Empirically Designed Framework for Junior Software Product Managers

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ABSTRACT

Context. Software Product Management (SPM) is an activity done by software product managers to develop products from the very first idea till the product is released to the market and providing service to customers. SPM helps software product managers to successfully maintain their product throughout product lifecycle till it is disposed of from the market. In this thesis we have studied about SPM both from the state of knowledge and state of practice to understand the different activities being followed by software product managers and concepts in those activities.

Objectives. The study identifies the practices followed in SPM, both from the literature and industrial practitioners. The study also unravels the order in which they implement SPM activities. We have focused on what activities need to be focused by junior software product manager when implementing SPM and based on the inputs from software practitioners a preliminary framework was designed.

Methods. Literature review was conducted to identify what are the different practices in SPM. To cover the literature related to SPM different international databases like Compendex, Inspec, IEEE Xplore, ACM Digital Library, Wiley Inter Science, Scopus, Science Direct, and Business Source Premier are selected. Articles from databases are selected between the years 1995-2011. Text books related to SPM, conference proceedings and grey literature are also used. Interviews and Survey are conducted with practitioners to identify how SPM is being implemented in organizations. We have also focused on what activities need to be implemented in SPM by junior software product managers after they take up their job.

Results. Totally 133 different practices are identified related to SPM and are grouped in to their respective activities. Based on the findings a preliminary framework was designed for junior software product managers where they need to implement 22 concepts and these concepts are grouped into their respective activities which are Requirements Management, Release Planning, Product Planning, Product Roadmapping and Marketing.

Conclusions. We conclude that the SPM frameworks identified through literature relate to each other and use similar activities. We also conclude that the frameworks identified from literature cover almost all of the activities implemented by software product managers during SPM when empirical research was conducted. The frameworks identified from literature don’t give a clear picture about what activities need to be focused by junior software product managers when implementing SPM. To overcome this, a preliminary framework was designed for junior software product managers based on the empirical evidence identified from interviews and survey. Moreover we conclude that a curriculum needs to be designed for SPM which clearly teaches junior software product managers regarding the activities and concepts involved in SPM and focusing more on the activities which need to be implemented by junior software product managers.

Keywords: Junior Software Product Managers, empirical framework, Software Product Management, empirical design.
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# GLOSSARY

Following is the list of abbreviated terms used in the document

<table>
<thead>
<tr>
<th>Terms</th>
<th>Explanation</th>
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<tbody>
<tr>
<td>BABOK</td>
<td>A Guide to the Business Analysis Body of Knowledge</td>
</tr>
<tr>
<td>GT</td>
<td>Grounded Theory</td>
</tr>
<tr>
<td>IREB</td>
<td>International Requirements Engineering Board</td>
</tr>
<tr>
<td>KPI</td>
<td>Key Performance Indicators</td>
</tr>
<tr>
<td>LR</td>
<td>Literature Review</td>
</tr>
<tr>
<td>PLM</td>
<td>Product Lifecycle Management</td>
</tr>
<tr>
<td>PMBOK</td>
<td>A Guide to the Project Management Body of Knowledge</td>
</tr>
<tr>
<td>QCA</td>
<td>Qualitative Comparative Analysis</td>
</tr>
<tr>
<td>Saas</td>
<td>Software as a Service</td>
</tr>
<tr>
<td>SPM</td>
<td>Software Product Management</td>
</tr>
<tr>
<td>SWEBOK</td>
<td>Guide to the Software Engineering Body of Knowledge</td>
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</table>

Table 1: Abbreviated Terms
1 \textbf{INTRODUCTION}

In the recent years Software Product Management (SPM) has gained much importance both in industry and in research. Software Product Management is governing of a product from inception till it is released to the market [2] [3]. The role of product manager in SPM has a key context as SPM activity is surrounded all over by a product manager. It depends on his capabilities as to how he manages the SPM activity. Often the role of product management is considered as a complex task [2] [7] [29]. SPM and the skills of product manager are considered as a key factor in determining the success of a product [2] [3] [4].

Software product management (SPM) is “the discipline and business process governing a product from its inception to the market or customer delivery and service in order to generate the largest possible value to a business” [2] [3] [4] [5]. Value to a business is in terms of revenue, return on investment, customer satisfaction, market share.

Product Management is the “holistic business management of the product from the time it is conceived as an idea to the time it is discontinued and withdrawn from the market” [62]. Product Management is considered as model for a business organization [62]. This product management includes “strategizing, conceiving, developing, introducing, managing, and marketing products” [62].

Product Management is the integrated job of product managers which includes planning, forecasting and marketing products or services [12]. SPM is mainly about requirements engineering, software quality, and productivity [2] [3] [4]. “The business environment is characterized by ever-more-demanding customers, increasingly shorter product life cycles and rapidly developing technologies. The demand for an overall view of the product and its future releases has become important” [5]. Most of the organizations have made a shift from customer oriented product development to market-driven product development [6]. This shift has made a new role to evolve which is the product manager [6].

Software Product Manager plays a key role in success of a product for any organization [4]. The roles of product managers vary from one organization to another [4] [27]. The product manager is often represented as mini-CEO of an organization [1] [2] and is positioned at the centre of the organization [2]. The key responsibilities of a product manager include “coordination of production and sales along with engineering; coordination of the entire project from inception to market; signing off on specifications, cost-targeting layout and maintaining direct contact with existing and potential customers” [12]. It is a rather complex task as the product manager has many responsibilities covering different areas of SPM [6].

The product manager works closely with marketing, sales and engineering, quality and development teams [3] [4] [12]. In some organizations product managers are responsible for managing the brand of the product i.e. entire marketing mix including lead generation and sales, and in some organizations product managers are considered as bridge between sales and engineering [4]. But a very less education exists in this area [1]. In [7] the authors mention that product management is of important value in strategic planning as the role of product manager is diverse.

1.1 \textbf{BACKGROUND}

Since the industrial revolution in 19\textsuperscript{th} century product management has been an approach for many technical industries [30]. In product management the product manager is held for success or failure of a product and it has a matrix organizational structure [12]. Product
management helps in better understanding who your customers are, competition from market and potential for particular set of products [12].

The success of product management in different industrial sectors has allowed software product companies like Microsoft and Alcatel to pay attention towards product management [7]. This shift mainly focused on the ever increasing requirements and handling market pressures [31] [33].

The role of product manager is a crucial task as he needs to administer all aspects of a product and deliver superior customer satisfaction while providing long term value for the organization [12].

The first roots for software product management was discussed by Tapan kilpi [30]. Later on different authors like Ebert [3], Kittlaus and Clough [28], Weerd et al. [7], Bekkers et al [1] have discussed about SPM.

1.2 AIMS AND OBJECTIVES

The aim of our thesis is to design a framework for junior software product managers for the International Software Product Management Association (ISPMA) [14].

In this thesis we like to investigate and analyze the state-of-practice of SPM, to identify present knowledge and practices used in SPM, what practices are being implemented by software product managers. We plan to conduct empirical research with industrial practitioners. Firstly we will interviewing different SPM practitioners, this helps in knowing the practices and concerns being followed by software product managers. The gathered data helps in identifying the different practices being implemented by software product managers during SPM and also to identify what activities are to be focused by junior software product managers when implementing SPM. A survey will be conducted to gain more input for proposing a framework for junior software product managers.

The following objectives are met to fulfill the aim:
- Obj1: To identify the state of knowledge of SPM by conducting a literature study.
- Obj2: Conduct a survey with industrial practitioners, to identify the state of practice being followed by junior software product managers.
- Obj3: A framework is designed.

Table 2 describes the objectives, what research method we are following for the research questions and the respective outcomes.

<table>
<thead>
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<th>OUTCOMES</th>
<th>RESEARCH METHOD</th>
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<tr>
<td>Obj 1</td>
<td>RQ 1 and RQ 1.1</td>
<td>Out 1</td>
<td>Literature study of Books and literature review</td>
</tr>
<tr>
<td>Obj 2</td>
<td>RQ 2 and RQ 2.1</td>
<td>Out 2</td>
<td>Empirical research through interviews and survey</td>
</tr>
<tr>
<td>Obj 3</td>
<td>RQ 3</td>
<td>Out 3</td>
<td>Analysis of RQ1.1 and RQ2, RQ 2.1</td>
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Table 2: Research Questions, Corresponding Objectives and Outcome

1.2.1 RELATED WORK

Different authors like Van de Weerd et al. [7], Ebert [3], Kittlaus et al. [28], Bekkers et al. [1], SPM framework [14] have designed different SPM frameworks. Explanation regarding these models is as follows.
i. **SPM REFERENCE FRAMEWORK [7]**: Van de Weerd et al. have designed a SPM reference framework. The framework gives a clear picture of who are the internal and external stakeholders of the organization. The framework also shows different product management activities starting with portfolio management continued with product roadmapping, requirements management and release planning. Each and every activity in turn has different sub activities. Relations between the different activities are depicted in the framework.

ii. **SPM FRAMEWORK [3]**: Ebert has designed a SPM framework. The framework has different set of characteristics like Life-Cycle phase, Product Management Processes, Competencies. The life-cycle phase gives a clear picture of what are the different phases involved in SPM. The product management processes explains what are the different activities carried out in SPM. The competencies shows what are the different adequacies needed for an organization during SPM.

iii. **SPM FRAMEWORK [28]**: Kittlaus and Clough have designed a SPM framework. In the top row the framework has different set of characteristics like Market analysis, Product analysis, Product strategy, Product planning, Development, Marketing, Sales and Distribution, Support and Services. The first column has two characteristics stating often on corporate level and product family level. The framework is in the form of a matrix where each characteristic has different set of activities which are done both at corporate and product level.

iv. **SPM FRAMEWORK [14]**: The ISPMA organization has designed a SPM framework. The framework is in the form of a matrix. The top row consists of different SPM Phases which are Strategic Management, Product Strategy, Product Planning, Development, Marketing, Sales and Distribution, and Evolution and Service. Each phase in turn has different set of activities which need to be implemented by the product manager.

The main problem with the above frameworks is

- Ebert [3] has designed a framework for SPM. But in the framework he discussed about Life-Cycle phase and the activities in these phase. Later he defined Product Management Processes but a connection of to which activities relate to the Life-cycle phase is missing and same applies to the Competencies.
- Van de Weerd et al. [7] have designed a framework clearly explains the activities of SPM. But the main problem with this framework is, the framework takes in to technical aspects like Portfolio Management, Product Roadmapping, Requirements Management, and Release Planning. A clear explanation about the other activities like Sales and Marketing, Market, Development are missing.
- Kittlaus and Clough [28] have designed a framework for SPM. But the main problem with this framework is the authors haven’t discussed some of the core activities like Marketing, Sales and Distribution, Support and Services.

A senior product manager can clearly understand the tasks involved within the above discussed frameworks and can connect to those activities based on the experience he has and can implement SPM efficiently. But when a junior software product manager (a person who has recently joined the SPM) tries to understand the above frameworks it gives him a baffle view as to how to use them. This is mainly because, the role of the product manager has many responsibilities like requirements management, release definitions, and new product launches taking in to account both internal and external stakeholders [7]. As a junior software product manager he needs to clearly understand these activities and properly align them in developing successful products.
1.2.2 PROBLEM STATEMENT

From the discussion in section 1.2.1 it can be clearly seen that though different frameworks are available a clear understanding of how these frameworks are being implemented in organization is obscure. So knowledge should be designed which helps practitioners in understanding and becoming effective in managing SPM.

In [1] [2] the authors mention that there is no distinct curriculum or a reference body for software product managers just like IREB [9] for requirements engineering, PMBOK [8] or SWEBOK [10] or BABOK [11]. No university or college has a distinct curriculum of teaching product management [33] due to which the people who take up the role of SPM are unaware of the risks. “By owning processes such as product requirements and product delivery, product managers become repositories of critical information, and will remain intimately involved with all aspects of the product throughout its lifecycle” [2] [5]. Many product managers are not aware, of what goals to be achieved as they often start out of a position as developer, sales or project manager and start learning their skills on-the-job [1] [13]. Product Management jobs are often offered accidentally [33]. Product managers are often unaware how corporate goals are attained from the products they develop [12].

From the above explanation it can be seen that most of the product managers learn their skills on job. The person who is newly appointed to the position of SPM and having experience of less than an year is considered as a Junior Software Product Manager. Due to this software product managers need to be educated prior to the task.

A junior software product manager is a person who is new to the field of SPM but has experience in the field of sales and marketing, R&D and sales.

The keys aspects which a product manager should understand are [12]:

- “What the product does? (Performance and technical functions)
- What the product is? (Configurations, component technologies)
- Who the product serves? (Target market) and
- What the product means to customers? (Character, personality and image)“.

Senior product managers understand the above key aspects from experience they gain from product management and use that knowledge for developing of future products. Whereas junior software product manager needs to be well educated about the key aspects of what tasks need to be implemented and what tasks need to be accomplished during software product management.

There are chances of SPM getting delayed due to the following activities:

- As most of the software product managers start out of a position as developer, sales or project manager it takes time for them to understand the different activities involved in SPM other than the role they come from.
- Even though they try to understand the activities in SPM, understanding the customer needs will throw them into a position where they might be rethinking of the activities within SPM regarding what requirements needs to be changed.

Along with the above delay in product management there are different consequences like improper planning, improper strategies etc. which indirectly effect the product development progress in product management. Due to these delays the product managers will not be able to deliver products to the customers on time which might decrease revenue for their products and also the reputation of the organization will be at stake.
To overcome these delays there is a need in educating the junior software product managers. So as a base for education firstly we are planning to design a framework by understanding what are the different activities involved in SPM and based on that conducting empirical research with practitioners regarding what activities junior software product managers must focus. Based on the data gathered the designed framework is updated and presented.

1.3 RESEARCH QUESTIONS

As the main aim of our thesis to design a framework for junior software product managers we think the following research questions will help us in meeting the objectives of our study.

RQ1. What is the state of knowledge of SPM?
   RQ1.1 what are the structural elements of SPM?

The above research question focuses on identifying the state of knowledge of SPM and identifying what are the structural elements which are the core activities of SPM.

RQ2. What are the practices followed, concepts utilized and deliverables expected from junior software product manager and their responsibilities?
   RQ2.1 what characterizes a person as new to the field?
   RQ2.2 how many years experience is needed before a person can be a junior product manager?

The above research question focuses on identifying what are the practices followed which are the core activities, concepts utilized means the different sub-activities involved in the practices and deliverables expected which is the output of the above practices.

RQ3. What should be taught for junior software product managers?

1.4 EXPECTED OUTCOMES

Expected outcomes would be a systematically reported documented with the following outcomes:

Out 1: An overview on the software product management practices that are discussed in literature.
Out 2: Report describing the State of practice of SPM focusing on junior software product managers.
Out 3: Report describing a model which helps in knowing what tasks need to be implemented in SPM by junior software product managers.

The framework is used to understand what are the main tasks need to be employed by junior software product managers while implementing SPM within their organizations.

1.5 THESIS OUTLINE

Thesis outline helps in having a brief idea about how the thesis is structured. It gives a glimpse of the main areas within a thesis. They are: Introduction, Research Methodology and Results. The structure of this is depicted pictorially as shown in below figure 1.
Figure 1: Thesis Outline
2 RESEARCH METHODOLOGY

Research is defined as “original investigation undertaken in order to gain knowledge and understanding” [15]. We implemented a sequential process [15] in our thesis.

A sequential process mainly has 4 steps:

1. **Review the field:** From a broad area of study a research topic is selected and literature study is conducted.
2. **Basic Framework:** Based on the literature study and understanding and interpretations of the field a basic framework was designed regarding the different activities in SPM.
3. **Test the data:** The framework is tested by conducting empirical research [16] [17] [23] [25] i.e. understanding whether the organizations are following the activities identified through literature review and also focused on the activities need to be focused by junior software product managers.
4. **Reflect and integrated:** Based on the testing’s conducted and based on the gathered data the framework was updated and is contributed to the body of knowledge.

In this section we describe research design and the selected research methodologies for the research questions and motivation for selecting them.

2.1 RESEARCH DESIGN

“Research Design is the process of selecting a method for a particular research problem, tapping into its strengths, while mitigating its weaknesses” [17].

In our thesis we have used mixed methodology i.e. both qualitative and quantitative approaches to address our research questions as these methods would help in yielding better results [36]. The study design is conducted in 5 phases.

In phase 1 first we conducted literature study. We conducted literature review based on the guidelines of Levy et al [19] where we identified the different structural elements and practices in SPM. Using grounded theory we have analyzed the data both qualitatively and quantitatively. The findings are reported in relation to RQ1 in section 3.3.

In phase 2 we conducted interviews with different industrial practitioners who are in to SPM irrespective of the size of the organization. Grounded theory is used to analyze the data qualitatively. The results are reported in section 4.3.

In phase 3 we did comparative analysis of both the data gathered through literature study and interviews. This helped us in understanding what are the practices being followed by practitioners in industries. The results are reported in section 6.

In phase 4 we conducted surveys with large pool of SPM practitioners. This allowed us in gathering more data for designing the framework. The results are reported in the section 5.4.

In phase 5 we designed a framework for junior software product managers based on the data gathered through interviews and surveys. The framework is discussed in chapter 6.
2.1.1 LITERATURE REVIEW

Our aim is to identify the state of knowledge of SPM with a literature review. Hence answer to research question (RQ1) is obtained by available knowledge found in both theoretical and empirical studies.

Literature review is defined as “the use of ideas in the literature to justify the particular approach to the topic, the selection of methods” [19] [20]. Literature review mainly helps in understanding the body of knowledge, provides a solid foundation for the study, and places the study in the context of existing work [19]. We plan to conduct literature review based on Kitchenham [38] guidelines. The main reason for doing so is that “it is difficult to know when to stop literature review as it is probably impossible to read every single artifact that has been published in a particular area” [19].

In our thesis we conducted literature review i.e. search for articles, inclusion exclusion criteria, articles selection and data extraction. The main reason was to identify the state of knowledge and activities related to SPM.

2.1.2 INTERVIEWS

An interview is a “flexible and adaptable way of finding things out” [25]. The main reason for selecting interviews is to gather qualitative data [23]. Interviews help in gaining more data from respondents. It has the potential of providing high and rich data [25].

In our thesis we mainly focus on conducting semi-structured interviews [23] [25] [60]. The fact for choosing semi-structured interviews is we can ask open ended questions where the key respondents discuss about the facts and also their opinions on the events they are following [22] [23] [25].

Open ended questions are flexible allowing do more in depth discussions on the topic [22] [23] [25]. This helps in testing the knowledge limits of the respondents and encourages co-operation which helps in making an assessment what the respondent really believes [25]. This helps to cover more data on the specified domain and offering flexibility and opportunity to follow up questions [23] [25].

Answer to research question (RQ 2) is obtained by interviews. The target audiences in the interviews are different SPM practitioners. The main reason is we want to know what are the different practices in software product management and we want to identify the practices followed, concepts utilized and deliverables expected by junior software product managers.

The main disadvantage with interviews is it is time-consuming. Interviews which are less than half an hour are considered invaluable and interviews over an hour are considered unreasonable [25].

To overcome the above disadvantages a careful preparation is made regarding the access permissions, whom we are interviewing and how we plan to collect the interview data and a thorough preparation of the interview questionnaire [25]. Not to miss any data during the interview, the interview data is recorded with the permission of the interviewee.

2.1.3 SURVEYS

A survey is “a retrospective study of a situation that investigates relationships and outcomes” [15].
“A survey is a good way, often the only way, of getting a picture of the current state of a group: a community, an organization, an electorate, a set of corporations, a profession” [37].

A survey research helps in identifying wide range of participants and is concerned with data collection through questionnaires [15] [16] [37].

A survey is “a comprehensive system for collecting information to describe, compare or explain knowledge, attitudes and behavior” [17]. A survey helps in identifying how the participants are reacting to the trends in relationship to different methods or tools and helps in capturing data [15].

The main reason for selecting Survey as an Empirical research is “first identifies a representative subset as the sample, and determines how to reach that subset for data collection” [16]. The advantages with surveys are we can reach large geographic areas, information is obtained immediately, data are automatically entered and can be automatically analyzed.

As we are focusing on what activities need to be implemented by junior software product managers as soon as they take up their role in SPM and how many years experience is needed to be a software product manager we thought survey would be feasible. So choosing a survey helps in reaching large groups of population.

The disadvantage with survey is sampling bias as it is difficult to generalize the results. This is because the respondents may not be representative from the target population [17].

Alternatives to surveys are structure interviews or data logging techniques [17]. The reason for not choosing them is, in structured interviews practitioners reply to the questions being asked and it’s a time consuming process as the practitioners might be busy with their work and difficult to gain access to them.

In our survey we are targeting different software product managers because experienced people will tell what are the activities to be assigned for junior software product managers based on their experience and persons new to the field i.e. who are having an experience level of just 1-2 years can help us in knowing what should be taught based on the field work and observations they have done while implementing SPM activities within their organizations.

2.2 DATA ANALYSIS METHODS

Data analysis methods are used to structure the data properly based on the findings. In our thesis we are focusing on qualitative data.

Qualitative data helps in understanding “which events led to which consequences and derive fruitful explanations” [39].

2.2.1 GROUNDED THEORY

“A grounded theory is one that is inductively derived from the study of phenomena it represents” [40]. Grounded theory (GT) is a qualitative inquiry that emerges from researcher’s observations and interviews [41]. GT mainly focuses “on the process if generating theory rather than a particular content” [41].

GT is a popular analytic technique in qualitative data analysis [41]. GT is mentioned as one of the analysis technique for qualitative data analysis [36]. GT helps in generating categories
of information and placing the context in a theoretical model and explains a story between the interconnection of categories [36] [40].

GT was first presented by Glaser and Strauss [42]. GT helps in building a body of knowledge [43]. GT helps in identifying the gaps in the data that helps in building new studies which extends the body of knowledge [43].

GT is a good technique for constructing body of knowledge based on understandings about what is happening or happened by analyzing raw data from real ground rather than developing notions from existing theories [44]. Charmaz [44] used two phases in developing GT. Glaser and Strauss [42] used three phases in developing GT. The main reason for not choosing Glaser and Strauss [42] GT was they mainly focused on two levels of coding where the first coding level the data is categorized into as many levels as possible and then the categories are integrated [47]. This was a bit ambiguous as a starting researcher the categorization of the data into different levels will be chaotic. So ensure such ambiguity and confusion we focused on Strauss and Corbin GT [40, 45].

Strauss and Corbin GT mainly focused on the induction, deduction and verification of data which helps in building theories [47]. This deduction and verification of data is divided into 3 phases mainly open coding, axial coding and selective coding [40] [45] [47].

Strauss and Corbin GT [40, 45], starts with open coding where all the data is inducting and generated as codes with the help of some analytical tools. In open coding the labeled things are place in a class of similar objects which has one or more recognizable property. The second phase is axial coding in which categories are related to sub categories along the lines of their properties and dimensions. The third and final phase of GT is selective coding which is the process of integrating and refining categories. The selective coding “focuses on one category at a time until the researcher feels ready to choose the core and thus focus on analysis on integration” [47].

In our thesis work we focused on using Strauss and Corbin [40] [45] GT. This is because Strauss [40] [45] GT focuses on structured procedures where as Glaser paradigm [46] focuses on theoretical sensitivity and is less structured.

The main reason for choosing GT in our research is to properly group the findings from literature and interviews in to their respective categories as SPM is not just one activity but it has several set of activities within it and activities have several tasks to be implemented by a software product manager.

2.2.2 COMPARATIVE ANALYSIS

Comparison is an important part of any research as it yields in identifying the differences and similarities in the literature with real world context. Qualitative Comparative Analysis (QCA) was developed by Charles Ragin [48] [51] [52] for the analysis of small and moderate data sets. This technique helps in unraveling the casual complexity by applying set theoretic methods [48].

QCA is mainly used with the aim of identifying correlation and distinction linked to each aspect [50]. It mainly focuses on identifying the “similarities, differences, and associations between entities” [50]. And our objective of study was to identify what practices are being followed by practitioners in comparison to the state of art in literature. So we found QCA fits in to this context aptly.
3 LITERATURE REVIEW

3.1 LITERATURE REVIEW AIM AND OBJECTIVES

The main aim of literature review is to study the state of knowledge of SPM and to get a background idea regarding what research has been conducted related to SPM and what results are presented regarding the activities involved in SPM. To identify the above aim following objectives are met:
1. Identify different frameworks and models discussed related to SPM.
2. Identify the different activities involved in SPM.
3. Identify the state of knowledge of SPM

3.2 LITERATURE REVIEW PROCESS

We have conducted literature review based on the guidelines of Kitchenham [38]. To identify the articles relevant to the area of research and not to have any biasness between the selected articles, the literature review design is conduct in three phases.
1. Planning the review
2. Conducting the review
3. Reporting the review

3.2.1 PLANNING THE REVIEW

3.2.1.1 NEED FOR A LITERATURE REVIEW

Literature review is used to collect the data in Software product management i.e. what are the different practices followed and key constraints or impediments during SPM. The main purpose of choosing literature review is it helps in understanding the body of knowledge of SPM and gives us a solid foundation for our study and places the study in the context of existing SPM knowledge.

3.2.1.2 DEFINING RESEARCH QUESTION

To understand the state of knowledge of SPM the following research question will be answered using literature review

RQ 1. What is the state of knowledge of SPM?
RQ 1.1. What are the structural elements of SPM?

The above research question helps in gaining the knowledge of SPM and what are the different structural elements which are the core activities and what practices are involved in those core activities used in SPM. Answers to RQ2 and RQ3 are gathered through empirical research.

The main focus of the above research question is to clearly understand what are the different practices involved in SPM and to identify the state of knowledge of SPM based on the literature gathered.

3.2.1.3 SEARCH STRATEGY

Search Strategy helps us in finding data for the relevant research questions. The search strategy followed in our thesis is as follows:
a) Keywords

Initially, the key words are identified which helps in finding articles relevant to SPM and what are the different practices or framework or process or methods or models involved. As our main focus was mainly to find the different practices involved in SPM we mainly focused on 2 main key words which are “Software Product Management” and “SPM”. In order to retrieve the articles for our work we have used Boolean operators “AND” and “OR” in between the keywords and formulated the search string. Articles were identified and are extracted based on the research questions.

Keywords that are identified in conducting literature review are shown in table 3.

<table>
<thead>
<tr>
<th>#</th>
<th>Search Strings</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Software Product Management</td>
</tr>
<tr>
<td>A2</td>
<td>SPM</td>
</tr>
<tr>
<td>B1</td>
<td>Practices</td>
</tr>
<tr>
<td>B2</td>
<td>Process</td>
</tr>
<tr>
<td>B3</td>
<td>Framework</td>
</tr>
<tr>
<td>B4</td>
<td>Method</td>
</tr>
<tr>
<td>B5</td>
<td>Model</td>
</tr>
<tr>
<td>C1</td>
<td>Product</td>
</tr>
</tbody>
</table>

Table 3: Keywords

b) Search String

The articles will be selected based on full-text criteria. From the above table we developed a search string using boolean “OR” and “AND”.

The Search string is as follows ((A1 OR A2) AND (B1 OR B2 OR B3 OR B4 OR B5) AND C2)

From [38]

- POPULATION: Population is an application area. In our work Population is “Software Product Management”.
- INTERVENTION: Intervention is the software methodology which addresses a specific issue. In our research work we are focusing on what are the different models or frameworks available for software product management.
- OUTCOME: Outcome relates to the factors of importance. In our research work the main factor of importance is a product which is in the form of a framework.

c) Resources

A review protocol will be developed that covers the search strategy. The following search venues are selected:

- IEEE Xplore
- ACM Digital Library
- Scopus
- Science Direct
- Wiley Inter science and
- EI Village Compendex.
- Business source premier.
Along with the above said databases Google and Google Scholar are used for identifying books about SPM, grey literature (i.e. technical reports) and conference proceedings like International workshop on Software Product Management (IWSPM), International conference on Software Business (ICSOB).

Paper published before 1995 will not be reviewed in this search. Reason for not selecting the articles before 1995 is most of the work before 1995 have been covered in the articles from 1995 till present and will also duplicate most of the results. To overcome research bias we have selected the articles between 1995-2011.

3.2.1.4 STUDY SELECTION CRITERIA

Selection criteria are done based on our research questions. Articles which discuss about SPM and its practices are selected. Articles selection is done based on Title, Abstract, Introduction and Conclusion. The study selection criteria are based on detailed inclusion and exclusion criteria which are explained as below:

- **Inclusion criteria:**
  - Articles are published in between the years 1995-2011
  - Articles which are peer-reviewed.
  - Articles have full-text.
  - Articles which are relevant to our research question.

- **Exclusion criteria:**
  - Articles which are not relevant to software engineering.
  - Articles which are not relevant to SPM (this was done based on studying the title, abstract, introduction and conclusion).
  - Duplicate Studies.
  - Languages other than English.

3.2.1.5 DATA EXTRACTION STRATEGY

A data extraction form was developed to extract the data related to RQ1 from the identified articles. The extraction form was developed into 2 phases mainly:

1. **Basic information about Research study/ Article**
   In this section we have noted the basic information related to the selected articles as follows
   - Article Name
   - Author Name
   - Article Type
   - Publication Date
   - Database Name

2. **Empirical Background regarding the article**
   In this section we have noted the empirical context of the article as follows
   - Main Method
   - Back Ground/ Nature of Study
   - Empirical focus i.e. empirically based or empirically evaluated.

3.2.1.6 DATA QUALITY ASSESSMENT CRITERIA

After the study selection criteria, the articles were validated against a quality assessment criterion. The main reason for this is to identify the limitation of the articles in the selected articles. The quality assessment criterion is done as shown in the table 4.
# Quality Assessment Checklist

<table>
<thead>
<tr>
<th>No</th>
<th>Question</th>
<th>Yes/Partial/No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Is the introduction to SPM clearly specified?</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Does the paper clearly specify the research methodology?</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Does the paper clearly discuss about the SPM practices or activities?</td>
<td></td>
</tr>
</tbody>
</table>

Table 4: Quality Assessment Checklist

3.2.2 CONDUCTING THE REVIEW

Conducting the review has following phases

3.2.2.1 ARTICLES RETRIEVAL

The articles have been retrieved from seven major databases in which the search string is used as discussed in section 3.1.1.3. The search string explained in section 3.1.1.3 was used in the databases. On a whole a total of 2767 articles were retrieved. The articles retrieval was performed in June 2011.

3.2.2.2 BASIC SELECTION CRITERIA

Each databases built in options were utilized to remove the non-english articles. Endnote\(^1\) was used to remove the duplicates. Zotero\(^2\) was also used to properly cite the references. The citations were extracted including abstract to endnote to remove the duplicates. After removing the duplicates and multiplication of articles, a total of 2129 articles were selected.

3.2.2.3 DETAILED EXCLUSION CRITERIA

From a total of 2748 articles after removing the duplicates 2040 articles were selected. Based on title and abstract a total of 126 articles were selected i.e. based on the inclusion and exclusion criteria. Finally a total of 25 articles were selected which contained full text.

Table 5 below shows a clear list about the summary of articles finalized after both inclusion and exclusion criteria.

<table>
<thead>
<tr>
<th>No</th>
<th>Databases</th>
<th>Total Articles</th>
<th>After Removing Duplicates</th>
<th>Title and Abstract Based</th>
<th>Full Review</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IEEE Explore</td>
<td>22</td>
<td>21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Elsevier Village</td>
<td>313</td>
<td>234</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Scopus</td>
<td>137</td>
<td>131</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Wiley Inter Science</td>
<td>619</td>
<td>210</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Science Direct</td>
<td>1225</td>
<td>999</td>
<td>126</td>
<td>25</td>
</tr>
<tr>
<td>6</td>
<td>Business Source Premier</td>
<td>46</td>
<td>46</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>ACM</td>
<td>386</td>
<td>363</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Google Scholar</td>
<td>42</td>
<td>36</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>2748</strong></td>
<td><strong>2040</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5: Selection of Articles

\(^{1}\) Reference management tool
\(^{2}\) Browser add-on for managing citations
3.2.3 REPORTING THE REVIEW

The results of the review are reported which shows a detailed view of the number of articles finalized. The following figure 2 shows the flow chart structure of the whole literature review articles selection.

![Diagram of Literature Review Process]

**Figure 2: Literature Review Process**

3.3 DATA ANALYSIS

For analyzing the data collected during literature review process we have used Grounded Theory (GT). In GT firstly we have collected the raw data from literature review. The raw data collected is in the form of citations, notes and fragments about the concepts and practices. GT starts with a coding process which is as shown in figure below.

![Diagram of Grounded Theory Analysis]

**Figure 3: Grounded Theory Analysis Diagram**
Open coding is the initial phase of GT in which the raw data are coded. The codes developed are in alignment to the raw data so that further coding can exploit them easily [44]. In open coding we have identified a total of 111 codes related to SPM practices.

Axial coding deals with generating of categories around the context of data identified. The open coded data are interrelated to each other to develop categories which explain the data more precisely [40]. In axial coding we have identified a total of 46 codes.

The final stage is selective coding where the categories are integrated and refined with the sub categories [40]. This categorization of common categories leads to a core category [47]. The core category is developed based on the understanding of the researcher. From the analysis of 46 codes, we have grouped them into 7 categories mainly Strategy, Market Analysis, Product Analysis, Product Strategy, Development, Marketing, and Sales and service. A detailed of the structural elements and their respective subcategories can be seen in table 8. Table 6 below shows the numerical results of GT conducted for literature review.

<table>
<thead>
<tr>
<th>Coding Stages</th>
<th>No. of Codes Identified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Coding</td>
<td>111</td>
</tr>
<tr>
<td>Axial Coding</td>
<td>46</td>
</tr>
<tr>
<td>Selective Coding</td>
<td>7</td>
</tr>
</tbody>
</table>

Table 6: Results of GT from Literature Review

### 3.4 LITERATURE REVIEW RESULTS

#### 3.4.1 QUANTITATIVE ANALYSIS

In quantitative analysis, results are shown in statistics related to the publication year, selection of studies, research context of the selected studies and authors’ contribution.

#### 3.4.1.1 PUBLICATION YEARS

A presentation regarding the selected studies based on publication year is shown in figure 4.

![Publication Years](image)
From the above graph we can see that articles related to SPM were first published by Kilpi in 1997 after that consecutively in 1998, 2 more articles were published by him. But there was a long gap and in 2006 again the need for SPM has raised as most of the companies were focusing from custom oriented to market-driven. In the above graph between the years 1999 and 2005 though articles related to SPM were published as our main focus was to identify literature related to different practices and activities in SPM and frameworks related to SPM, the articles in between these years did not explain about these. So gap was generated in between these years.

### 3.4.1.2 SELECTED STUDIES WITH RESPECT TO DATABASE

The articles selected for final work from different databases are shown in the below figure 5. Based on the review protocol we discussed in section 3.1.

From the graph we can see that most of the papers were published in EI (Compendex and Inspec), IEEE and Scopus. The below graph in figure 5 has duplicates between the databases EI, IEEE and Scopus. The articles listings were maintained in MS-Excel, where we have listed in which databases a particular was published. This helped us in showing the following figure 5. We just wanted to show in which databases most of the articles related to SPM were identified.

![Selected studies findings in Database](image)

**Figure 5: Selected Studies from Different Databases**

### 3.4.1.3 RESEARCH CONTEXT

Study context related to the identified studies is shown in figure 6. From the studies majority of them focused on industry. Out of total 25 articles majority of the articles i.e. 12 were evaluated in Industry or based on conducting case studies in industries. 7 articles were focusing on both industry and academia. 3 articles did not mention the contextual information clearly. 3 articles were literature reviews or thesis works.
3.4.1.4 AUTHORS CONTRIBUTION

Majority of the contribution towards SPM was done by Van de Weerd, I. [1] [7] [29] [31] [33] [79] which can be clearly illustrated from the figure 7 above. But initially it was Kilpi [30] [69] [70] [71] who focused on SPM which can be seen in figure 4 in section 3.1.1.1.

3.4.2 QUALITATIVE ANALYSIS

We have observed what are the key structural elements and concepts in SPM through qualitative analysis. From literature we have identified different frameworks [3] [7] [28] are available for SPM and in addition different authors [1] [66] [67] [70] [71] [76] etc have discussed about the activities involved in SPM. To group the whole data accordingly GT was used. The following table 7 gives a view of the structural elements in SPM.
Business Strategy | Market Analysis | Product Analysis | Development | Product Strategy | Marketing | Sales & Service
--- | --- | --- | --- | --- | --- | ---
It is to check how concrete you are in a specific line of business. We have placed business related factors in this category. | Analysis of the external environment to identify critical factors in the market. We have placed factors related to market in this category. | It relates to the performance of a product from business perspective. | It relates to the development of the product based on the requirements. | It deals with the positioning and pricing of the product and various factors are included. | Marketing relates to the way you market your products to meet the customer needs. | It deals with the customer factors related to support and service.

Table 7: SPM Structural Elements

3.4.2.1 STRUCTURAL ELEMENTS AND CONCEPTS IN SPM

The main structural elements in SPM are categorized as Business Strategy, Market Analysis, Product Analysis, Product Strategy, Development, Marketing and, Sales and Service.

Different researchers [3] [7] [14] [28] have designed models or frameworks related to SPM. But these models have some points which are different from each other. The differences identified are Ebert [3] has mentioned phase-gate process which is not mentioned by other frameworks [7] [14] [28]. Similarly [14] [28] have mentioned about scoping but it was not mentioned in [3] [7]. To overcome such constraints we have analyzed the data using GT by collecting all the material available through literature. Therefore we have defined the terms based on the understandings. Figure 8 shows a view of the 7 structural elements which we have identified from literature which are involved in SPM.

![Figure 8: SPM Structural Elements and their Flow](image-url)
A detailed discussion regarding the structural elements and concepts within SPM are discussed in the following sections.

3.4.2.1 BUSINESS STRATEGY:

Strategy is defined as “a game plan that stakes out firms industry posture and competitive position” [12].

Determining vision and strategy of the overall company is a basic part of business analysis” [12]. The main aim of any companies’ business strategy is “Where do we want to go? How will we get there? And why do we think we will be successful?” [26] [28]. This helps an organization in defining their vision and what activities they need to follow in achieving that vision. Vision should always highlight the core capabilities which the organization have or is willing to develop [12]. So we have structured all the concepts related to business strategy as follows: Portfolio Analysis, Strategic Planning and Management, Win/ Loss Analysis, Innovation, Market trend Identification.

![Hierarchy of Business Strategies](image)

3.4.2.1.1 Portfolio Analysis:

In portfolio analysis both the Product Managers and the company board will make decisions based on detailed analysis of current situation and what needs to be done to achieve organizations strategic objectives [12]. The decisions can be made by posing questions as below:

- Should product in development be cancelled?
- Should a mature product be revived?
- Should we focus on investments to increase market share?
- Should we invest in a more diverse set of products so that we minimize our exposure to risk in a given product category?
- Should we invest in improving the product’s name recognition in a limited geography?
- Should we invest in cost cutting for a product line?
- Should we invest in other marketing mix elements, new distribution channels, or more advertising and promotion?
- Should some products be discontinued?

3.4.2.1.2 STRATEGIC PLANNING AND MANAGEMENT

“Primary task of executive management is the definition, communication and implementation of corporate vision and strategy” [28]. Strategic planning or strategic vision of any organization is “Where do we want to go? How will we get there? And why do we think we will be successful?” [28] [68].

There are different strategic tools available like he Boston Consulting Group’s BCG Growth Share Matrix and the GE/McKinsey Model [62]. Strategic planning is familiar to the SWOT
The fundamentals of strategic planning are marketing mix elements which include pricing, promotion and place [62].

3.4.2.1.1.3 WIN/LOSS ANALYSIS
In [62] the author has explained that every organization needs to conduct a win/loss analysis. This is mostly done by product managers within the organization. The win/loss analysis is conducted after the post-launch session of a product. Product managers need to ensure that a sales person finds out the progress of the product. An official win/loss audit is conducted after the post launch session of the product. The win/loss audit is conducted in two ways which is internal and external audit.

**Internal audit:** Internal audit manages to understand the other organizations situation. The organizations situation can be identified by what was the qualification of the product, how we can sustain in the market and also interaction with sales effort. This internal audit also focuses on who the competitors were and what their representations are and how this data can be interpreted with customers.

**External Audit:** External audit needs customer interview. This needs to be taken seriously as the products are being developed for customer segments their feedback means a lot to the organization. The data or feedback from customers needs to be charted out properly.

The data gathered both from internal and external audit will be in a report which will be used by the product manager. Based on the analyzed data product manager’s needs to understand why they lost the product in the market, and what improvements can be done for future releases.

3.4.2.1.1.4 INNOVATION
Innovation is a way of solving customer or market problem which is more unique rather than that is available in the market [62]. Innovation is used to develop a product with internal or external opportunity and use its creative efforts to develop new products or process [14]. During innovation markets play a key role as most of the innovative ideas come from customer segments. So organizations must be on a role conducting surveys to identify the customer or market problems.

In the following table 8 the aforementioned activities related to business strategy are summed up

<table>
<thead>
<tr>
<th>Core Category</th>
<th>Categories</th>
<th>Article References</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Portfolio Analysis</td>
<td>[3]</td>
</tr>
<tr>
<td></td>
<td>Win/Loss Analysis</td>
<td>[28]</td>
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<tr>
<td></td>
<td>Strategic Planning and Management</td>
<td>[3]</td>
</tr>
<tr>
<td></td>
<td>Innovation</td>
<td>[28][3]</td>
</tr>
</tbody>
</table>

Table 8: Business Strategy

3.4.2.1.2 MARKET ANALYSIS

Market analysis deals with the external environment. It helps in gathering decision support information related to the markets [1]. Factors related to market analysis are placed in this section, which are as follows: Market Research, Market trend identification, Market Planning, Market Sizing, Technology assessment, Partner Companies, Supplier Management.
3.4.2.1.2.1 MARKET RESEARCH

Market research is a formal and informal method for understanding customer requirements, learning about the industry, identifying competitors which enable an organization to achieve optimal market focus [62]. Software product managers should maintain an extended network both inside and outside of the organization to get various inputs from different sources [28]. These different sources are:

- Colleagues in Marketing, Sales, Support, Services and Development.
- Internal Market Research.
- External Market Research.

Market research also helps in gather information related to market problems, market sizing and opportunities.

3.4.2.1.2.2 MARKET TREND IDENTIFICATION

Market trend identification is an active research for market opportunities which helps the product managers in expanding their existing products or creating new innovative products [1]. Market trends make change management more complex [62]. Product managers should be abrupt at determining the trends they are going to actively seek and the ones which they are going to evaluate opportunistically [12]. Trends should be categorized in terms of probability and significance [12].

3.4.2.1.2.3 TECHNOLOGY ASSESSMENT

Both opportunities and threats can accommodate with technology trends [12]. Product Managers should be aware of those threats and opportunities based on the market trend identification. Engineers often have an opinion that new tool or technique will solve all the market related problems [62]. This is due to the emerging new technologies with in the market.

3.4.2.1.2.4 SUPPLIER MANAGEMENT

Suppliers play crucial role in supply management [53]. They increase customers’ satisfaction through a value chain. Product managers must strive in identifying right set of suppliers so that the product developed creates a large potential to the organization in terms of business.

In the following table 9 aforementioned activities related to market analysis are summed up

<table>
<thead>
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<th>Core Category</th>
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<th>References</th>
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<td></td>
<td>Market Trend identification</td>
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<td>Market Sizing</td>
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<td></td>
<td>Technology Assessment</td>
<td>[28]</td>
</tr>
<tr>
<td></td>
<td>Partner Companies</td>
<td>[28][80][29][31][1][79]</td>
</tr>
<tr>
<td></td>
<td>Supplier Management</td>
<td>[28]</td>
</tr>
</tbody>
</table>

Table 9: Market Analysis

3.4.2.1.3 PRODUCT ANALYSIS

3.4.2.1.3.1 PRODUCT LIFECYCLE MANAGEMENT

Product lifecycle management (PLM) is an approach for “product related information and knowledge management within an enterprise, including planning and controlling of processes that are required for managing data, documents and enterprise resources throughout the entire product lifecycle” [14].

PLM is the business activity of governing company’s product in the most effective way, all the way throughout their lifecycle from the basic idea of developing the product until it is retired and disposed of [83]. It also concerns about the major changes made to the product across the product portfolio [1].

3.4.2.1.3.2 PRODUCT ROADMAP

A product map gives a clear picture of how the product is going to be developed in terms of new releases or versions in a time frame of 5 years [14] [28]. A roadmap is a relatively common way of representing targets based on development in the context of time and releases [54].

Product roadmap key features are short-term vision, theme identification, internal consultation, long-term roadmap, external variants [1] [79].

3.4.2.1.3.3 PRODUCT PERFORMANCE

Product performance depends mainly on the range and quality of its core strategy [62]. Product manager and key stakeholders are responsible for product performance. A product performance report card should be on the monthly agenda for product team as it is an excellent communication to use [62].

In many organizations Key Performance Indicators (KPI) are used to track the performance of a product [62]. The following list represents the product performance:

- Unit volumes
- Pricing
- Customer satisfaction
- Cost of goods
- Quality measurements
- Warranty claims
- Warranty costs
- Repair and return levels

The product performance report card at a minimum should include:

- Financial results (unit volumes, average prices, gross profit)
- Major sales activity (key wins and losses)
- External KPIs (industry and competitive activity)
- Operational KPIs; and
- Marketing mix performance (pricing movements/discounting, promotional campaign performance, and channel performance).

3.4.2.1.3.4 PRODUCT PORTFOLIO

According to [62] the product portfolio contains information regarding products those under development and existing products. Product portfolio plays an important role in PLM. Product Portfolio helps an organization managing the products for medium and long-term. Products within an enterprise have different product portfolios. Product managers should
have a strategic thinking as the net result will be having an effect on the long-term strategy or portfolio [12].

3.4.2.1.3.5 PRODUCT DEFINITION AND REQUIREMENT
A software product manager concentrates more on product dimension for which he uses inputs from different sources for gathering requirements [28]. Product definition comes into picture ones the market research, technical resource and operational analysis of the forthcoming product are complete [62]. Product definition acts as a guiding force for product planning and development process [62].

Most of the organizations accomplice product definition with product requirements, features and few business activities which were not fulfilled previously [62]. Product definition has business case as a primary business document.

Product requirements are generally implemented within the project requirements [28]. “Product requirements are the bridge between the activities of product planning and the actual building or production of a sellable product” [62].

In the following table 10 aforementioned activities related to product analysis are summed up

<table>
<thead>
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<th>Core Category</th>
<th>Categories</th>
<th>References</th>
</tr>
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<td>Product Portfolio</td>
<td>[7][74][1][29]</td>
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<td>Product Roadmap</td>
<td>[64][79][74][7][1]</td>
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<td>Product Performance</td>
<td>[28]</td>
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<tr>
<td></td>
<td>Product Line identification</td>
<td>[64][7][29][67][79]</td>
</tr>
<tr>
<td></td>
<td>Product Definition and Requirement</td>
<td>[3]</td>
</tr>
</tbody>
</table>

Table 10: Product Analysis

3.4.2.1.4 PRODUCT STRATEGY

Product strategy is a set of documents which emphasis the vision and strategy for the product or product line [62]. Khurum and Gorschek [68] have mentioned that VMOST analysis is an organizational analysis technique which helps in capturing and confirming the current strategy of the product. In addition Khurum and Gorschek [68] have mentioned that MERTS helps in creating product strategies taking both technical and strategic views in to account and also it can used by product managers in performing early requirements triage for selecting the right set of requirements during product release.

The factors which relate to product strategy are Business case, Positioning and value proposition, Product launch, Release plan, Ecosystem, Make or Buy, Pricing, Delivery model, and Legal terms.

3.4.2.1.4.1 BUSINESS CASE
A business case is a formal document which has features related to the costs of the product, product enhancements and marketing expenditures to derive economic benefits or value from it [12] [28] [63].

3.4.2.1.4.2 POSITIONING AND VALUE PROPOSITION
Product positioning is an important activity of the product team throughout the entire product life cycle [63]. It is used as a way to differentiate your products from competitors’ product
and give a cutting edge to your business making customers to buy [63]. Product positioning cannot be established without the proper foundational pieces [63]. The foundational pieces are:

1. The market segment (and customer target) on which you are focusing;
2. The need states, motivations, or problems of the customer targets;
3. The environment of the industry;
4. The competition and how each of their products is positioned.

Value proposition defines the needs and proves the economic equity to a specific customer based on the benefit observed by the customer [63]. Value proposition for product should be clearly stated and expressed in language understandable by the customer [63].

3.4.2.1.4.3 RELEASE PLAN

“Software release management is the process through which software is made available to, and obtained by, its users” [7] [29]. Release plan is always has concerned with two questions: when and what [28]. To successfully create and launch a release a release plan helps in [1].

Release plan deals with core functions like requirements prioritization, release definition, release definition validation, scope change management, build validation and launch preparation [1] [7] [29].

3.4.2.1.4.3.1 REQUIREMENTS PRIORITIZATION

From market analysis the product manager will be flowed with huge number of requirements. To handle all the requirements for the product management team will be a tedious task. So at the product management level early requirements triage should be done where illicit or inappropriate requirements are discarded [54]. Based on this the requirements are identified and prioritized by assigning weights [1] [54].

3.4.2.1.4.3.2 RELEASE DEFINITION

Once the requirements are prioritized the release definition phase will have the requirements which will be implemented for the next release [1].

3.4.2.1.4.3.3 RELEASE DEFINITION VALIDATION

The prioritized requirements are cross checked with the development team to have a clarification whether they are building the product for the right set of requirements or not [1].

3.4.2.1.4.3.4 SCOPE CHANGE MANAGEMENT

Scope change management handles different types of scope changes related to product during the development of release [1].

3.4.2.1.4.3.5 RELEASE BUILD VALIDATION

Release build validation is done with development to ensure that the build product meets the requirements set during release definition [1].

3.4.2.1.4.3.6 LAUNCH PREPARATION

Launch preparation deals with formally launching the product. The launch preparation is intimated to both internal and external stakeholders and negotiations are done regarding the issues ranging from communication, to documentation, training and preparations for the release of the product [1].
3.4.2.1.4.4 PRODUCT LAUNCH

The final phase of the software release is called product launch. It is an important and vital activity in the product life cycle phase [62]. Before the product launch a pre-launch session should be conducted. The pre-launch session helps the product manager in verifying that all the preparations have been done for the actual product introduction [12][62].

To have an attractive market window product launches should be successful [62]. Product launch is categorized into three categories they are soft launch, minimal launch and full-scale launch. Customers are more interested in a full-scale launch [84][57].

- **Soft Launch**: Frequently many companies will release the product within a short time of period because they don’t have enough resources and financial. After releasing the product, based on the customer feedback they will release certain type of versions.
- **Minimal Launch**: Taking into considerations, when the company has limited resources and funding. After releasing the product software companies might think that they will come up with a minor revision after releasing the product.
- **Full-Scale Launch**: Full scale launch is planned to yield market sales and market lead. If the companies have enough resources and budget they plan to release the product in full-scale launch and it leads to best chances of market success.

After the launch strategy a post-launch session should be conducted. The main aim of this stage is to improve future product developments efforts and shift the product from new-product to being an ongoing product requiring long-term maintenance [12].

3.4.2.1.4.5 ECOSYSTEM

“A software ecosystem is an ecosystem that forms around one specific software vendor” [55]. In [55] authors have mentioned software ecosystem as “a set of actors functioning as a unit and interacting with a shared market for software and services, together with the relationships among them. These relationships are frequently underpinned by a common technological platform or market and operate through the exchange of information, resources and artifacts”.

From above definitions it can be understood that in an ecosystem a set of companies strive towards a common goal by exchanging products.

In an ecosystem the software vendor acts as a niche player, dominator or keystone [55] [28]. Organizations in software ecosystem interact with customers, partners or software vendors in following ways [55]:

- They integrate the products or services with the software vendors products and services and sell them to the software vendors customers,
- They sell software vendors products,
- They subscribe or license to the software vendors products for internal use or for including in their own products,
- They license software to the software vendor,
- They align on the standards set by the software vendors to generate bigger markets for their standardized products.

3.4.2.1.4.6 MAKE OR BUY

Make or buy deals with acquisition of core assets and identifying partners for outsourcing or subcontracting in development [1]. Product managers need to focus on the Return on investment when they are making make or buy decisions.
3.4.2.1.4.7 PRICING

Pricing deals with what value fixed for the product. Pricing strategies are very much important in throughout the product life cycle [62]. Based on the market and product maturity the pricing of the product varies. “Often, product managers, marketers, and salespeople fixate on prices because pricing is the most visible barometer of success” [62]. Product managers should be aware of the market-oriented pricing strategies. Market pricing strategies can have opposite effects.

3.4.2.1.4.8 DELIVERY MODEL

Delivery models are the forms in which the product is delivered to the customers. Delivery models allow customers to use software over internet or by installing on their system. Previously the delivery models were in the form of CD’s. But after the advancement of SaaS the users can directly use software over internet without any need of installing it on their computers [28].

3.4.2.1.4.9 LEGAL TERMS

Legal terms are the agreement between the software vendor and customers to use the intellectual property of the software vendor i.e. the software product [28]. Depending on the nature and complexity of the software offering the organizations have a contract or license agreement in which the software can be acquired based on term and conditions [28]. The license agreement deals with some terms like what it covers and doesn’t cover.

In the following table 11 aforementioned activities related to product strategy are summed up

<table>
<thead>
<tr>
<th>Core Category</th>
<th>Categories</th>
<th>Article References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Strategy</td>
<td>Positioning and Value Proposition</td>
<td>[3]</td>
</tr>
<tr>
<td></td>
<td>Product Launch</td>
<td>[3][65]</td>
</tr>
<tr>
<td></td>
<td>Release Plan</td>
<td>[1] [31] [7] [29] [70] [64] [66] [65] [79] [69] [78] [30] [75] [65] [80] [67]</td>
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<td></td>
<td>Business Case</td>
<td>[3] [28]</td>
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<td></td>
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<td>[28]</td>
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<td></td>
<td>Make or Buy</td>
<td>[1] [28]</td>
</tr>
<tr>
<td></td>
<td>Pricing</td>
<td>[28]</td>
</tr>
<tr>
<td></td>
<td>Delivery Model</td>
<td>[28]</td>
</tr>
<tr>
<td></td>
<td>Legal Terms</td>
<td>[28]</td>
</tr>
</tbody>
</table>

Table 11: Product Strategy

3.4.2.1.5 DEVELOPMENT

Development is the process of developing software from inception to the desired output based on the requirements specified by the product manager [8]. The factors which have key focus in development are: Requirements management, Project management, Project plan, Project requirements management, Risk management, Quality assurance.

3.4.2.1.5.1 REQUIREMENTS MANAGEMENT

Requirements management is the process of managing requirements before and after the release of the product [1]. Requirements management is the activity that control requirements development, including requirements change control, requirements attributes definition, and requirements traceability [14]. Requirements management has some of the core activities like Requirements gathering, Requirements identification, and Requirements organizing [1].
3.4.2.1.5.1.1 REQUIREMENTS GATHERING
Requirements’ gathering is the process of gathering requirements both from internal stakeholders and market [1]. In this process the internal stakeholders are involved in the product management process to check right set of requirements are gathered. Partners are involved to check that the right requirements are being gathered which adheres in proper product quality.

3.4.2.1.5.1.2 REQUIREMENTS IDENTIFICATION
Requirements identification is the process of identifying the right set of requirements for the product, rewriting from market requirements [1]. In this process the requirements are rightly identified and validated so that there will not be any rework done. Also the requirements are thoroughly checked so that there will not be any duplication of requirements and similar requirements are grouped together.

3.4.2.1.5.1.3 REQUIREMENTS ORGANIZING
Requirements’ organizing is the process of organizing requirements throughout the product lifecycle and describes dependencies between product requirements [1]. In requirements organizing product requirements are organized based on similar functionality. The requirements are stored in the database to check whether the requirement is released in any feature or the requirement is ready for the next release. Requirements dependencies are also checked whether are there any conflicting requirements. This helps the team in properly thinking which requirements to be implemented in the product development.

3.4.2.1.5.2 PROJECT MANAGEMENT
“Project management is the application of knowledge, skills, tools and techniques to project activities in order to meet or exceed stakeholder needs and expectations from a project” [8].

- “Scope, time, cost and quality.
- Stakeholders with different needs and expectations.
- Identified requirements (needs) and unidentified requirements (expectations)” [8].

3.4.2.1.5.3 PROJECT PLAN
To guide the project plan properly project control and project execution are used. The main objective of project plan is to “document planning assumptions and decisions, facilitate communication among stakeholders, and document approved scope, cost, and schedule baselines” [8].

3.4.2.1.5.4 PROJECT REQUIREMENTS MANAGEMENT
Project requirements management is the process of analyzing and detailing product requirements and ensuring they are implemented within the project boundaries [28].

3.4.2.1.5.5 RISK MANAGEMENT
In [8] authors clearly define project risk management as the process concerned with identifying, analyzing and responding to project risk. In includes the process of decreasing negative consequences and maximizing positive events. Project risk management has 4 major processes they are:

- **Risk Identification**: Determining which risks are going to affect the project and documenting the characteristics of each.
- **Risk Quantification**: Evaluating risks and risk interactions to assess the range of possible project outcomes.
- **Risk Response Development**: Defining enhancement steps for opportunities and responses to threats.
• **Risk Response Control**: Responding to changes in risk over the course of the project” [8].

### 3.4.2.1.5.6 QUALITY ASSURANCE

It is the process of assessing overall project performance on a regular basis to ensure that the project will satisfy all the quality standards [8].

### 3.4.2.1.5.7 TECHNOLOGY

Technologies are used to share information regularly back and forth throughout the project phase and they can vary significantly from brief conversations to extended meetings and also from simply written documents to readily available online databases and schedules [8].

In the following table 12 aforementioned activities related to development are summed up

<table>
<thead>
<tr>
<th>Core Category</th>
<th>Categories</th>
<th>References</th>
</tr>
</thead>
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<td>Project Requirements Management</td>
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<td></td>
<td>Technology</td>
<td>[28]</td>
</tr>
</tbody>
</table>

Table 12: Development

### 3.4.2.1.6 MARKETING

Marketing deals with identifying the customer needs and developing products to meet those needs [63]. The different activities involved in market analysis are launch plan, customer analysis, partner management, and operational marketing.

#### 3.4.2.1.6.1 LAUNCH PLAN

Launch plan is a cross-functional effort and needs a team plan [62]. A launch plan deals with launching the product successfully into the market with the help of marketing team and sales team.

In the following table 13 aforementioned activities related to marketing are summed up

<table>
<thead>
<tr>
<th>Core Category</th>
<th>Categories</th>
<th>References</th>
</tr>
</thead>
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<td>Customer Analysis</td>
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<tr>
<td></td>
<td>Partner Management</td>
<td>[1][7][28][29][79]</td>
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<td>Operational Marketing</td>
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<td></td>
<td>Material</td>
<td>[28]</td>
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</tbody>
</table>

Table 13: Marketing

### 3.4.2.1.7 SALES AND SERVICE

Sales and service deals with the operation of sales and offers support services to the customers. Below is the list of tasks involved with in Sales and Service.

#### 3.4.2.1.7.1 SERVICE AND SUPPORT MANAGEMENT

Service & support management is used to manage the helpdesk to answer questions (1st line support) and also solve problems, such as small defect repair (2nd line support) and large defect repair (3rd line support) [7] [14].
3.4.2.1.7.2 SALES SUPPORT

Product manager needs to manage the sales support. At the initial stage of kickoff meeting he trains sales team how to sell products in an effective manner. In sales support they may also have sales guides, sales kits, sales briefs, and other meaningful documents in order to support the sales team to generate high market share [62].

In the following table 14 activities related to sales and service are summed up

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<thead>
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<th>Core Category</th>
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<td>Voice of Customer</td>
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<td>Understanding</td>
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<td></td>
<td>Channel Preparation</td>
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</tbody>
</table>

Table 14: Sales & Services

Based on the data gathered from literature results we have grouped the activities and their respective concepts which can be clearly seen in table 15.

The grouping was done using GT. The grouping criteria were mainly on the understanding of the literature i.e. the articles and textbooks were studied to understand what the terms really meant. Based on the understandings of the terms the grouping was started using GT which lead us to the table 15.

<table>
<thead>
<tr>
<th>Business Strategy</th>
<th>Market Analysis</th>
<th>Product Analysis</th>
<th>Product Strategy</th>
<th>Development</th>
<th>Marketing</th>
<th>Sales &amp; Services</th>
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</thead>
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<td>Business Case</td>
<td>Requirements Management</td>
<td>Launch Plan</td>
<td>Service &amp; Support Management</td>
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<td>Product Performance</td>
<td>Release Plan</td>
<td>Project Plan</td>
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<td>Sales Support</td>
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<td>Project Requirements Management</td>
<td>Operational Marketing</td>
<td>Operational Sales</td>
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<td>Partner Companies</td>
<td>Product Definition &amp; Requirement</td>
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</tbody>
</table>

Table 15: SPM Framework (Literature Review)
3.4.3 UNDEFINED TERMS IN LITERATURE

From literature review we have identified that some of the terminologies were mentioned within the articles and textbooks but an explanation regarding what the terminologies mean is not discussed. Such undefined terminologies in literature are:
1. Market Sizing
2. Partner Companies
3. Customer Analysis
4. Partner Management
5. Operational Marketing
6. Material
7. Technical Support
8. Operational Sales
9. Service Partner
10. Sales Management
11. Channel Preparation.

The above terms were identified after we have thoroughly gone through the articles and the text books identified during literature review.

3.5 SUMMARY

Initially a pilot study was conducted in Google scholar using the term “Software product management” to check how many articles were available relevant to the research study. Based on the articles identified from pilot study search string was formulated taking into account keywords mentioned in those articles. The search string is as shown in table 3.

From literature review we have identified 3 frameworks [3] [7] [28] for SPM. In addition we have also identified activities involved in SPM discussed by different authors [1] [66] [67] [70] [71] [76]. Firstly we have collected the data from the 3 frameworks and the articles identified through literature were collected into excel sheet based on the data extraction form which is shown in figure 22. To properly structure the data gathered through literature review we have used Strauss and Corbin GT [45]. The 3 frameworks were clearly studied to understand which activities are being involved in their respective practices. Based on this a preliminary framework was designed for the literature review data which is as shown in table 15. A detailed discussion about the SPM activities is discussed in section 3.3.2.

In addition from the literature review, we have identified some of the activities which are mentioned in the literature, but an explanation regarding what these activities meant is missing. So we have identified such undefined terms from literature which are shown in section 3.4.3.

3.5.1 LIMITATIONS OF LITERATURE REVIEW

From literature review we have identified articles related to SPM. But as our main focus was to study what are the different practices and activities involved in SPM we have gone through all the articles clearly. There might be a chance we might have missed some articles to overcome this we have gone through each and article thoroughly to select articles related to our research aim. We have used two main keywords “Software product management” and SPM as our main focus was to find the different activities involved with in SPM. We have not used some of the terms like Business Analyst or Product Management etc in our search string. This was mainly because a business analyst mainly focuses on requirements
engineering. As product management is a huge area and is more focused on other industrial sectors not only software itself we have excluded it. This might be a threat to our work. To overcome this based on the pilot study conducted we have identified the keywords and formulated the search string so we assume we haven’t missed much of the articles.
4 INTERVIEWS

In our thesis we did interviews with different SPM practitioners to identify what are the different SPM practices they are following and what deliverables they are expecting from junior software product managers. This helped us in finding answers to RQ2.

4.1 INTERVIEW AIM AND OBJECTIVES

The main aim of conducting interview was to identify what are the different practices followed by software product managers during SPM. In interviews we mainly focused on gathering data related to what practices needs to be focused by junior software product managers and what deliverables are expected from them. To fulfill the above aim following objectives are met:

1. To identify what practices are being followed by software product managers.
2. To identify what different practices needs to be focused by junior software product managers.
3. To identify what deliverables are expected from junior software product managers.
4. To identify how many years of experience is needed to be chosen for the role of software product manager.

4.2 INTERVIEW PROCESS

In our thesis we conducted qualitative interviews. According to Wohlin et al [58], in qualitative interview there is no fixed control or restrictive structure. Kvale [59] described qualitative research interview as a means to seek the meanings of the central themes with in the world of the subjects. Kvale [59] described seven stages of interview investigation which are thematizing designing, interviewing, transcribing, analyzing, verifying and reporting. In our interview structure we followed these steps to overcome difficulties and ambiguity during the interviews.

4.2.1 THEMATIZING

Thematizing helps in investigating why and what is the purpose of the interview [59]. So in the starting itself it was crucial for us to defining and clarifying what was the purpose of interview and rationales are. The purpose of conducting interview was to find answers to the following research questions:

RQ2. What are the practices followed, concepts utilized and deliverables expected from junior software product manager and their responsibilities?

RQ2.1 what characterizes a person as new to the field?

RQ2.2 how many years experience is needed before a person can be a junior product manager?

The interview participants were first contacted through mail in advance and introduced the purpose of the interview. They were provided with the aim of the study, expected outcomes of the study to familiarize them with the purpose of the research. A detail classification of the study is clearly presented in Chapter 1.

4.2.2 DESIGNING

The way in which interviews are carried out may have an impact on the quality of the data collected [60]. Therefore interviews should be designed and conducted with great attention and exertion. We designed the interview in a semi-structured way were the open-ended
questions were asked for discussion and closed ended questions for inquiry. A detailed list of interview questions is presented in Appendix 10.3. Due to exploratory nature there were chances that the interviewer’s understanding regarding the topic can alter. Thus the following questions evolved.

4.2.2.1 INTERVIEWEE SELECTION

To get valuable and exact information selection of participants is absolutely important. In this study, the interviewee selection was important because we are focusing on designing a model for junior software product managers so practitioners who are having minimum 1 year experience in SPM were considered. These peoples experience helps in gaining insights broadly in to the theme from different views.

4.2.2.2 INTERVIEW TECHNIQUES

Predefined interview techniques makes qualitative data interview different from daily conversations [61]. During interviews follow up questions should be asked carefully for clarification. Interview guide should be used cautiously otherwise it can oppose the participant’s interest in continuing the interview [61]. Concentrated listening, genuine interest on subject and self intuition on the subjects story can yield in effective questioning [61].

All the interviews were conducted by both the interviewers who did this research work. The role of one interviewer was to take notes regarding the questions being asked and collecting data while the other interviewer was leading the interviewee by posing question to the respondent. Each interview was set to a length of one hour.

4.2.3 INTERVIEWING

In total 2 interviews were conducted. It was really difficult in finding the contacts of software product managers because they are often represented as mini-CEO of an organization [1] [2]. Getting contacts of such level people has been a tedious task. We conducted the interviews using Skype. In [59] author has mentioned that before the start of interview a brief introduction regarding the interview should be given. Before the start of interview the interviewee was clearly explained the goal of the interview and post the interview the interviewee was explained regarding the outcomes of the study and its benefits. Briefing the interviewee regarding the interview helped us in getting more insight and asking more questions regarding the topic of focus.

4.2.3.1 INTERVIEWEE BACKGROUND

Detailed information regarding the interviewee background is summarized in the following sections.

4.2.3.1.1 INTERVIEWEE 1, UNILYRICS

Unilytics is a global leader in web analytics arena founded in 2001. It has a client base of over 800 customers including top firms in a diverse range of industries and all levels of government. The interviewee works in US and is working with the organization for almost 3 years.

Interviewee has an experience of 3+ years in SPM and has 12 years experience in Sales. The interviewee is working on creating products, which customers did not get from Google Analytics. The interview was conducted for an hour. During the start of the interview the
interviewee was clearly explained regarding the goal of the interview and based on these questions were asked. The interview was an open-ended discussion on the research topic which is SPM.

4.2.3.1.2 INTERVIEWEE 2, XYZ ORGANIZATION

Interviewee has an experience of 6 years in SPM and has 7-8 years experience in developing telecom software.

<table>
<thead>
<tr>
<th>COMPANIES</th>
<th>KEY PRODUCTS</th>
</tr>
</thead>
</table>
| UNILYTICS | Montage- Dashboard Application  
Mergence- SharePoint Analytics application 
VHED- 1:1 Marketing application |
| XYZ       | Platform Management 
Operating Supporting System 
Telecom Software |

Table 16: Summary of Organizations

4.2.4 TRANSCRIBING

Transcribing the data gathered during interview an iterative process within itself [59]. Different methods are available for recording the data during interviews. During interviews we have used two methods for collecting data which are tape recording and taking notes. Tape recording was used to record the data being said by the interviewee during the course of interview as not to miss any single bit of information during the analysis. Notes were also taken regarding important points and regarding questions which were raised during the interview session. One interviewer lead the interview and the other acted as an inscriber.

The data was transcribed immediately after the interviews as to reduce potential threats. The sources used for data transcription are notes and tape recordings used during the interview process. The gathered data from transcription are summed to a whole data. The authors have worked individually in transcribing the data and later discussed the data. During ambiguity the authors referred back to the collected data to overcome the hurdles.

After the interview was done the interviewees were asked to fill the data in the questionnaire and send it, so that it acts as a validation proof in case of any mistakes done during the transcribing process.

4.2.5 ANALYSIS

Analyzing is the process evaluating the transcribed data revealing the actual knowledge received in terms of texts through interviews. Different analysis approaches are explained by Kvale [59]. They are condensation, categorization, structuring through narratives, interpretation and ad-hoc meaning generation. For generating different results during analysis of data these methods can be used.

We used GT for analyzing the data which are recorded during the interview and transcripts. The chunk of data received during interviews collected and analyzed using GT. The main reason for using GT was it helps in putting codes to the data gathered and so on proceed to build theory which is a framework in our case. During this building process GT also helps to check back at data whenever there is an ambiguity regarding the theory being developed. During analyzing of data when ever doubts occurred we referred back to the recordings to clear ambiguity within.
4.2.6 VALIDATING

After the interview was done we asked the interviewees to fill the questionnaire and mail it back to us so that in case of any ambiguity we referred it as a validation proof. This helped us in clarifying vague data which was received during the interview like some of the data was not clear i.e. the speech of the interview respondent was not clear when transcribing the data gathered.

4.2.7 REPORTING

Reporting is the final phase of qualitative interview research where a generalized report is developed contributing to the state of knowledge [59]. The process of thematizing, designing, interviewing, transcribing, analyzing, validating are discussed clearly in the previous sections. The results are reported in the subsequent sections below.

4.3 DATA ANALYSIS

In the interviews we have used the ISPMA framework [14] and SPM framework [57] to make familiarize with the questions we are asking. The reason for choosing these two frameworks is after analyzing the literature review data we have observed that most of the activities are being covered in [14] and [57] had some of the activities which we have gathered through literature. To make it easy during the interview process we have chosen the frameworks framework [14] and SPM framework [57].

During the interview process both interviewees have mentioned they follow Pragmatic Marketing Framework [81] but one of the interviewee has mentioned they use it partially but uses all the practices mentioned in the ISPMA framework [14]. The main categories in ISPMA framework [14] are Strategic Management, Product Strategy, Product Planning, Development, Marketing, Sales and Distribution, and Evolution & Service. Categories in Pragmatic Marketing framework [81] are Market, Strategy, Business, Planning, Programs, Readiness and Support. So for analyzing the data in the ISPMA [14] and Pragmatic Marketing [81] frameworks we have used GT. Data received is collected as a chunk and then the data are coded accordingly. These codes were grouped to their related categories or structural elements.

Initially we have identified a total of 75 codes. After removing the synonyms and similar words we have got 47 codes. These 47 codes were grouped together with their similarities and processes. Finally we generated 7 core categories. The results are shown in table 17.

<table>
<thead>
<tr>
<th>Coding Stages</th>
<th>No. of Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Coding</td>
<td>75</td>
</tr>
<tr>
<td>Axial Coding</td>
<td>47</td>
</tr>
<tr>
<td>Selective Coding</td>
<td>7</td>
</tr>
</tbody>
</table>

Table 17: Results of GT from Interview Data

4.4 INTERVIEW RESULTS

From interview we have identified structural elements in. There are 7 structural elements which are Market Analysis, Strategic Management, Product Planning, Development, Product Strategy, Marketing, Sales and Service. We have arrived to these 7 structural elements using GT. A detailed view of the structural elements and concepts in SPM which were gathered through interviews are shown in table 18.
4.4.1 STRUCTURAL ELEMENTS AND CONCEPTS IN SPM

4.4.1.1 MARKET ANALYSIS

Market analysis deals with the identification of market problems and competitors within the market. Factors related to these market ideologies are grouped in this section.

4.4.1.1.1 MARKET PROBLEMS

Market problems deals with customer problems, customer requirements, what customers are expecting from organizations.

4.4.1.1.2 WIN/LOSS ANALYSIS

Win/loss analysis deals with identifying who bought your product and who did not buy your product [81]. Analyzing what is the reason for people choosing or not choosing your product helps in identifying what type of products customers are expecting.

4.4.1.1.3 DISTINCTIVE COMPETENCE

Identifying core strengths of the organization and delivering value to the market through those abilities [81].

4.4.1.1.4 COMPETITIVE LANDSCAPE

Competitive landscape is used to identify the competitors in the market who are offering the same product with some distinct features [81]. Analyzing their strengths and weaknesses within the market segments and developing strategies to win over them within the targeted markets.

4.4.1.2 STRATEGIC MANAGEMENT

Strategic management deals with the strategies the organization implements to have a leading edge than their competitors.

4.4.1.2.1 CORPORATE STRATEGY

Corporate strategy is the strategy used by organizations to withstand themselves in the marketing settings and allocating proper resources for the products being developed.

4.4.1.2.2 MARKET DEFINITION

Mapping the market problems with target segments and analyzing the markets to actively engage. The target markets should be large so that it helps for the current and future business products.

4.4.1.2.3 INNOVATION

Innovation is the process of developing a product using either internal or external stakeholders’ ideas so that it solves the market or customer requirements.

4.4.1.2.4 BUSINESS PLAN

Business plan deals with making a thorough analysis of the targeted markets to identify opportunities, so that the organization can have their investments in those segments [81].

4.4.1.2.5 TECHNOLOGY ASSESSMENT

Organizations should be abrupt at the new emerging technologies. They should be always advanced in adopting the new technologies based on the market needs. This is because to survive in the competition organizations should always look for options.
4.4.1.2.6 RESOURCE MANAGEMENT

Resource management is a key area for any organization. For developing products organizations should allocate resources. So based on their previous products win/loss analysis organizations should be aware in allocating resources properly, otherwise it leads for improper product development and less quality products.

4.4.1.3 PRODUCT PLANNING

Product planning deals with the positioning of the product in alignment to the corporate strategies both in top-down and bottom-up approach.

4.4.1.3.1 PRODUCT LIFECYCLE MANAGEMENT

Product lifecycle management deals with the entire lifecycle of the product from the very first idea of generating the product until the product is retired from market.

4.4.1.3.2 PRODUCT ROADMAP

Product roadmap deals where does the product be in a span of 5 years and how do you want to get there. Based on the short term and long term goals product roadmap is designed.

4.4.1.3.3 PRODUCT PROFITABILITY

Analyzing and monitoring the product progress in the markets. Indicating key performance indicators to identify how the product is affecting the organizations progress and helping in building profits [81].

4.4.1.3.4 POSITIONING

Positioning the product in the whole organizations product line and where to place the product in the market is always a challenging decision to the software product manager.

4.4.1.3.5 PRICING

Pricing is another hurdle which most of the software product managers face. To overcome this software product managers should establish pricing models and generate strategies with the sales team so that they can fix appropriate value to the product developed [81].

4.4.1.3.6 RELEASE PLAN

Release plan deals with prioritizing and elicitation of the requirements. Using release plan software product managers try to characterize their products release i.e. whether the product should be released in 2 phases or 3 phases.

4.4.1.3.7 REQUIREMENTS

Requirements deals with which requirements should be included in the product based on the market problems. A requirements database should be managed by the software product manager which requirements are highlighted during the release plan and which requirements should be opted for the next release.

4.4.1.3.8 STATUS DASHBOARD

Status dashboard is used to identifying the key dates regarding the product launches based on the launch plan [81].

4.4.1.3.9 LAUNCH PLAN

A launch plan is an integration of all the teams within the organization to ensure the product releases and ready for the product launch [81].
4.4.1.3.10 BUYING PROCESS
Researching and documenting the buying process which the customers encounter during buying of a product [81]. A detailed documenting should be done what challenges are customers are encountering during the selection process of the product.

4.4.1.4 PRODUCT STRATEGY

Product strategy is a set of documents which emphasis on the vision and strategy of the product developed.

4.4.1.4.1 PRODUCT PORTFOLIO
Product portfolio contains information about existing products and those that are under development process.

4.4.1.4.2 BUY, BUILD OR PROCESS
Often during SPM software product managers are faced with the problem of not getting the product on time. At such times product managers have a discussion with the project managers whether the engineering team will be developing the product within the give time or they plan to buy components from 3 party vendors or they build the component by outsourcing it. This is often a challenging decision to the software product managers as they have to allocate extra resources during this process.

4.4.1.4.3 ECOSYSTEM MANAGEMENT
Software product managers have to manage their ecosystem as third party vendors are interested to build suitable software or plug-ins for their products. So the software product manager has to see whether the vendors are in alignment to the standards set by them.

4.4.1.4.4 LEGAL AND IPR MANAGEMENT
Legal and IPR management is the terms and condition between the software vendors and customers to use their products. It is the legal norms set by the government which has to be followed by every organization.

4.4.1.4.5 DELIVERY MODEL
Delivery model is the way in which products are delivered to customers.

4.4.1.5 DEVELOPMENT

Development is used for building the product based on the requirements specified by the software product manager.

4.4.1.5.1 PROJECT MANAGEMENT
It is the application of knowledge and skills in order to meet the stakeholders’ requirements.

4.4.1.5.2 PROJECT REQUIREMENTS ENGINEERING
It is the process of managing the requirements specified by the software product manager within the specified boundaries of the project.

4.4.1.5.3 ENGINEERING MANAGEMENT
Engineering management deals with the principles of engineering and management to solve the problems of developing a product from inception to a final product.
4.4.1.5.4 QUALITY MANAGEMENT
Quality management is the process of ensuring overall quality of the product pre and post the development of the product.

4.4.1.5.5 PERFORMANCE AND RISK MANAGEMENT
Performance and risk management deals with the performance of the product components and identifying the risk in the project.

4.4.1.6 MARKETING
Marketing deals with identification of the human and social needs and meeting them [63].

4.4.1.6.1 EVENT SUPPORT
It is used for advertising the product in the markets during events such as conference, tradeshows, webinars and seminars [81].

4.4.1.6.2 PRESENTATION AND DEMOS
Is used to describe what are the standards are available in the product and also provide demo scripts to the users or customers [81].

4.4.1.6.3 THOUGHT LEADERSHIP
Innovate and generate information through webinars, blogs, e-books etc to influence “customers, buyer’s industry specialist, research analyst and also other third parties” [81].

4.4.1.6.4 REFERRALS AND REFERENCES
Customers willing to give testimonials and interested as being a referee account for the product is called referrals & references [81].

4.4.1.6.5 CUSTOMER RELATIONSHIP MANAGEMENT
A strategy used for managing and developing close relationship between the organization and customers [62].

4.4.1.6.6 CUSTOMER ANALYSIS
Identify the customers who are willing to buy your product and make an analysis of the other buyers which lead them to buy your product.

4.4.1.6.7 MARKETING MIX OPTIMIZATION
Marketing mix optimization enables a product manager to allocate resources for marketing the product to attract customers and generating revenue on the long run.

4.4.1.6.8 MARKETING SUPPORT
Marketing support is used to manage and train the sales team for generating high market share on the market [62].

4.4.1.6.9 MARKETING PLAN
Marketing plan is used for marketing the products to attract large pool of customers and detailed report where the product sales are high and low. The marketing manager should look for opportunities and prepare marketing strategies and programs [63].
4.4.1.7 SALES AND SERVICE

4.4.1.7.1 SALES PROCESS
For selling a product or service describing the key characteristics of the product aligning with organization’s selling process to the buying process [81].

4.4.1.7.2 TECHNICAL SUPPORT
Technical support is used to solve the customer problems through live chat, email, and telephonic conservations.

4.4.1.7.3 SPECIAL CALL
It is used to provide information about product to key customers in support with existing sales efforts [81].

Considering both the Pragmatic marketing framework and ISPMA framework the data is gathered and using GT we have grouped the activities and their respective concepts which can be seen in below table 18.

<table>
<thead>
<tr>
<th>Market Analysis</th>
<th>Strategic Management</th>
<th>Product Planning</th>
<th>Product Strategy</th>
<th>Development</th>
<th>Marketing</th>
<th>Sales &amp; Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market Problems</td>
<td>Corporate Strategy</td>
<td>Product Lifecycle</td>
<td>Product Portfolio</td>
<td>Project Management</td>
<td>Event Support</td>
<td>Sales Process</td>
</tr>
<tr>
<td>Win/Loss Analysis</td>
<td>Market Definition</td>
<td>Product Roadmap</td>
<td>Buy, Build Or Process</td>
<td>Project Requirements</td>
<td>Presentation &amp; Demos</td>
<td>Sales Management</td>
</tr>
<tr>
<td>Distinctive Competence</td>
<td>Innovation</td>
<td>Product Profitability</td>
<td>Ecosystem Management</td>
<td>Engineering Management</td>
<td>Thought Leadership</td>
<td>Technical Support</td>
</tr>
<tr>
<td>Competence Landscape</td>
<td>Business Plan</td>
<td>Positioning</td>
<td>Legal &amp; IPR Management</td>
<td>Quality Management</td>
<td>Referrals &amp; References</td>
<td>Service Preparation</td>
</tr>
<tr>
<td>Technology Assessment</td>
<td>Pricing</td>
<td>Delivery Model</td>
<td>Performance &amp; Risk Management</td>
<td>Customer Relationship Management</td>
<td>Services Provisioning</td>
<td></td>
</tr>
<tr>
<td>Resource Management</td>
<td>Release Plan</td>
<td></td>
<td></td>
<td></td>
<td>Customer Analysis</td>
<td>Special Calls</td>
</tr>
<tr>
<td>Requirements</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Marketing Mix Optimization</td>
<td>Operational Distribution</td>
</tr>
<tr>
<td>Status Dashboard</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Marketing Support</td>
<td>Collateral</td>
</tr>
<tr>
<td>Launch Plan</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Marketing Plan</td>
<td></td>
</tr>
<tr>
<td>Buying Process</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 18: SPM Framework (Interview Results)

4.5 SUMMARY

Based on the data gathered from literature review interviews were conducted with 2 practitioners. During the interview we have asked the SPM practitioners what type of framework they use when implementing SPM. Both the software product managers mentioned they don’t follow any specific framework for SPM but their work is more close to
the pragmatic marketing framework [8]. In addition they mentioned they cover almost all the activities mentioned in the ISPMA framework [14]. To properly structure the data gathered from interviews we have used Strauss and Corbin GT [45]. Based on this a preliminary framework was designed which is shown in table 18.

Our main focus for conducting interviews was to identify what activities needs to be focused by junior software product managers. Both the practitioners have mentioned they need to be more of a product marketing manager and needs to focus on requirements management. This was mainly because as a product marketing manager he will be close to the customer segments which helps him in understanding what are the market problems and what customers are mainly expecting from their products. Based on this he can properly design strategies for the future products as he moves up by gaining experience as a software product manager. As a product marketing manager he needs to properly manage requirements. This helps him in properly understanding whether he is gathering the correct set of requirements which the customers are expecting for the future products or not.

4.6 LIMITATIONS OF INTERVIEWS

In our research we were able to conduct interviews with only 2 participants. This mainly because a software product manager acts as a mini-CEO in the organization and findings contacts of such high level people was not easy. During the interviews we tried to gain as much data as possible from the interviewees. The data was collected in the form of audio tapes and written notes. During the analysis of the data we could not understand some of the words due to audio clarity. To overcome this we have asked the interview participants to fill the interview questionnaires and send it back to us post the interview session. This way we have tried to overcome some limitation regarding the data clarity. Finding more interview contacts would have been more helpful to our research scope but due to limited time constraints we were not able to find contacts on time. This might act as a limitation to our work as finding more contacts would have helped in getting more insight into SPM. To overcome this, survey was conducted to gather data from more participants.

4.7 COMPARATIVE ANALYSIS

We performed comparison analysis of literature data with interview data. We did the comparison with the initial codes drawn from raw data which is open codes both from literature review and interviews. This was done mainly because open codes gave us the precise understanding of the entities.

Totally we got 111 open codes from literature and 75 open codes from interview for doing comparative analysis. In table 19 common and unique codes are shown both for the interview and literature results.

<table>
<thead>
<tr>
<th></th>
<th>Total Codes</th>
<th>Common Codes</th>
<th>Unique Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Literature review</td>
<td>111</td>
<td>53</td>
<td>58</td>
</tr>
<tr>
<td>Interview</td>
<td>75</td>
<td>53</td>
<td>22</td>
</tr>
</tbody>
</table>

Table 19: Comparison of Common and Unique Codes

Comparison of the practices identified from literature review and interview are shown in figure. We have identified much of the unique codes from literature review. We have identified 22 new practices from interview.
From the above figure 10 we can see that most of the practices are reported in literature where as less number of practices are identified from interviews.

During the interviews we have used the ISPMA [14] and SPM [57] frameworks as we have observed during the analysis of literature data that most of the activities are covered in these two frameworks. So there is a chance of redundancy in the literature review and interview data. In addition to the above mentioned two frameworks the interviews have introduced us to a new framework called Pragmatic marketing framework [81]. So for during the analysis of interview data the Pragmatic marketing framework [81] was also considered.

Below table 20 gives a list of common codes identified both from literature review and interviews.

<table>
<thead>
<tr>
<th>COMMON CODES IDENTIFIED FROM LITERATURE REVIEW AND INTERVIEWS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Case</td>
</tr>
<tr>
<td>Product and Technology Roadmapping</td>
</tr>
<tr>
<td>Voice of Customer Understanding</td>
</tr>
<tr>
<td>Eco System</td>
</tr>
<tr>
<td>Project Management</td>
</tr>
<tr>
<td>Project Definition and Support Management</td>
</tr>
<tr>
<td>Launch Plan</td>
</tr>
<tr>
<td>Product Line Identification</td>
</tr>
</tbody>
</table>

Table 20: List of Common Codes Identified both from Literature Review and Interviews
Based on the comparative analysis of the literature review data and interviews data we have designed a preliminary framework regarding the activities in SPM. The table 21 below shows the different SPM practices and activities involved in them.

<table>
<thead>
<tr>
<th><strong>Market Analysis</strong></th>
<th><strong>Strategic Management</strong></th>
<th><strong>Product Planning</strong></th>
<th><strong>Product Strategy</strong></th>
<th><strong>Development</strong></th>
<th><strong>Marketing</strong></th>
<th><strong>Sales and Services</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Market Research</td>
<td>Portfolio Analysis</td>
<td>Product Lifecycle Management</td>
<td>Business Case</td>
<td>Project Management</td>
<td>Launch Plan</td>
<td>Service Partner</td>
</tr>
<tr>
<td>Market Trend Identification</td>
<td>Innovation</td>
<td>Product Roadmapping</td>
<td>Product Launch</td>
<td>Project Requirements Management</td>
<td>Event Support</td>
<td>Sales Management</td>
</tr>
<tr>
<td>Competitive Analysis</td>
<td>Business Plan</td>
<td>Release Plan</td>
<td>Positioning and Value Proposition</td>
<td>Risk Management</td>
<td>Thought Leadership</td>
<td>Sales Support</td>
</tr>
<tr>
<td>Technology Assessment</td>
<td>Strategic Planning and Management</td>
<td>Product Definition and Requirement</td>
<td>Delivery Model</td>
<td>Project Plan</td>
<td>Marketing Mix Optimization</td>
<td>Technical Support</td>
</tr>
<tr>
<td>Win/ Loss Analysis</td>
<td>Status Dashboard</td>
<td>Ecosystem Management</td>
<td>Quality Assurance</td>
<td>Marketing Plan</td>
<td>Channel Preparation</td>
<td>Operational Distribution</td>
</tr>
<tr>
<td></td>
<td>Buying</td>
<td>Pricing</td>
<td>Marketing Support</td>
<td>Customer Relationship Management</td>
<td>Collateral</td>
<td></td>
</tr>
</tbody>
</table>

Table 21: Framework based on Comparative Analysis of Literature Review and Interview Data
5 Survey

We conducted survey to identify what practices are being followed by software product managers and also junior software product managers. We also focused on what areas should junior software product managers must focus once they take up the job. To properly identify the practices being followed by practitioners during SPM the data gathered through interviews helped us in formulating the survey questionnaire. We have opted survey as the best option for our research, when compared to other research methods like case studies, experiment, and ethnography. In our research, these methods are not suitable for us because it needs an in-depth analysis of a particular organization or company [36]. As our work was to identify what practices are being followed we have ruled out those methods.

Benefit of survey is to we can target large number of population and get more information from practitioners globally. This helps in receiving huge number of responses which helps in analyzing the data towards our thesis aim [58]. Survey is conducted to draw samples from the population obtained, this aims at generalizing the suggestions [58]. Due to limited time constraint we found that survey is the best suitable method for our research. This survey helps us answering the research question

RQ2. What are the practices followed, concepts utilized and deliverables expected from junior software product manager and their responsibilities?

RQ2.1 what characterizes a person as new to the field?

Survey design, survey process and the results obtained from survey are discussed in the following sections.

5.1 Survey Design

Based on literature review and the input gathered from interviews we have designed the questionnaire which can be seen in Appendix 10.4. Literature review and interviews were the basis for performing surveys with different SPM practitioners globally. As we could not interview much of the practitioners, so to target large pool of practitioners we have used survey as an alternative. The main aim is to identify what practices are being followed by software product manager as well as junior software product managers. As a result, designed the survey with questions related to the practices being followed and what is the order they follow those activities.

Questionnaire is designed through a web interface (www.fluidsurvey.com) as it is the best approach for the respondents who are residing in various geographical locations. By sending a web survey link to them it is easy to collect response from them. Fluid surveys are free to use and we can analyze the results very carefully and it has some extra features. Survey was divided into two parts.

The first part consists of demographic questions and the second part consists of both open ended and close ended questions. Second part of the questionnaire focuses on the research question. In our survey we have total 10 questions in this two are demographic question and the remaining 8 questions are relevant to our research question RQ2 and RQ2.1. In those 8 questions, one is both open ended and close ended question and the remaining questions are close ended questions. To get information about the participants, demographic questions were asked. Questions like what are products you have developed, what is the size of the organization, how many year of experience they had before being a software product manager which was important for our research question and the remaining questions were
based on literature review results. All the close ended questions consist of multiple choice and single choice. And the open ended question was made optional to the participants. Detailed survey questionnaire is shown in the appendix 10.4.

5.2 QUESTIONNAIRE DISTRIBUTION

The survey was conducted online. First of all, we have identified what are the different groups available related to Product Management and Software Product Management on LinkedIn, Google groups, Yahoo groups etc. and the questionnaire was posted in each and every group. We have also identified individual product managers through some social networking sites and blogs. We have requested them to participate in the survey. The selected participants were currently working as software product managers’ in different organizations globally. Figure 11 shows the survey design process.
5.3 PILOT SURVEY

A pilot survey was conducted with one of the industry practitioner. Based on the understandings and feedback from him we have modified the survey questionnaire. We had undergone two iterations during the survey questionnaire construction. This was because some questions were ambiguous or they were not attracting the practitioners because of the data representing them. Based on a thorough pilot survey we have finalized the survey questionnaire and uploaded it in different blogs related to Product Management and Software Product Management.

5.4 SURVEY RESULTS

This section presents the results which were obtained from the survey. We got a total of 72 responses from which 29 were fully filled responses and 43 were incomplete responses. So we have excluded the 43 responses. All the respondents in the survey had experience in SPM. 4 respondents had experience of 1-2 years, 15 respondents had experience of 3-6 years, 3 respondents had experience of 7-10 years and 7 respondents had experience of 10+ years. From the values we can see that most of them had good experience in SPM. Detailed analysis of the survey results are as follows.

5.4.1 DEMOGRAPHIC QUESTIONS

In our survey we had 2 demographic questions:

1. How many employees work in your organization?
2. What are the different products you have developed?

The authors have kept contact name and Email as optional this is because most of the respondents might not be interested in disclosing themselves.

<table>
<thead>
<tr>
<th>Response</th>
<th>Chart</th>
<th>Percentage</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. 1-50 employees</td>
<td></td>
<td>25%</td>
<td>7</td>
</tr>
<tr>
<td>B. 51-100 employees</td>
<td></td>
<td>11%</td>
<td>3</td>
</tr>
<tr>
<td>C. 101-500 employees</td>
<td></td>
<td>25%</td>
<td>7</td>
</tr>
<tr>
<td>D. 500+ employees</td>
<td></td>
<td>39%</td>
<td>11</td>
</tr>
</tbody>
</table>

Figure 12: Number of Employees in Organization

Figure 12 shows that 11 respondents are working in organization which has 500+ employees. This is 39% of the overall responses. 7 respondents are working in organizations which have 10-50 employees and 101-500 employees. This is 25% of the overall responses. 3 respondents are working in organizations which have 51-100 employees. This is 11% of the overall responses. From the table we can see that majority of the responses from respondents who are working in organizations which has 500+ employees.
Figure 13 shows what are the different products they are developing. Most of the respondents are developing Operations and Professional software, Platform and management software and most of the respondents mentioned they develop other types of software’s like Operating supporting system, Telecom software, Media management product, Petroleum exploration/ Production, Firewalls, Banking item processing, Vehicle management software, Enterprise performance management products.

<table>
<thead>
<tr>
<th>Response</th>
<th>Chart</th>
<th>Percentage</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Platform and management</td>
<td></td>
<td>45%</td>
<td>13</td>
</tr>
<tr>
<td>B. Education and reference</td>
<td></td>
<td>7%</td>
<td>2</td>
</tr>
<tr>
<td>C. Home and entertainment</td>
<td></td>
<td>10%</td>
<td>3</td>
</tr>
<tr>
<td>D. Content and communications</td>
<td></td>
<td>24%</td>
<td>7</td>
</tr>
<tr>
<td>E. Operations and professional</td>
<td></td>
<td>55%</td>
<td>16</td>
</tr>
<tr>
<td>F. Product manufacturing and service delivery</td>
<td></td>
<td>17%</td>
<td>5</td>
</tr>
<tr>
<td>G. Line of business</td>
<td></td>
<td>28%</td>
<td>8</td>
</tr>
<tr>
<td>Other, please specify:</td>
<td></td>
<td>31%</td>
<td>9</td>
</tr>
</tbody>
</table>

**Total Responses** 29

Figure 13: Different Products they are developing

In the survey we have mentioned different types of software Platform management, Education and reference, Home and entertainment etc. The below table shows what are all the products are included in those.

<table>
<thead>
<tr>
<th>Platform and Management</th>
<th>Desktop, Network infrastructure and Management software</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education and reference</td>
<td>Educational Software</td>
</tr>
<tr>
<td>Home and Entertainment</td>
<td>Proposal use and Gaming Software</td>
</tr>
<tr>
<td>Content and Communications</td>
<td>Office Productivity suites, Multimedia players, File viewers, Web browsers</td>
</tr>
<tr>
<td>Operations and Professional</td>
<td>ERM, CRM, Information management, Application Insurance</td>
</tr>
<tr>
<td>Product Manufacturing and Service delivery</td>
<td>Administrative support, Information, finance and Insurance</td>
</tr>
<tr>
<td>Line of business</td>
<td>Accounting applications, Supply chain management, Resource planning applications</td>
</tr>
</tbody>
</table>

Table 22: Categorization of Different Software’s [56]
5.4.2 ANALYSIS RESULTS OF CLOSED AND OPEN ENDED QUESTIONS

In this section we present the analysis results of both open ended and closed ended questions. As this is the crucial and important part with in the survey. The results are presented along with the survey questions.

5.4.2.1 SURVEY QUESTION 1

- How many years of experience you have as a Software product manager?

The question helps us in knowing who all the respondents are participating in the survey. This is because we want to categorize the data based on the experience levels. This helps us in getting a clear picture regarding how we can design the model for junior software product managers when implementing SPM.

<table>
<thead>
<tr>
<th>Response</th>
<th>Chart</th>
<th>Percentage</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. 1 year - 2 years</td>
<td></td>
<td>14%</td>
<td>4</td>
</tr>
<tr>
<td>B. 3 years - 6 years</td>
<td></td>
<td>48%</td>
<td>14</td>
</tr>
<tr>
<td>C. 7 years - 10 years</td>
<td></td>
<td>28%</td>
<td>8</td>
</tr>
<tr>
<td>D. 10+ years</td>
<td></td>
<td>10%</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Responses</strong></td>
<td></td>
<td><strong>29</strong></td>
<td></td>
</tr>
</tbody>
</table>

Figure 14: Years of Experience in SPM

From the figure 14 we can see that most of the respondents have an experience of 3 years- 6 years, followed by 7 respondents having experience of 10+ years. We can say that many respondents have good experience in SPM.

5.4.2.2 SURVEY QUESTION 2

- What was your area of work before being a Software product manager?

From literature study we have observed that most of the people start their position as developer, sales or project manager before being a Software product manager. We wanted to see from which area most of the Software product managers are coming from.

<table>
<thead>
<tr>
<th>Response</th>
<th>Chart</th>
<th>Percentage</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Business Analysis</td>
<td></td>
<td>34%</td>
<td>10</td>
</tr>
<tr>
<td>B. Software Engineering</td>
<td></td>
<td>34%</td>
<td>10</td>
</tr>
</tbody>
</table>
C. Project Management 48% 14
D. Marketing 24% 7
E. Sales and Distribution 14% 4
F. Evolution and Service 17% 5
G. Line Management 14% 4
Other, please specify: 7% 2
Total Responses 29

Figure 15: Area of Work before being a Software Product Manager

From the figure 15 we can see that most of the software product managers are coming from Project Management. 14 respondents have background from Project Management which is 48% of the overall responses. 10 respondents are from Business Analysis or Software Engineering which is 34% of the overall responses. 7 respondents are from Marketing which is 24% of the overall responses.

From this survey we have analyzed that people mostly coming from Project Management or Business Analysis or Software Engineering or Marketing areas are becoming Software product managers. Whereas, very less people are coming from Sales and Distribution or Evolution and Service or Line Management are been considered to the role of Software product managers.

5.4.2.3 SURVEY QUESTION 3
- How many years of experience you had before being a Software Product Manager?

<table>
<thead>
<tr>
<th>Response</th>
<th>Chart</th>
<th>Percentage</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. 1 year - 2 years</td>
<td>Blue</td>
<td>14%</td>
<td>4</td>
</tr>
<tr>
<td>B. 3 years - 6 years</td>
<td>Green</td>
<td>48%</td>
<td>14</td>
</tr>
<tr>
<td>C. 7 years - 10 years</td>
<td>Red</td>
<td>28%</td>
<td>8</td>
</tr>
<tr>
<td>D. 10+ years</td>
<td>Yellow</td>
<td>10%</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>29</td>
</tr>
</tbody>
</table>

Figure 16: Years of Experience in SPM
From the figure 16 we can see that 14 respondents have replied they had 3 years- 6 years of experience before being a Software Product Manager. 8 respondents had 7 years- 10 years of experience.

For a person to be considered for the role of junior software product manager he needs to have a minimum experience level of 3 years- 6 years. People from Project Management or Software Engineering or Business Analysis have more chances of becoming a Software product manager.

5.4.2.4 SURVEY QUESTION 6
- Do you follow any model or framework while implementing SPM?

From literature study we have identified there are 3 frameworks [3] [7] [28] for implementing SPM with in organizations. In addition there are 2 websites [14] [57] which are being run by the authors who designed the 3 frameworks. We wanted to identify what type of model or framework is being used by practitioners when implementing SPM.

![Different SPM Frameworks](image_url)

Figure 17: Different SPM Frameworks

From the above figure 17 we can see that many of the Software product managers are using different frameworks other than the ISPMA [14] and SPM [57]. 11 respondents have mentioned they are following ISPMA framework and 8 respondents have mentioned they are following the SPM framework. 3 respondents are using both the ISPMA and SPM framework. 8 respondents have mentioned they are using frameworks like pragmatic marketing framework, 280 group optimal product process, agile development and internal corporate.

5.4.2.5 SURVEY QUESTION 7
- What practices do you follow in SPM?

From literature study we have identified different practices which are being followed during SPM. We also identified from [5] that the role of product manager varies between SMEs and Large scale organization.
<table>
<thead>
<tr>
<th>Response</th>
<th>Chart</th>
<th>Percentage</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Strategic Management</td>
<td></td>
<td>59%</td>
<td>17</td>
</tr>
<tr>
<td>B. Product Strategy</td>
<td></td>
<td>76%</td>
<td>22</td>
</tr>
<tr>
<td>C. Product Planning</td>
<td></td>
<td>93%</td>
<td>27</td>
</tr>
<tr>
<td>D. Development</td>
<td></td>
<td>55%</td>
<td>16</td>
</tr>
<tr>
<td>E. Marketing</td>
<td></td>
<td>55%</td>
<td>16</td>
</tr>
<tr>
<td>F. Portfolio Management</td>
<td></td>
<td>45%</td>
<td>13</td>
</tr>
<tr>
<td>G. Product Roadmapping</td>
<td></td>
<td>83%</td>
<td>24</td>
</tr>
<tr>
<td>H. Requirements Management</td>
<td></td>
<td>76%</td>
<td>22</td>
</tr>
<tr>
<td>I. Release Planning</td>
<td></td>
<td>69%</td>
<td>20</td>
</tr>
<tr>
<td>J. Sales &amp; Distribution</td>
<td></td>
<td>28%</td>
<td>8</td>
</tr>
<tr>
<td>K. Evolution &amp; Service</td>
<td></td>
<td>41%</td>
<td>12</td>
</tr>
<tr>
<td><strong>Total Responses</strong></td>
<td></td>
<td></td>
<td>29</td>
</tr>
</tbody>
</table>

Figure 18: Different SPM Practices being followed

From the above figure 18 we can see that most of the software product managers are following almost all the activities. Most of the software product managers are following Product planning which is 93% of the overall response rate followed by Product Roadmapping (83%), Product strategy (76%) and Requirements Management (76%), Release Planning (69%), Strategic Management (59%), Development (55%) and Marketing (55%), Evolution and Service (41%), and Sales and Distribution (28%).

5.4.2.6 **SURVEY QUESTION 8**

- Rate the activities in the order you follow in SPM.

From survey question 7 we can see that almost all the activities are being covered by software product managers. But a study is needed in the order of their implementation throughout SPM. This question mainly focuses on the order of their implementation throughout SPM.

From the following figure 19 we can see how the activities are being followed during SPM.
The order in which the activities are followed are Strategic management, Product strategy, Product Planning, Requirements management, Development, Release Planning, Marketing, Sales and Distribution, and Evolution and Service.

5.4.2.7 SURVEY QUESTION 9
- After becoming a Software Product Manager which was your key focus area when implementing SPM. What is the reason for choosing that particular area?

We identified that most of the software product managers are coming Project Management, Development, Sales, and Marketing etc. There is a need to study which was their key focus area after becoming a software product manager because most of the product managers are unaware where to start their role during SPM.

<table>
<thead>
<tr>
<th>Response</th>
<th>Chart</th>
<th>Percentage</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Strategic Management</td>
<td></td>
<td>17%</td>
<td>5</td>
</tr>
<tr>
<td>B. Product Strategy</td>
<td></td>
<td>38%</td>
<td>11</td>
</tr>
<tr>
<td>C. Product Planning</td>
<td></td>
<td>69%</td>
<td>20</td>
</tr>
<tr>
<td>D. Development</td>
<td></td>
<td>14%</td>
<td>4</td>
</tr>
<tr>
<td>E. Marketing</td>
<td></td>
<td>17%</td>
<td>5</td>
</tr>
<tr>
<td>F. Portfolio Management</td>
<td></td>
<td>21%</td>
<td>6</td>
</tr>
<tr>
<td>G. Product Roadmapping</td>
<td></td>
<td>38%</td>
<td>11</td>
</tr>
</tbody>
</table>
Figure 20: Practices followed after becoming Software Product Manager

From the figure 20 we can see that most of the respondents’ key focus area after becoming software product manager was Product Planning (69%), Product Strategy (38%) and Product roadmapping (38%), Requirements Management (34%), Release Planning (28%), Portfolio Management (21%), Strategic Management (17%) and Marketing (17%), Development (14%), Sales and Distribution (10%), and Evolution and Service (3%).

Product Planning, Product Roadmapping, Product Strategy, Requirements management and Release planning were the key focus areas for most of the software product managers after taking up their job.

Some of the respondents mentioned getting a proper cross functional product lifecycle management in place is a key to success. Also focusing on marketing problems during the entire product lifecycle management gives hard data to base your whole strategy.

5.4.2.8 SURVEY QUESTION 10

- If you recruit a junior software product manager under you what are the different tasks he needs to accomplish?

From [1] [13] we have understood that many product managers are not aware of what goals to be achieved during SPM, as they often start out of a position as developer, sales or project manager and start learning their skills on-the-job. So to help them in knowing what activities to focus on we have formulated this question.

<table>
<thead>
<tr>
<th>Response</th>
<th>Chart</th>
<th>Percentage</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Strategic Management</td>
<td></td>
<td>3%</td>
<td>1</td>
</tr>
<tr>
<td>B. Product Strategy</td>
<td></td>
<td>3%</td>
<td>1</td>
</tr>
<tr>
<td>C. Product Planning</td>
<td></td>
<td>31%</td>
<td>9</td>
</tr>
<tr>
<td>D. Development</td>
<td></td>
<td>21%</td>
<td>6</td>
</tr>
<tr>
<td>E. Marketing</td>
<td></td>
<td>24%</td>
<td>7</td>
</tr>
</tbody>
</table>
F. Portfolio Management 3% 1
G. Product Roadmapping 24% 7
H. Requirements Management 76% 22
I. Release Planning 52% 15
J. Sales & Distribution 17% 5
K. Evolution & Service 31% 9
Other, please specify: 3% 1

Total Responses 29

Figure 21: Tasks need to be accomplished by Junior Software Product Managers

From figure 21 we can see that most of the software product managers have suggested that a junior software product manager needs to focus on Requirements Management, Release Planning, Product Planning, Evolution and Service, Product Roadmapping, Marketing, Development, Sales and Distribution. Whereas activities like Strategic Management, Product Strategy and Portfolio Management are given least preference. One of the respondent has mentioned as a junior software product manager he needs to study markets, understand solutions, do study and help where we stand with.

Contrary to this most of the software product managers during their early stages of SPM have mentioned they focused on Product Planning, Product Roadmapping, Product Strategy, Requirements management and Release planning which can be seen from the responses in section 5.4.2.7.

5.5 DISCUSSION

Participants were asked questions related to how SPM is being implemented by them and what all are the activities they are covering during SPM based on the activities found from LR. The survey questions were asked based on the 7 structural elements identified from LR. Section 5.4 shows a clear discussion regarding the data collected from survey participants. Almost all of the participants who have fully filled the questionnaire have experience in SPM domain. As the responses were received globally almost 38% of the respondents were using ISPMA framework where as 28% of the respondents were using SPM framework and 14% of the respondents mentioned they are following pragmatic marketing framework. This shows that most of the organizations are following different SPM models or frameworks based on the regional settings and their market segments.

Most of the respondents are following the activities as mentioned in section 5.4.2.6. Another interesting focus was most of the software product managers after taking up their roles as software product managers their key focus areas were product planning, product strategy, product roadmapping, requirements management and release planning. This was mainly to understand the market and customer problems and develop products which solves the market
issues and generates revenue to the organization and also helps in developing strategies where we can reach more market segments based on the data collected.

When asked about what tasks a junior software product manager should accomplish after taking up the job most of the software product managers mentioned they should focus on 22 respondents mentioned requirements management, 15 respondents said release planning and 9 respondents said evolution and service and product planning. Requirements management helps a junior software product manager how to handle customer requirements when there is a huge inflow of requirements. Release planning helps him in understanding which requirements should be prioritized based on the market strategies and changing markets. This helps him to explore different market segments. Evolution and service helps in reaching to the target audience and also maintaining proper mix with marketing and sales team helps him in knowing what customers are expecting and what their major requirements based on which the requirements management can be properly organized, product planning can be effectively managed regarding which requirements should be prioritized for current market segments and which requirements can be prioritized for future release.

In our survey different practitioners with different levels of experience have participated. There was a difference in the activities they have been following during the initial days and currently. A detailed list of the experience levels and the activities they are following is as follows

1. 4 persons having 1-2 years of experience have participated survey. During the early stages most of them focused on Product Roadmapping (3), Product Planning (2), Portfolio Management (2) and Requirements Management (2). As they achieved experience their focus areas are Product Planning (4), Product Roadmapping (4), Development (3), and Requirements Management (3).

2. 15 persons having 3-6 years of experience have participated survey. During the early days as a software product manager most of them focused on Product Planning (11), Requirements Management (8), Release Planning (6), Product Roadmapping (5) and Product Strategy (5). As they slowly gained experience their focus areas are Product Planning (13), Product Strategy (12), Product Roadmapping (11) and Release Planning (10).

3. 3 persons having 7-10 years of experience have participated survey. During the early days of SPM most of them focused on Release planning (2), Product planning (1) and Product strategy (1). As the gained experience their focus areas were Product Planning (3), Product Roadmapping (3), Strategic Management (2), Product Strategy (2), Requirements management (2) and Release planning (2).

4. 7 persons having 10+ years have participated in the survey. During the early days as a software product manager the areas they focused are Product Planning (5), Product Strategy (4), Strategic Management (3), Product Roadmapping (3), Development (2), and Requirements Management (2). As the gained experience their focus areas were Product Strategy (7), Product Planning (7), Requirements Management (7), Marketing (7), Strategic Management (6), Release Planning (6), Product roadmapping (6), Portfolio Management (5), Development (4), Evolution and Service (4), and Sales and Distribution (4).

From section 5.4.2.8 the authors were able to identify what practices needs to be followed by junior software product managers and what deliverables are expected from them. A detailed explanation about the practices expected from junior software product managers is discussed in Chapter 6.
6 FRAMEWORK

From interview and survey we have identified practices being followed by practitioners. In addition we have also asked what are the practices need to be followed by junior software product managers once they take up their job. We are proposing a framework for junior software product managers because there is a need for understanding where to start in SPM. The back ground and structure of the framework are presented in the following subsections.

6.1 BACKGROUND

In existing SPM frameworks in literature, most of the frameworks discuss about the SPM activities to be followed. But there is a lack to understand where to start these activities from, for a junior software product manager. From literature a number of practices related to SPM are identified. Survey and interviews have been conducted with practitioners regarding the activities they are following. From survey and interview we have identified that most of the software product managers during their initial stages of SPM have followed various practices irrespective of the background they come from. Most of the software product managers have confirmed based on the organizations goals they had to follow different activities after taking up their job. So there is a need to propose a framework which clearly explains what activities should be followed by junior software product managers. Moreover the proposed framework should be suitable for all scales of organizations.

6.2 STRUCTURE OF FRAMEWORK

RQ3. What should be taught for junior software product managers?

A preliminary framework is proposed for performing SPM by junior software product managers which can be seen in table 23. This framework consists of practices and concepts utilized by junior software product managers which are labels of theory. The framework is developed using GT where the data gathered through literature review and interviews was used as an input for survey. Based on the responses from practitioners the framework was reformulated. The proposed framework is an output of the comparative analysis conducted between the survey data and the comparative analysis data of literature review and interviews. An SPM framework is proposed by defining the activities within the set of practices which is applicable to all sizes of organizations. Based on the context of the organization the framework can be adaptable which is presented in figure.

The practices involved in the framework and their corresponding activities are discussed below. Step 1 and Step 2 are the core activities which are done once the requirements are gathered from the market. Step 3 is where the product planning is based on the activities of step 1 and step 2. Step 4 and step 5 are the activities to be done once the step 3 is finalized. The rest of the activities are done in an orchestra once the 5 steps are finalized. As step 1 is the Requirements management, all the requirements need to be properly gathered, identified and organized which is the input in Step 1 of the framework.

6.2.1 STEP 1: REQUIREMENTS MANAGEMENT

This is the first and initial step of the framework. Being a Market- driven organization first the software product manager needs to identify all the requirements properly both from customer segments and internal stakeholders. After gathering all the requirements the
software product manager needs to identify the right set of requirements which are main to the current market problems. He needs to properly organize these requirements and the other requirements in a requirements database. As identifying functional and non-functional requirements is a tedious task the software product manager needs to carefully distinguish these requirements. So for identifying these requirements he needs to early triage of the requirements as described in MERTS [54] by Khurum et al.

After analyzing the data from interviews and surveys most of the software product managers have stated that as a junior software product manager he needs to be close to the market segments by identifying the current market problems and customer needs. Based on this he can properly judge which type of product he can deliver to the market problems by properly organizing the requirements.

6.2.2 STEP 2: RELEASE PLANNING

Release planning helps a software product manager to know when and what type of product he can deliver to the market. Based on the requirements gathered during the requirements management stage, the software product manager needs to properly prioritize the requirements with the help of stakeholders and based on the prioritization of the requirements, he needs to select the requirements for product. Once the requirements are selected, he needs to pre-check the requirements with the stakeholders whether the selected are the final set of requirements for developing the product. After the requirements are finalized for developing the product the software product manager needs to check for any scope changes within the product. He needs to ensure that any changes within the product should be aforementioned to the stakeholders and negotiations should be done. Once the negotiations are done and the product is developed a formal launch preparation should be prepared with both the internal and external stakeholders.

The main reason for choosing release planning as step 2 is most of the practitioners have mentioned once the requirements are gathering the junior software product manager should be properly prioritize the requirements and design a release plan when to release which requirements based on the customer needs.

6.2.3 STEP 3: PRODUCT PLANNING

Product planning deals with the positioning of the product in alignment to the corporate strategies. During the product planning the software product manager should clearly define the product life cycle. PLM is governing company’s product in the most effective way, all the way throughout their lifecycle from the very first idea of the product till it is removed from market [62]. The junior software product manager should effectively and intellectually design the product lifecycle management. Once the product lifecycle is designed he needs to properly manage the requirements and release plan of the product. Based on the release plan he needs to design a roadmap for the product.

Practitioners mentioned a clear and perfect product planning not only ensures product success but also gives a cutting edge over the competitors’ product.

6.2.4 STEP 4: PRODUCT ROADMAPPING

Product roadmap helps a junior software product manager in getting a clear picture regarding how the product will be developed based on the releases in a time span of 5 years [14] [28]. During the roadmap construction the junior software product manager first needs to identify the theme of the product. Theme identification helps a junior software product manager in getting a clear direction to the releases of product [1]. During theme identification the junior software product manager should involve with different stakeholders which helps in identifying the themes for releases which are stored centrally so that they can be linked to the
market trends [1]. After identifying the theme the junior software product manager has to look for core assets. Core assets are the reusable components which can be used for the current product from the existing products. This helps in reducing the maintenance costs. Once the core assets are identified the junior software product manager needs to construct the roadmap. The roadmap construction is done based on the core assets identified and for the core assets in development.

Both the practitioners from survey and interview have mentioned that a clear product roadmap helps the junior software product manager in optimizing resources for developing of the product.

6.2.5 STEP 5: MARKETING

Marketing deals with identification of the needs of the market and customers, and delivering products based on their needs. A junior software product manager needs to be in close proximity with the markets so that he can identify the needs of the market and delivery products based on their needs which can generate large value to their business. During marketing a junior software product manager needs to focus first on marketing mix optimization. Marketing mix optimization helps a software product manager to allocate resources for marketing their products through advertising or other means which helps him in achieving the marketing goals. Once the marketing mix optimization is done the software product manager needs to focus on market planning.

Market planning helps a junior software product manager in addressing how he will be reaching the customers and his target markets. Product launch is a crucial phase for a junior software product manager. He needs to clearly analyze the target markets and based on that he needs to define when he launches the product in to the market. Without proper analyzing of the market a proper product launch will be a failure and vice versa. Once the product is launched in to the market the junior software product managers should be on the verge of analyzing the customers.

Customer analysis helps a software product manager to know who is buying your product and what made other customers to choose your competitors product. This helps the junior software product manager to clearly understanding how he can improve the product plan and release plan for their future products. Opportunity management is another key focus which the junior software product managers should be always aware of. Opportunity management helps a junior software product manager to know the needs of the customers and by properly analyzing them he can manage his products to the right opportunities of the market and can gain a competitive edge over his competitors. Operational marketing deals with providing proper service to customers by gaining customer satisfaction.

Based on the above 5 steps we have designed the framework which is as shown in table 23. We did comparative analysis for both interview results and survey results based on that a preliminary framework was proposed. The proposed framework gives a picture of what activities needs to be considered by junior software product managers as soon as they take up their role during SPM. The main reason for choosing only these 5 activities are most of the practitioners mentioned that as a junior software product manager he needs to be close with the customer proximities. This helps a software product manager to understand what customers are expecting from their products and what problems are in market. By understanding these problems and developing products to those problems will give a cutting edge over the competitor products.

In the table 23 there are other practices like Evolution and Service, Development, Sales and Distribution, Strategic Management and Product Strategy. These activities can be organized as an orchestration.
In addition to the data gathered through interviews and survey we suggest that a curriculum needs to be designed for junior software product managers based on the factors reported by Gorchels [12]. The main reason for the proposal of design of curriculum is most of the product managers are learning their skills on job as they come from different roles like developer, sales or project manager and are not aware of what goals needs to be achieved [1] [13].

The lists of factors are as follows:

1. **Product Managers Job:** The main task of any product manager is to oversee all the activities of a product or service line to create and deliver superior satisfaction to customers and providing a long term value for the organization [12].

2. From [12] we have also identified that most of the product managers are spending much of the time on strategic planning. So a change needs to be done and focus on proper time management and properly interacting with customers and to understand future needs and applications of customers.

3. The role of product management is viewed as a functional solution for many organization problems but it is not [12].

4. A product manager needs to be given more responsibilities as the challenges to going to markets increase.

5. A product manager needs to successfully balance the activities among day-to-day, short and long-term goals.

Haines [12] suggested that a product manager needs to have a set of practices which are:

1. **Leading and Influencing:** As a product manager he needs to lead the teams under him and should be influencing them to follow his vision.

2. **Cross-functional teaming:** Every product manager will be involved with a cross-functional team. So he should be skillful in managing these cross-functional teams as these people have expertise from many different areas.

3. **Making decisions:** Product managers should strive for making better decisions continually across the product’s life cycle.

4. **Financial planning and analysis:** In product management planning the profitability of the product and assessing the profitability of existing products is an important activity. So a product manager should have sound knowledge in financial planning and analysis.

5. **Assessing the industry and competition:** As a product manager he needs to be assessing the industry the environment in which the company is operating. He should also be good in assessing the competition from other organizations that are producing the same products. It is his duty to assess the industry standards and competition and based on these he needs to modify the strategies for the product and develop a proper product portfolio.

6. **Market Segmentation and targeting:** Segmentation is a joint effort where in not only the cross-functional team is involved but also outside research firms. As a product manager he should be focused on market research and segmentation as these are no substitute for discovering the customer needs.

7. **Formulating product and market strategies:** The product manager main job is to establish a vision for the product and creating a path for the future of the product. Another important activity of the product manager is to align the strategies of the product with that of the organization strategies to make sure they are in alignment with the product portfolio.

8. **Forecasting:** An essential task of the product manager’s job is to forecast volumes, market share and revenue. A new product manager should own this activity from start to finish as he is the sole leader of the product which will be developed and released based on the customer needs.
The activities in the framework should be considered from left to right.

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Table 23: Proposed Framework
7 VALIDITY THREATS

For any research there are mainly four types of threats as discussed by Wohlin et al [58] and Trochim [85] [86] [87] [88] which are:

- **Construct Validity**: “Construct validity involves generalizing from your program or measures to the concept of your program or measures” [85].

- **Internal Validity**: “Internal Validity is the approximate truth about inferences regarding cause-effect or causal relationships” [86].

- **External Validity**: “External validity is the degree to which the conclusions in your study would hold for other persons in other places and at other times” [87].

- **Conclusion Validity**: “Conclusion validity refers to the statistically significant relationships between the treatment and outcome” [88].

7.1 INTERNAL VALIDITY

**Selection of Articles:**

The aim of the literature review was to find articles related to the context of study which is software product management. To find the articles search string was formulated and seven international databases were used to extract the articles using the search string. A total of 2748 articles were retrieved from which 25 articles were selected related to the topic of study. Grey literature and text books were also included to gain more information.

During the search string formulation we did not use some of the terms like product management, technical product manager which may lead us to miss some of the material related to the study.

**Use of Grounded Theory in Analysis of LR data:**

Grounded theory was originally designed by Glaser and Strauss [42]. Both the researchers had a variance in the way of generation of categories and used of memos [47]. Glaser paradigm is more focused on theoretical sensitivity [46]. We have used Strauss and Corbin [40, 45] GT as it focused on three levels of coding and provided clearly structured procedures [47].

Strauss GT adhere a fixed coding procedure which bears a threat and can limit emergence of theory [89]. We mitigated this threat by cross checking the codes with the raw data in every coding procedure.

**Interviewee Selection:**

Interviewee selection might be a threat to our work. Both the interviewee participants were identified through LinkedIn. To overcome this threat prior to the interview both the interviewee participant’s roles were clearly studied to check whether the practitioners are working in the field of work in which the researchers are conducting their study.
Information Misunderstanding Extracted during Interview

There is a chance of misunderstanding of information during the interview process. To overcome this, the interviews were recorded with the permission of the interviewees. Not to have any ambiguity in the interview data the questionnaires were sent to the interviewees and were asked to fill the information which acted as a proof for validity.

7.2 EXTERNAL VALIDITY

Validity of Interview Participants

Interviews were conducted with participants who are from different geographical locations. One participant is from USA and the other participant is from Italy. Due to limited time constraints we were able to conduct only 2 interviews. This might act as a risk to our as generalization of data would not big enough. To overcome this threat we have conducted survey.

Validity of Survey Participants

Survey was conducted online. The survey link was posted in different groups on networking sites like LinkedIn, Google groups and Yahoo groups. Responses were received from all over the world. In the survey first we presented a page what is the survey is about and who are conducting the survey. This way we think we might have reduced the risk in getting the data of the survey participants.

7.3 CONSTRUCT VALIDITY

Literature review

During literature review there is a threat we might have missed some of the articles during the iteration process. To overcome this both the researchers have thoroughly gone through each and every article.

In literature review between the years 1996- 2005 we did not find articles relevant to our study. To overcome this we have gone through the search string and the articles we have extracted. There were articles published related to SPM but those articles were not relevant to our research study so we have excluded them.

Analysis of the literature review data might be a threat during the construction of the framework. To overcome this we have closely checked the codes with the raw data and on clearly understanding the terms the framework was constructed.

Interview Data Analysis

Analysis of the interview data might be a threat to our work as there is a chance of misalignment in the data collection process. To overcome this threat the interview recordings were clearly analyzed and using GT we have structured the data properly using codes. This might have reduced the risk to a major extent.

Framework

Based on the understanding of the data gained from literature review, interviews and survey was conducted to identify the activities needs to be followed by junior software product
managers. A total of 31 responses were received on a whole. The framework was developed after analyzing the data received from interviews and survey.

If more number of participants has participated both in interviews and survey there is a chance that there might be a deviation in the proposed framework. We did not validate the proposed framework. So the above constraints might acts as a threat to our work.

7.4 CONCLUSION VALIDITY

One possible threat to conclusion validity is the findings about what should be taught for junior software product managers from interview. To overcome this threat we have conducted survey with SPM practitioners to check whether the findings from interview are in alignment regarding what tasks should junior software product managers implement during SPM.

The conclusions derived from literature review and interviews can act as a threat to our work. So overcome this, the survey questionnaire was carefully developed and a pilot test was conducted with one of the practitioner. Analyzing of the survey data might be threat as there were responses from people having experience at least 1 year and up to 10+ years. To overcome this, the data received was properly organized and analyzed regarding the recommendations to the junior software product managers. So this way we have reduced the risk to certain extent.
8 CONCLUSION

In this thesis we have studied an area called Software Product Management (SPM) both from the state of knowledge and practice. We have studied what are the different practices being followed when implementing SPM. To achieve the aim of the study five sequential phases were conducted. Data related to SPM were collected through literature review, interviews and survey. We have applied Grounded Theory (GT) and Qualitative Comparative Analysis (QCA) as analysis methods.

Firstly we have conducted literature review in our research work to study the state of knowledge of SPM and to identify what are the different practices or structural elements involved in SPM. Based on the data gathered from literature review Strauss and Corbin GT [40] was used to properly structure the data and a framework was designed for the literature review data regarding the different practices and activities involved in SPM which is shown in table 15. After understanding the different practices and activities in SPM from literature review we have conducted interviews.

Interviews were conducted with 2 participants. Data was gathered from interviews in the form of notes and audio tapes. This data was taken as a chunk and GT was applied to properly structure the data. Based on this a framework was developed for the interview data which is as shown in table 16. Comparative analysis was conducted for the literature review and interview data. We have identified a total of 53 common codes both from literature review and interviews which is shown in table 20. Using comparative analysis for literature review and interviews a preliminary framework was designed which is shown in table 21.

The data gathered from literature review and interviews was used as input for survey. This was because we wanted to get information from more number of participants regarding the different SPM practices being followed by them and, what activities a junior software product manager needs to focus when implementing SPM. The data gathered from survey was analyzed based on the experience of the practitioners. Comparative analysis was conducted for survey data and the preliminary framework (table 21). Based on the inputs from the survey and the interviews a framework was designed for junior software product managers which is shown in table 23.

We have proposed a preliminary framework for junior software product managers, how to implement SPM after they take up their job as software product managers based on the findings from interviews and surveys. Most of the practitioners confirmed they follow most of the practices published in literature and in addition they have introduced to new SPM frameworks like [81] which we did not find through literature review. About 42 % of the practitioners have stated that Requirements Management, Release Planning, Product Planning, Product Roadmapping, and Marketing are the key practices which need to be focused by junior software product managers.

8.1 ANSWERS TO RESEARCH QUESTIONS

8.1.1 What is the state of knowledge of SPM?

The state of knowledge of SPM is low. We basically conducted a pilot study using the term “Software Product Management” during July 2011. We got a total of 510 articles related to SPM. This shows that very less research exists and more extensive research needs to be conducted in this area. To support this argumentation Maglyas et al [80] have conducted a systematic mapping study on Software product management during May 2011 where in they
basically conducted a pilot study and identified 474 articles. There is a difference of 26 articles between the two pilot studies. This shows that SPM is gaining importance in terms of research. But more research focus should be conducted in the fields of product planning, product strategy and product analysis [80].

8.1.1.1 What are the structural elements of SPM and challenges in SPM?

To identify the structural elements and concepts in SPM and challenges in SPM we have conducted literature review based on guidelines of Kitchenham [38]. We have used grounded theory proposed by Strauss and Corbin [40] to identify the structural elements and concepts in SPM. Finally a total of 7 structural elements are identified related to SPM. The results are discussed in section 3.3.2.1.

8.1.2 What are the practices followed, concepts utilized and deliverables expected from junior software product manager and their responsibilities?

The different practices followed in SPM are Strategic Management, Product Strategy, Product Planning, Requirements Management, Development, Product Roadmapping, Release Planning, Marketing, Sales and Distribution, and Evolution and Service.

Among the above activities different practices and concepts expected from junior software product manager are shown in table 24.

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<thead>
<tr>
<th>Requirements Management</th>
<th>Release Planning</th>
<th>Product Planning</th>
<th>Product Roadmapping</th>
<th>Marketing</th>
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<td>Product Profitability</td>
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Table 24: Practices and Concepts Expected from Junior Software Product Managers

In addition to the above practices and concepts the responsibilities expected from junior software product manager are he should be a good team player, should have knowledge about SPM, and should properly interact with market and to understand customer requirements.

8.1.2.1 What characterizes a person as new to the field? How many years experience is needed before a person can be a junior product manager?

From survey and interviews we have identified that most of them had prior experience in different areas like project management, software engineering, business analysis, sales etc. A person from the above areas is characterized as new to the field of SPM.
From the above areas to be a junior software product manager he should need to have 3-6 years experience. These results are discussed in section 5.4.2.2 and 5.4.2.3.

8.1.3 What should be taught for junior software product managers?

Based on the findings from literature review, interviews and survey we have proposed a preliminary framework for junior software product managers. A curriculum needs to be designed just like the IREB [9], which emphasis on what software product management is and what are the different activities involved in it. A detailed discussion regarding the framework is discussed in Chapter 6.

8.2 FUTURE WORK

In our research we have designed a preliminary framework for junior software product managers. This framework was designed based on the interview conducted with 2 participants who are from small scale organizations and survey with 29 participants. This shows that more extensive and in-depth research needs to be conducted in this area by involving more number of participants from all scales of organizations. Due to limited time constraints the proposed framework could not be validated.

As a future work we plan to focus on extending the survey with more number of participants and validating the framework. We focus on designing a curriculum for junior software product managers which helps them in understanding what software product management is and what are the areas which they need to focus when implementing SPM in their organizations.

The participants in the survey have mentioned regarding use of different SPM frameworks like Agile development, 280 group etc. So research should be conducted on how these frameworks are being implemented in organization which helps in adding information to the SPM body of knowledge.
9 REFERENCES


### 10 APPENDIX

#### 10.1 LITERATURE REVIEW SEARCH STRINGS

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<td>7</td>
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<td>Science Direct</td>
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Table 25: Search String Used in Different Databases
10.2 DATA EXTRACTION STRATEGY

![Figure 22: Data Extraction Strategy](image)

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<td>2</td>
<td>Does the paper clearly specify the research methodology</td>
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<tr>
<td>3</td>
<td>Does the paper clearly discuss about the SPM practices or activities</td>
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10.3 INTERVIEW QUESTIONS

1. How long you have been working as a Software Product Manager?
2. What was your area of work before being a Software Product Manager?
3. How many years of experience you had before being a Software Product Manager?
4. How many employees work in your organization?
5. What are the different products you have developed?
6. Which model or framework do you follow during Software Product Management?
7. What are the different Practices do you follow in Software Product Management?
8. Rate the activities in the order you follow in Software Product Management?
9. After becoming a Software Product Manager which was your key focus area when implementing Software Product Manager?
10. If you recruit a junior Software Product Manager what are the different tasks he needs to accomplish?
11. What are the key challenges in SPM? Where do you encounter these?
12. Recommendations for junior SPM?
10.4 SURVEY QUESTIONNAIRE
Software Product Management Framework

What is this survey? The aim of this survey is to identify different practices followed by Software Product Managers. We also trying to identify what tasks need to be accomplished by junior Software Product Managers during initial stages of Software Product Management.

Benefits to the respondents: After completing the survey, all the interested participants can provide us their email address so that we can send our summarized survey results report. This report helps in understanding how different organizations are implementing Software Product Management.

Who can participate in this survey? People who are working as Software Product Managers from any country can participate in this survey.

Duration of the survey: This survey contains 10 questions, which would take 5-10 minutes to complete.

Who is conducting the survey? This survey is conducted by two Software Engineering Master students from Blekinge Institute of Technology, Sweden, as part of their Master thesis.

If you have any questions regarding this survey, please do not hesitate to contact us via email provided below.

Thank you in advance for participation in this survey.

Sincere regards,
Mahesh, Praveen (Master students)

Software Engineering Research Lab Blekinge Institute of Technology Sweden (BTH)
Email: mamu09@student.bth.se, hata10@student.bth.se
Survey Questions

1. How long have you been working as a Software Product Manager?
   - A. 1 year - 2 years
   - B. 3 years - 6 years
   - C. 7 years - 10 years
   - D. 10+ years

2. What was your area of work before being a Software Product Manager?
   - A. Business Analysis (Requirements Engineering)
   - B. Software Engineering (Architecture, Design, Development, Testing)
   - C. Project Management (Development Projects, Customer Projects)
   - D. Marketing (Market Analysis, Publicity, Communication)
   - E. Sales and Distribution (Business Development, Account Management)
   - F. Evolution and Service (Support, Provisioning)
   - G. Line Management (General Management, Strategic Management)
   - Other, please specify: ______________________

3. How many years of experience you had before being a Software Product Manager?
   - A. 1 year - 2 years
   - B. 3 years - 6 years
   - C. 7 years - 10 years
   - D. 10+ years

4. How many employees work in your organization?
   - A. 1-50 employees
   - B. 51-100 employees
   - C. 101-500 employees
   - D. 500+ employees

5. What are the different products you have developed?
   - A. Platform and management (desktop, network infrastructure and management software)
   - B. Education and reference (educational software)
   - C. Home and entertainment (personal use and gaming software)
   - D. Content and communications (office productivity suites, multimedia players, file viewers, web browsers)
6. Which model or framework do you follow during Software Product Management?

A = http://ispma.org/spmbok/
B = http://www.cs.uu.nl/wiki/bin/view/Spm/SpmCompetenceModel

☐ A
☐ B
☐ Other, please specify: ______________________

7. What practices do you follow in Software Product Management?

☐ A. Strategic Management (Portfolio Management, Corporate Strategy, Innovation Management, Resource Management, Market Analysis, and Product Analysis)
☐ B. Product Strategy (Positioning and Product Definition, Delivery Model, Sourcing, Business Case and Costing, Performance and Risk Management, and Ecosystem Management)
☐ C. Product Planning (Product Life-Cycle Management, Market-Driven Requirements Management, Release Planning, and Roadmapping)
☐ D. Development (Project Management, Engineering Management, Project Requirements Management, and Quality Management)
☐ E. Marketing (Marketing Mix Optimization, Market Planning, Product Launch, Customer Analysis, Opportunity Management, and Operational Marketing)
☐ F. Portfolio Management (Partnering and Contracting, Product Life-Cycle Management, Market Trend identification, and Product Line Identification)
☐ G. Product Roadmapping (Theme identification, Core Asset Identification, and Roadmap Construction)
☐ H. Requirements Management (Requirements Gathering, Requirements Identification, and Requirements Organizing)
☐ I. Release Planning (Requirements prioritization, Requirements selection, Release definition, Release Validation, Launch Preparation, and Scope Change Management)
☐ J. Sales & Distribution (Customer Relationship Management, Sales Strategy and Planning, Channel Preparation, Sales Management, and Operational Distribution)
☐ K. Evolution & Service (Technical Support, Marketing Support, Sales Support, Service Preparation, and Services Provisioning)

8. Rate the activities in the order you follow in Software Product Management.
For ex: For a new product or an existing product which order do you follow among the following activities
9. After becoming a Software Product Manager which was your key focus area when implementing Software Product Management? What is the reason for choosing that particular area?

- B. Product Strategy (Positioning and Product Definition, Delivery Model, Sourcing, Business Case and Costing, Performance and Risk Management, and Ecosystem Management)
- C. Product Planning (Product Life-Cycle Management, Market-Driven Requirements Management, Release Planning, and Roadmapping)
- D. Development (Project Management, Engineering Management, Project Requirements Management, and Quality Management)
- E. Marketing (Marketing Mix Optimization, Market Planning, Product Launch, Customer Analysis, Opportunity Management, and Operational Marketing)
- F. Portfolio Management (Partnering and Contracting, Product Life-Cycle Management, Market Trend identification, and Product Line Identification)
- G. Product Roadmapping (Theme identification, Core Asset Identification, and Roadmap Construction)
- H. Requirements Management (Requirements Gathering, Requirements Identification, and Requirements Organizing)
- I. Release Planning (Requirements prioritization, Requirements selection, Release definition, Release Validation, Launch Preparation, and Scope Change Management)
- J. Sales & Distribution (Customer Relationship Management, Sales Strategy and Planning, Channel Preparation, Sales Management, and Operational Distribution)
- K. Evolution & Service (Technical Support, Marketing Support, Sales Support, Service Preparation, and Services Provisioning)
10. If you recruit a junior Software Product Manager under you what are the different tasks he needs to accomplish?

☐ A. Strategic Management
☐ B. Product Strategy
☐ C. Product Planning
☐ D. Development
☐ E. Marketing
☐ F. Portfolio Management
☐ G. Product Roadmapping
☐ H. Requirements Management
☐ I. Release Planning
☐ J. Sales & Distribution
☐ K. Evolution & Service
☐ Other, please specify: ______________________
10.5 SPM RELATED MATERIAL

SPM WEBSITES

The following websites are good starting for a software product manager to know what are the different activities involved in software product management. These websites gives some basic foundation and have certification courses also.


TEXT BOOKS RELATED TO SOFTWARE PRODUCT MANAGEMENT

The following textbooks are the references which we have came through during our thesis which we think might be helpful for product managers as a starting point.

This book gives a basic introduction about product management. It discusses about how product managers can manage strategic planning, identify trends and maintain competitive strategies. It also gives an idea about what product management is about and also how to manage product managers.

This book explains about how software organizations can manage software product management. What are the different activities involved and how they can generate revenues to their products by proper pricing.

This book is a good reference for software product managers. This book covers all the activities in software product management. This book is a best starting point for software product managers to study what software product management is and different activities involved and how to conduct those activities.

This book gives tips and techniques need to be implemented by product managers during product launch and product roadmapping. The strategies and tools explained in this book helps product managers to stay focused on their path and generate revenues for their products.

This book gives a clear picture about product lifecycle management. This book helps product managers in managing the products throughout their lifecycle. This book explains clearly how to reduce product related costs during the development and provides tools how to reduce those costs.
This book explains about how strategic management should be applied. This good is a good start for product managers to apply strategies for their business and products.

This book gives a detailed explanation about how to manage marketing. This book helps product managers how to manage their marketing networks and how to market their products in a competitive setting.