Tuijin Jishu/Journal of Propulsion Technology
ISSN: 1001-4055
Vol. 44 No. 3 (2023)

# Synthesis Methods - Product Feature Prioritization Frameworks in Startups using PRISMA

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**Abstract**-The focus of the research is to understand the prioritization framework utilization or adoption from the Startups, Factors influencing prioritization framework selection, decision making on selecting the prioritization and relevant case studies. Though there are various methods available for synthesizing qualitative research. The need for the synthesis was more towards arriving at an approach grouping the studies into various homogeneous groups or categories to identified evidence of the synthesis to represented for Startups , Digital Product Development, Includes factors influencing prioritization and availability of case study
**Keywords -** Startup, Prioritization, Frameworks, Product Features, Decision Making, Case Studies

## 1. Introduction- Synthesis methods:

Design Synthesis is the process of translating research data into actionable knowledge and is a critical part of the design methodology. The goal of this process is finding relationships between different pieces of data to uncover meaning in the behaviours that were observed during the research phase. This understanding allows us to identify opportunities and constraints that will set the space in which will generate more accurate solutions. For this reason Textual Narrative Synthesis[1] was used. This was used to find and document the study characteristics, context, quality, and the findings reports. These were tabulated with the help of an excel sheet against the Requirement Questions context.

## 2. RESULTS

Study Selection: PRISMA Flow diagram

**Study Characteristics**

From the data collection spreadsheet as source for analysis. Data such as methods used for prioritization frameworks used, case studies, Number of factors, Number of samples considered, Key outcomes, any gaps were added to the literature review which is documented in a separate document for detailed literature review for future reference for each paper. Each paper were evaluate against the RQ#1..RQ#5 as outlined the research question section outlined in this research paper.

The focus of the research would be focusing on the following questions:
RQ#1: What are prioritization approaches discussed with relevance to startup and why?
RQ#2: What are the prioritization methods adopted for digital product development?
RQ#3: What approaches used in selection of the Prioritization method/Techniques/Framework?
RQ#4: What factors affect selection of prioritization framework?
RQ#5: What are different case studies available with respect to selection of prioritization framework?

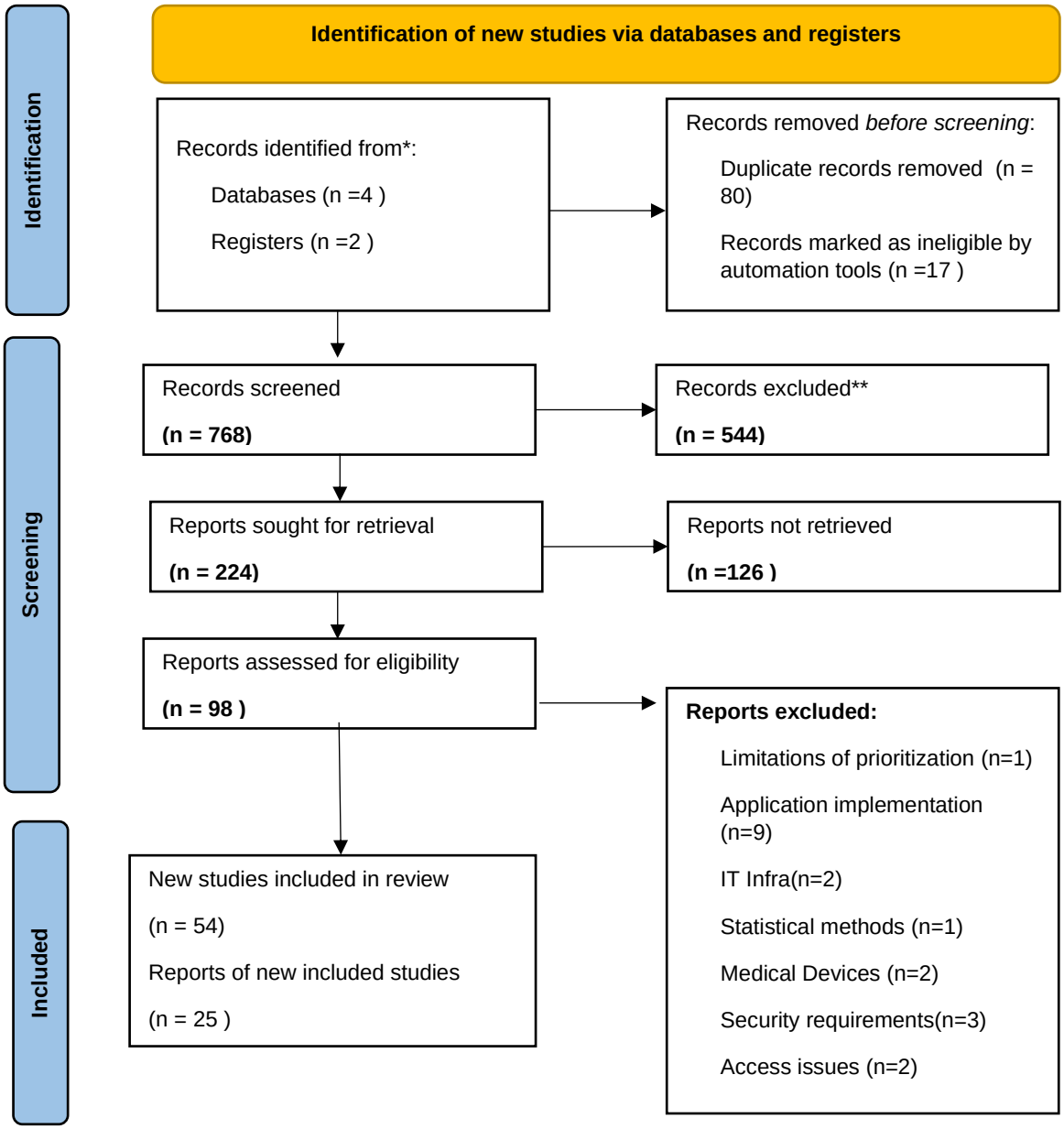

**Table 1:** Synthesis of literature review based on the Requirement Questions

| Paper # | Paper Title | Author | Year | RQ #1 | RQ# 2 | RQ#3 | RQ# 4 | RQ# 5 |
|---|---|---|---|---|---|---|---|---|
| 1 | Empirical Evaluation of Two Requirements Prioritization Methods in Product Development Projects | Laura Lehtola, Marjo Kauppinen | 2004 | 0 | 1 | 1 | 1 | 1 |
| 2 | Requirements Prioritization Challenges in Practice | Laura Lehtola, Marjo Kauppinen, Sari Kujala | 2004 | 0 | 1 | 1 | 1 | 1 |
| 3 | Optimizing Process Decision in COTS-Based Development Via Risk Based Prioritization | Ye Yang, Barry Boehm | 2006 | 0 | 1 | 1 | 1 | 1 |
| 4 | Suitability of requirements prioritization methods for market-driven software product development | Laura Lehtola, Marjo Kauppinen | 2006 | 0 | 1 | 1 | 1 | 1 |
| 5 | Towards a research framework on requirements prioritization | P Berander, KA Khan, L Lehtola | 2006 | 0 | 1 | 1 | 1 | 0 |
| 6 | Improving process decisions in COTS-based development via risk-based prioritization | Ye Yang, Barry Boehm | 2007 | 1 | 1 | 1 | 1 | 1 |
| 7 | Value-Oriented Requirements Prioritization in a Small Development Organization | Jim Azar, Randy Smith, David Cordes | 2007 | 1 | 1 | 1 | 1 | 1 |
| 8 | Innovation and decision making: Understanding selection and prioritization of development projects | E. Gutierrez, G. Olundh Sandstrom, J. Janhager, S. Ritzen | 2008 | 0 | 1 | 0 | 0 | 0 |
| 9 | New Lanchester Theory for Requirements Prioritization | Thomas M. Fehlmann | 2008 | 0 | 1 | 0 | 0 | 1 |
| 10 | Requirement prioritization decision factors for agile development environments | G Hoff, A Fruhling, K Ward | 2008 | 0 | 1 | 1 | 1 | 1 |
| 11 | Requirements prioritization based on benefit and cost | M Daneva, A Herrmann | 2008 | 0 | 1 | 1 | 1 | 0 |

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| | prediction: A method classification framework | | | | | | | |
| 12 | A classification framework for software requirements prioritization approaches | NM Carod, A Cechich | 2009 | 0 | 1 | 1 | 1 | 0 |
| 13 | Requirements Prioritization in On-line Banking Systems: Using Value-Oriented Framework | Amir Seyed Danesh, Soolmaz Mir Mortazavi, Seyed Yahya Seyed Danesh | 2009 | 0 | 1 | 1 | 1 | 1 |
| 14 | Understanding the Waste Net: A Method for Waste Elimination Prioritization in Product Development | Marcus V. P. Pessôa, Warren Seering, Eric Rebentisch, Christoph Bauch | 2009 | 0 | 1 | 1 | 1 | 0 |
| 15 | A quality-based requirement prioritization framework using binary inputs | CE Otero, E Dell, A Qureshi… | 2010 | 0 | 1 | 1 | 1 | 0 |
| 16 | Exploring Software Product Management decision problems with constraint solving - opportunities for prioritization and release planning | Bjorn Regnell, Krzysztof Kuchcinski | 2011 | 0 | 1 | 1 | 1 | 0 |
| 17 | Prioritization of Features in Agile Product Line Engineering | Jessica Díaz, Juan Garbajosa, Jennifer Pérez | 2011 | 0 | 1 | 0 | 0 | 0 |
| 18 | Comparison of Various Elicitation Techniques and Requirement Prioritization Techniques | M Nilofer, G Sheetal | 2012 | 0 | 1 | 0 | 0 | 0 |
| 19 | Does the prioritization technique affect stakeholders' selection of essential software product features? | Hans Christian Benestad, Jo Erskine Hannay | 2012 | 0 | 1 | 1 | 1 | 0 |
| 20 | Factors affect on Requirement Prioritization | S Hassan, S Awan, F Jaan, H Akmal | 2012 | 0 | 1 | 1 | 1 | 0 |
| 21 | Software requirement prioritization using fuzzy multi-attribute decision making | A Ejnioui, CE Otero, AA Qureshi | 2012 | 0 | 1 | 1 | 0 | 0 |
| 22 | A survey of requirement prioritization methods | G Kaur, S Bawa | 2013 | 0 | 1 | 0 | 1 | 0 |
| 23 | Comparisons of techniques of | M Khari, N Kumar | 2013 | 0 | 1 | 1 | 1 | 0 |

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| | requirement prioritization | | | | | | | |
| 24 | Requirement Prioritization: A Study and Proposed Framework | LB Goel, Prof. Sanjeev Thakur. | 2013 | 0 | 1 | 0 | 1 | 0 |
| 25 | A Framework for Requirement Prioritization for Software Products | S Devulapalli, A Khare | 2014 | 0 | 1 | 0 | 1 | 0 |
| 26 | Application of requirements prioritization decision rules in software product line evolution | Mari Inoki, Takayuki Kitagawa, Shinichi Honiden | 2014 | 0 | 1 | 1 | 1 | 1 |
| 27 | FRanC: A Ranking Framework for the Prioritization of Software Maintenance | D Chaudhari, M Zulkernine… | 2014 | 0 | 0 | 1 | 0 | 0 |
| 28 | Software Requirement Prioritization using Machine Learning. | D Singh, A Sharma | 2014 | 0 | 1 | 1 | 1 | 1 |
| 29 | Stakeholder prioritization in requirement engineering process: a case study on school management system | SI Majumdar, MS Rahman, MM Rahman | 2014 | 0 | 1 | 1 | 1 | 1 |
| 30 | Comparison of Requirement Prioritization Techniques to Find Best Prioritization Technique | JA Khan, IU Rehman, YH Khan, IJ Khan… | 2015 | 0 | 1 | 1 | 1 | 1 |
| 31 | Injecting value-thinking into prioritization decisions | J Cleland-Huang | 2015 | 0 | 1 | 1 | 1 | 0 |
| 32 | Requirement Prioritization with Quantitative Data - A Case Study | Enrico Johansson, Daniel Bergdahl, Jan Bosch, Helena Holmström Olsson | 2015 | 0 | 1 | 1 | 1 | 1 |
| 33 | Stakeholder‟ s Influence in Requirement Engineering: Identification & Prioritization | MA Ullah, M Saeed, HS Dar | 2015 | 0 | 1 | 0 | 0 | 0 |
| 34 | Factors and proposal of new framework for requiremetns prioritization for | D SITA | 2016 | 0 | 1 | 1 | 1 | 0 |

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|---|---|---|---|---|---|---|---|---|
| | successive releases of application software | | | | | | | |
| 35 | Opportunity cost in task prioritization and its influence on resource allocation decisions: Shark Punch Oy-A Technology startup case study | PE Kiis | 2016 | 1 | 1 | 1 | 1 | 1 |
| 36 | Product feature prioritization using the Hidden Structure method: A practical case at Ericsson | Robert Lagerstrom, Mattin Addibpour, Franz Heiser | 2016 | 0 | 1 | 1 | 1 | 1 |
| 37 | RePizer: a framework for prioritization of software requirements | SUR Khan, SP Lee, M Dabbagh, M Tahir… | 2016 | 0 | 1 | 1 | 1 | 0 |
| 38 | Requirements Prioritization Decision Rule Improvement for Software Product Line Evolution | Mari Inoki, Takayuki Kitagawa | 2016 | 0 | 1 | 1 | 1 | 1 |
| 39 | Requirements prioritization: survey and analysis | S Devulapalli, A Khare, ORS Rao | 2016 | 0 | 1 | 1 | 1 | 0 |
| 40 | Selection of prioritization technique for software requirement using Fuzzy Logic and Decision Tree | S Dhingra, G Savithri, M Madan… | 2016 | 0 | 1 | 1 | 1 | 1 |
| 41 | A subjective and objective fuzzy-based analytical hierarchy process model for prioritization of lean product development practices | Daniel O. Aikhuele, Faiz M. Turan | 2017 | 1 | 1 | 1 | 1 | 1 |
| 42 | Model of primary pivots prioritization in startups | OA Kozina, NK Stratiienko | 2017 | 1 | 1 | 1 | 1 | 1 |
| 43 | Neutrosophy for software requirement prioritization | RB Dias, WO Choez, IM Alcivar… | 2017 | 0 | 1 | 1 | 1 | 1 |
| 44 | A Survey on Machine Learning Based Requirement Prioritization Techniques | S Qayyum, A Qureshi | 2018 | 0 | 1 | 1 | 1 | 0 |
| 45 | Software requirements prioritization practices in software start-ups: A qualitative research | RG Vajrapu, S Kothwar | 2018 | 1 | 1 | 1 | 1 | 1 |

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|---|---|---|---|---|---|---|---|---|
| | based on start-ups in india | | | | | | | |
| 46 | Teaching lean startup principles: an empirical study on assumption prioritization | M Gutbrod, J Münch | 2018 | 1 | 1 | 1 | 1 | 1 |
| 47 | Fuzzy AHP based prioritization and taxonomy of software process improvement success factors in global software development | Arif Ali Khan, Mohammad Shameem, Rakesh Ranjan Kumar, Shahid Hussain, Xuefeng Yan | 2019 | 0 | 1 | 1 | 1 | 0 |
| 48 | The Challenge for Practitioners to Adopt Requirement Prioritization Techniques in Practice | Y Ji, H Zheng | 2019 | 0 | 1 | 1 | 1 | 0 |
| 49 | A Framework for Requirements Prioritization Process in Agile Software Development | Khaled AbdElazim, Ramadan Moawad, Essam Elfakharany | 2020 | 0 | 1 | 1 | 1 | 0 |
| 50 | Feature prioritization in SAFe model using COCOMO II | H Emami | 2020 | 0 | 1 | 1 | 1 | 1 |
| 51 | Guideline for the Selection of Requirement Prioritization Techniques in Agile Software Development: An Empirical Research | 0 | 2020 | 0 | 1 | 1 | 1 | 1 |
| 52 | Identification and Prioritization of Agile Requirements Change Management Success Factors in the Domain of Global Software Development | Tahir Kamal, Qinghua Zhang, Muhammad Azeem Akbar, Muhammad Shafiq, Abdu Gumaei, Ahmed Alsanad | 2020 | 0 | 1 | 1 | 1 | 0 |
| 53 | Using Interdependencies for the Prioritization and Reprioritization of Requirements in Incremental Development | Aryaf Al-Adwan, Anaam Aladwan | 2020 | 0 | 1 | 1 | 0 | 0 |
| 54 | Formulation and Prioritization of Sustainable New Product Design in Smart Glasses Development | Carman-Ka-Man Lee, Lucas Lui, Yung-Po Tsang | 2021 | 0 | 1 | 1 | 1 | 1 |

## 3. DISCUSSION

**RQ#1: What are prioritization approaches discussed with relevance to startup and why?**

Out of the 54 selected for study only 7 were having direct relevance to startups. One specific research has lot of relevance to the research question we had set as the objective was by Sravika Kothawar and Rakesh Guptha Vajrapu. [2]. The evaluation was done with 285 people involving Software Developer, CEO, Project Manager, Business Analyst, Requirement Analyst, Consultant and CTO. They were across the application domains Healthcare, Mobile Apps, Gaming, Telecom, Customer Support Services and Healthcare management. Also discussion of workshop conducted on startups was also very relevant for the studies[39]. The other papers were specific to prioritization method.

**RQ#2: What are the prioritization methods adopted for digital product development?**

During the literature review we also identified the various prioritization methods involved in each of the study. The predominant ones found to be FuzzyAHP which is reflecting across the other systematic literature survey found. Out of the 54 studies found almost 53 studies discussed about the requirement prioritization except for 1. Interestingly only 4 studies used the world “Feature” instead of “requirements” which is of interest to the research problem.

**RQ#3: What approaches used in selection of the Prioritization method/Techniques/Framework?**

The literature review had studies which include 15% of the studies not having approach to select the framework or method. 85% included reasons or approach towards selecting the framework. The studies had close co-relation with RQ#2. Almost 13 papers (24%) were directly dealing with Decision involving selection of the prioritization framework. Some of them were related to Commercially of the Shelf product and discussed the aspects of decision tree for selection of prioritization framework which is relevant to our research questions. There were also paper studies pertaining to comparison prioritization framework in finding the best one.

**RQ#4: What factors affect selection of prioritization framework?**

Out of the 54 studies 46 (85%) studies discussed the various factors which affect the prioritization and sparingly about aspects which affects selection of prioritization framework. This would encompass factors like Scalability, Flexibility, Effort required to use, Complexity, etc., These factors are also validated in some of the studies which was inferred through the case studies.

**RQ#5: What are different case studies available with respect to selection of prioritization framework?**

Only 48% of the total studies have representation of the case studies. The focus was to gain insights on the startup’s adoption on prioritization framework. The case studies were focusing on various stakeholders involved in the case studies.

## 4. CONCLUSION:

Startups needs to manage the product development meticulously for which selection of right prioritization helps in building the right features. We conducted the SLR based on PRISMA methodology to gain an understanding of adoption of prioritization framework among the startups or digital product development environment. Out of the 778 studies shortlisted based on the protocol 54 were selected for primary studies which included aspects of Factors, decision making, Case Studies and prioritization frameworks. The result of our review shows that startups are discussed very little and needs lot of attention. Predominantly the literature review has been found on Fuzzy AHP kind of methods. Also identified that lack of empirical evidence of decision-making frameworks available for simplified selection of prioritization framework. Future work should focus on aspects of Bias in terms of size of the organization and other such metrics. The focus is established to build a decision-making framework based on the attributes for specific prioritization frameworks identified and also perform a survey with stakeholders involved in digital product development from startups context to validate decision making on prioritization framework.

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