathering,

analyzing, and interpreting data about target markets, customers, competitors, and industry trends to inform strategic decision-making, product development, and marketing strategies, ensuring alignment with market needs and preferences.

Table 14. Discussed PM activities in software startup publications.

Activities	%
Requirements prioritization	8,43%
Product planning (incl. releases)	6,02%
Resource allocation	4,82%
Requirements gathering	4,82%
Project management	4,82%
Product strategy & vision	4,82%
Product ideation	3,61%
Manage software development	3,61%
Requirements analysis	3,61%
Lead	3,61%
Market research	3,61%

Notably, the most discussed activity in the software startup literature seems to be requirements prioritization, accounting. It has been the case for all of the included studies and good for 8,43% of the discussions. Which shows that the potential for further in-depth scholarly exploration is even much more prominent when it comes to this particular context.

4. Discussion

RQ1: What are the characteristics of software startups?

Software startups are characterized by their adoption of agile methodologies, which enable them to iterate rapidly and respond effectively to market feedback. Additionally, these startups prioritize lean operations to optimize resource allocation and maximize value delivery, minimizing waste and inefficiency. Central to their success is a customer-centric approach, where startups focus on understanding and meeting the evolving needs of their target audience. Innovation is a core driver for software startups, as they constantly seek to develop new technologies and features that set them

apart in the market. Scalability is also crucial, with startups aiming to efficiently grow their operations and customer base as demand increases. Many startups aspire to disrupt established industries by offering innovative solutions that challenge traditional norms. Funding and investment play a pivotal role in fueling the growth and expansion of software startups, providing the resources needed to invest in talent and technology. Speed and agility are inherent traits of startups, allowing them to quickly adapt to market changes and capitalize on emerging opportunities. With a product-centric focus, startups prioritize the development of compelling, user-centric products that address real-world problems. Collectively, these characteristics highlight the dynamic and competitive nature of software startups, underscoring the importance of innovation, customer-centricity, and efficient operations in driving success in the technology landscape.

RQ2: What are the specific activities commonly associated with the responsibilities of a product manager, and how can we demonstrate the distribution of these identified activities across publications?

In the systematic literature review, we delve into the multifaceted nature of the product manager (PM) role through an analysis of 662 unique tasks. Refining the analysis to 122 distinct activities, we identify selection, prioritization, and planning as the most discussed themes in the literature. However, we acknowledge that the academic focus on optimizing handling large backlogs may not align with the primary challenges faced by practitioners, especially in software startups and product companies. For practitioners, time management and improving product decision-making processes are of paramount importance to enhance the probability of product lifecycle success.

Our study not only deepens our understanding of the complexities surrounding the PM role but also provides valuable insights for organizations seeking to optimize product management processes and foster successful product lifecycles. By addressing crucial research questions and observations during analysis, the systematic literature review lays the groundwork for future research endeavors, contributing to the advancement of product management practices and knowledge.

RQ3: Which studies of the literature consider the context of software startups?

Our systematic literature review unveils the underexplored domain of product manager (PM) activities in software startups. Only 7 out of 134 studies specifically focus on niche, reflecting its relative under-researched nature. Moreover, the scope of activities covered in these studies appears relatively narrow compared to the broader literature on PM activities. Here the same observation can be made that there's an interesting gap between what's currently receiving scholarly interest, and what the actual needs of early-stage software venture product managers. Because this is such a young field of scholarly interest, it's still possible to start closing the gap early on.

The research demonstrates how researchers are actively working to bridge the gap between academia and practitioners by focusing on topics relevant to startup environments. The approach aims to address the unique demands of startups and contribute to their success. However, the study also highlights potential areas of untapped research opportunities, particularly in topics that could be crucial for early-stage ventures. Future research endeavors should consider exploring these lesser-addressed aspects to further enrich the understanding of product management in the dynamic realm of software startups.

5. Completeness

Within the confines of the formulated research questions, we have conducted a rigorous review exercise on product management activity research, with a special interest for the software startup context, resulting in the identification and selection of 134 studies that adequately address at least one of the defined research questions. Spanning from the earliest publication in 1983 to the most recent ones in 2022, the selected studies provide valuable insights into the domain. However, it is essential to acknowledge that a systematic literature review, by its nature, cannot ever be fully completed. The paradigm shift and dynamic nature of product management, especially in the context of startup research, may have led to some relevant studies eluding our inclusion. Additionally, the decision to focus solely on English-published articles, and non-grey literature may have inadvertently omitted important and pertinent studies available in other languages. Despite these limitations, the review provides a comprehensive and valuable snapshot of the current state of requirement prioritization research, serving as a foundation for further exploration and analysis in the ever-evolving field.

Quality assessment of the research

Evaluating the quality of research related to product managers is vital for determining the credibility and reliability of existing studies. The assessment provides researchers and practitioners with insights into the rigor, methodology, and validity of the research conducted in this domain. By examining the quality of studies, the SLR can inform future research directions and guide decision-making processes based on robust and trustworthy evidence.

When analyzing the QAC scores for the retained studies, the average score on 10 is 6,55. The quality criterion with the highest average score (1,61) is related to the number of references the study had. (Table 15) shows the QAC scores of all qualified studies.

Table 15. Quality Assessment Criteria scores.

Ref.	QAC1	QAC2	QAC3	QAC4	QAC5	Score
[19]	2	2	2	2	2	10
[22]	2	2	2	2	2	10

Ref.	QAC1	QAC2	QAC3	QAC4	QAC5	Score	Ref.	QAC1	QAC2	QAC3	QAC4	QAC5	Score
[58]	2	2	2	2	1	9	[106]	2	2	2	0	1	7
[18]	1	2	2	2	2	9	[65]	1	2	2	1	1	7
[21]	2	2	2	2	1	9	[68]	1	1	2	1	2	7
[10]	1	2	2	2	2	9	[72]	1	1	1	2	2	7
[67]	1	2	2	2	2	9	[73]	1	2	1	2	1	7
[117]	2	2	2	1	1	8	[76]	1	2	2	1	1	7
[118]	2	2	2	0	2	8	[126]	2	2	1	1	1	7
[116]	1	2	1	2	2	8	[79]	2	2	2	0	1	7
[9]	2	2	2	0	2	8	[88]	2	2	2	0	1	7
[113]	1	2	2	2	1	8	[11]	2	1	1	0	2	6
[119]	2	2	1	2	1	8	[82]	2	1	2	0	1	6
[73]	1	2	2	2	1	8	[31]	1	2	1	1	1	6
[24]	1	2	2	1	2	8	[109]	1	2	2	0	1	6
[96]	1	2	2	2	1	8	[104]	2	0	1	2	1	6
[100]	2	2	1	2	1	8	[57]	2	2	1	0	1	6
[89]	1	1	2	2	2	8	[127]	1	2	2	1	0	6
[87]	2	2	1	2	1	8	[95]	1	2	1	0	2	6
[120]	2	1	2	0	2	7	[108]	1	2	1	1	1	6
[121]	2	2	2	0	1	7	[8]	1	2	2	0	1	6
[122]	2	1	2	0	2	7	[69]	1	2	2	0	1	6
[123]	2	2	2	0	1	7	[74]	1	2	2	0	1	6
[35]	1	2	1	2	1	7	[97]	1	1	1	2	1	6
[90]	2	1	2	1	1	7	[95]	1	2	2	0	1	6
[92]	2	2	1	0	2	7	[103]	0	2	1	2	1	6
[91]	2	1	2	0	2	7	[99]	1	1	1	2	1	6
[111]	2	2	1	1	1	7	[77]	1	1	1	2	1	6
[124]	2	1	1	2	1	7	[78]	1	2	2	0	1	6
[125]	2	1	1	2	1	7	[90]	2	1	2	0	1	6
[112]	1	2	1	2	1	7	[128]	2	2	0,5	0	0,5	5
[70]	2	2	2	0	1	7	[129]	2	2	0,5	0	0,5	5
[70]	1	2	2	1	1	7	[81]	2	1	1	0	1	5
[71]	2	2	1	1	1	7	[25]	1	2	1	0	1	5
[107]	2	1	1	2	1	7	[59]	1	1	1	0	2	5
[62]	1	1	2	2	1	7	[17]	1	2	1	0	1	5
[61]	1	1	2	2	1	7	[60]	1	2	1	0	1	5
[105]	2	2	2	0	1	7	[60]	1	2	1	0	1	5
[63]	1	2	2	1	1	7	[39]	1	2	0	1	1	5
[114]	2	2	1	1	1	7	[93]	1	1	1	1	1	5
[85]	1	2	2	0	2	7	[110]	1	1	1	0	2	5

Ref.	QAC1	QAC2	QAC3	QAC4	QAC5	Score
[83]	1	2	1	0	1	5
[94]	1	1	2	0	1	5
[101]	1	2	1	0	1	5
[20]	1	0	1	1	2	5
[64]	1	1	1	2	0	5
[84]	1	1	1	0	2	5
[102]	1	2	1	0	1	5
[66]	1	2	1	0	1	5
[80]	1	2	1	0	1	5
[130]	1	2	1	0	1	5
[98]	1	2	1	0	1	5
[75]	1	2	1	0	1	5
[86]	1	1	1	0	2	5

6. Threats to Validity

The review protocol encountered various challenges that could potentially threaten its validity, including bias in publications and data extraction inaccuracies. To mitigate these challenges, a meticulous search strategy was devised, encompassing diverse literature databases, explicit selection criteria, and rigorous quality criteria. However, it is acknowledged that not all relevant research might have been captured through search terms, leading to the possibility of important studies being omitted. To address it, a secondary search strategy involving manual inspection of references from extracted studies was implemented to identify any overlooked research. Furthermore, strict adherence to selection criteria and comprehensive quality assessment was enforced to minimize incorrect omissions. In the context of the systematic literature review, several types of validity were considered and addressed:

Descriptive Validity: The precision with which the research accurately portrays the collected information was ensured through the utilization of a data extraction form, documenting the information essential for addressing the research questions and maintaining descriptive validity.

Theoretical Validity: To capture the intended scope of investigation effectively, efforts were made to avoid biases in study identification, maintain neutrality in inclusion and exclusion criteria, and ensure accurate data extraction and classification. Ongoing refinement of the review protocol, even using a pilot on 100 studies, all aspects of the protocol got checked in order to maximized the study's theoretical validity and objectivity.

Generalizability: Given the extensive coverage of a broad research area over an extended period, the findings of the mapping study are highly generalizable, even without the inclusion of unindexed studies from grey or none-English publications.

Interpretive Validity: The involvement of researchers with expertise in software engineering and empirical research enhanced the interpretive validity of the study, minimizing the impact of personal bias on data interpretation. Here also artificial intelligence got used to increase the internal consistency, in order to further reduce any personal bias on the data interpretation.

Repeatability: Documentation of the mapping procedure and outcomes based on the studied research papers contributes to the study's repeatability, enabling replication by other researchers under similar conditions.

Although efforts have been made to ensure the validity of the study, it is recognized that other researchers might arrive at a similar list of decisions and publications but not necessarily identical to ours [28]. The inherent complexity and evolving nature of academic research necessitate a continuous and critical approach to address potential threats to validity, enhancing the reliability and robustness of future studies in the domain.

7. Conclusion

The presented SLR aimed to explore the landscape of research on product manager (PM) activities, with a specific focus on the context of software startups. Through a rigorous and comprehensive analysis, we identified key trends and insights that shed light on the evolving nature of product management practices.

Our investigation into the distribution of identified activities across publications demonstrated that while product planning and requirements prioritization are dominant topics, a substantial number of activities remain underrepresented, indicating areas for future research. Notably, we found that the interests of researchers in the software startup context differ from those in the general literature, suggesting distinct challenges and priorities for product managers in startup environments.

Based on the findings from SLR, several avenues for future research emerge. To bridge the gap between academic research and practitioners, a "Pragmatic Framework for Product Managers" (PFPM) could be further refined towards software startups. It would be the first of its kind in terms of academic validity, and could therefore be the foundation to further explore which activities are in fact highly relevant to the software startup context and refine it accordingly. Understanding how these activities impact early-stage ventures and their product management processes can provide valuable insights for startup success.

Additionally, the dearth of research addressing activities like go-to-market strategies, creating roadmaps, and requirements selection in the startup context presents a promising research agenda. Investigating these neglected areas [131, 132] can enhance the understanding of critical aspects of product management within software startups and con-

tribute to their sustainable growth.

To enrich the existing body of literature and foster collaboration between academia and industry, future research should also consider adopting mixed-method approaches, involving both qualitative and quantitative methods. The integrative approach can lead to a deeper understanding of the intricacies of product management practices and foster actionable insights.

In conclusion, presented SLR provides valuable insights into the current state of research on product manager activities, emphasizing the significance of software startups as a specific research context. Our research agenda outlines promising directions for future studies, ultimately contributing to the advancement of product management practices and facilitating the success of software startups.

Abbreviations

PM	Product Manager
RE	Requirements Engineering
SLR	Systematic Literature Review
SPM	Software Product Management
PFPM	Pragmatic Framework for Product Managers
RQs	Research Questions
QAC	Quality Acceptance Criteria
DEF	Data Extraction Form
Y	Yes
N	No
GtM	Go to Market
IP	Intellectual Property
Incl.	Inclusive

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Biography

Frederic Pattyn, born in Kortrijk, Belgium in 1987. He received his B. S., M. S. and teaching degrees in Strategic Management from the Ghent University in 2011, before starting there his Ph. D. degree in Applied Economic Sciences, in 2022. His current research interests include product management (requirements engineering, planning, validation and prioritization…) in a software startup context. Helping out startups and investors since 2012 as founder of Aquila Ventures as consultant or board member, as ISPMA fellow and since 2016 as co-founder, and Principal Product Manager of NOWJOBS, a House of HR company.