ADOPTING CAPACITY PLANNING IN AGILE PRODUCT MANAGEMENT FOR OPERATIONAL EXCELLENCE

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Dedication

This thesis is dedicated to the scholars and researchers whose work has revealed the important factors for success in any project. Their research has been essential in guiding my own study and understanding. I am grateful for their contributions and the inspiration they provided.

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ABSTRACT

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In today's fast changing business world, organizations are significantly investing in development of streamlined products to gain competitive advantage. Behind these efforts lies the Product Lifecycle Management (PLM) team who is tasked to leveraging wide project management strategies to deliver innovative offerings synced with business requirements. One increasingly popular approach is Agile Product Management, focused on developing product strategies and creating roadmaps within an agile framework. This method emphasizes adaptability in planning and execution, enabling companies to quickly respond to feedback and create products that resonate deeply with customers.

In integration to Agile Product Management, Agile capacity planning is a critical component of the planning process and a pivotal element of the strategizing phase. This practice involves assessing the productive engineering time at hand for an Agile team during a sprint or iteration. By understanding team capability, organizations can effectively

allocate resources, manage workloads, and optimize productivity. his study aims to investigate the adoption of Agile capacity management planning within Product Management practices in organizations and its impact on operational performance. Scope creep often undermines capacity planning, leading to project inefficiencies and failures. To counteract this, capacity planning needs to be fine-tuned to handle changes effectively. By optimizing these practices, teams can better manage scope creep and enhance their operational excellence in agile product management.

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CHAPTER I:

1.1 Introduction

Capacity planning is an essential part of turning your roadmap into an action. (Ika et al., 2020) proposed a balanced theoretical approach on how project behaves and take different and complex out-turns by the Planning Fallacy and the Hiding Hand. Further, (Ika et al., 2020) pointed on, how product managers struggle to estimate the cost overruns and benefit shortfalls. Planning error refers to the tendency to set project plans, costs, and benefits close to unrealistic optimal information (Lovallo and Kahneman, 2003). The concept of Hiding Hands, proposed in 1967 by Albert O. Hirschman, offers an opposing view of the procedural error. It suggests that individuals or organizations involved in ambitious projects often benefit from not knowing all the challenges they will face. This lack of knowledge can lead them to engage in tasks that would initially seem daunting or impossible if they were first aware of their full complexity.

According to (Sacolick, 2022), the challenge is that many agile team's needs, such as people, technologies, and partnerships, require forward-looking projections because of the necessary lead time to procure, onboard, and integrate. (Sacolick, 2022) further pointed that Agile leaders should view capacity planning as an opportunity to improve productivity, avoid frustration, gain support for Devops investments, and reduce blocks and barriers to their objectives.

(Krajewski *et al*., 2013) focused on the four main performance criteria in the past which were measured as a base for Capacity management within organisations. These according to Krajewski (2013) were quality, cost, speed and flexibility. The studies by Crandall and Markland (1996), Fitzsimmons and Fitzsimmons (1998), and Armistead and Graham (1994) have significantly contributed to refining operational planning and control issues, as noted by Sugumaran et al. (2009). Their work would accentuate the practical implications of integrating these theoretical frameworks into operational strategies, thereby enhancing overall organizational performance and competitiveness.

Adequate capacity planning methods are essential to assess the ramifications of these decisions on the production system (Giebels, 2000; Gademann & Schutten, 2005; Hans et al., 2007; Sawik, 2009; Montreuil et al., 2013). In their study, Kirkley and Squires (1999) underscore the importance of comprehending organizational capacity and its measurement in the context of designing a robust capacity management program. This becomes especially critical when capacity is governed by explicit limitations. Organizations often face challenges when accepting projects without adequately assessing their impact on resource capacity, which includes human resources, equipment, time, and other critical resources. This oversight can lead to resource overload, negatively affecting delivery performance and the profitability of production systems (Hans et al., 2007). Despite the availability of decision support tools in academic literature designed to address tactical planning problems, there remains a significant gap in their application in real-world settings. The academic literature in this area presents research–practice gap that translates into a lack of studies on the application of decision support tools to address tactical

planning problems in real-world settings. Above mentioned gap has been a recurrent theme in many papers (Buxey, 2003; 2005; Corti et al., 2006; Ramezanian et al., 2012; Sharda & Akiya, 2012; Jamalnia & Feili, 2013; Lingitz et al., 2013; Liu et al., 2013; Díaz-Madroñero et al., 2014).

(Aizaz et al 2021) noted that Scope creep is considered one of the crucial reasons for the failure of traditional software development projects. . Scope creep refers to the gradual increase in project requirements over time, typically occurring when new project requirements are introduced by clients or stakeholders after project execution has commenced. These changes often lack proper review, thereby placing additional tasks, deliverables, and milestones on the project team to be completed within the original resource and time constraints. Komal et al. (2019) emphasized that human factors contribute significantly to scope creep, leading to a lower success rate in construction projects. These factors encompass human capabilities, limited stakeholder involvement, lack of experience, change requests, and the personal capacities of project team members. (Madhuri & Rao, 2014) noted that organization should implement the best practices such like continuous improvement and the maturity models assuring for a notable improvement on quality, productivity and resources, henceforth, removing the fear for both management and employees. From the year 2000 software companies have adopted Capability Maturity Model popularly known as CMMI (Bhargava & Chakrabarti, 2003)

(Ward et al., 1998) explained that in operations management research, the study of various manufacturing practices and strategies in relation to the organizational production capabilities have been of importance in establishing the overall organizational

performance. (Rudberg and Olhager, 2003) highlighted the necessity of achieving systematic production efficiency for long-term success in production firms, impacting competitive performance in terms of product quality, cost, delivery speed, and flexibility.

1.2 Research Problem

(Carvalho, 2017) explained that Tactical planning is a middle-level activity connecting strategic planning and operations control in which the basic problem to be solved is the allocation of resources such as capacity, workforce availability, and storage over a medium-range planning horizon (Bushuev, 2014). Above statement, outlines the research problem related to tactical planning, emphasizing on the challenges of effective allocation of resources synced with organizational objectives and operational needs. It suggests that the primary issue to address in tactical planning is how to strategically allocate resources to optimize performance within a defined planning horizon. The research problem at this planning level revolves around the integration of project acceptance or rejection decisions with effective capacity planning methods and their consequences for the production system, thereby, optimizing resource allocation and operational outcomes. At the tactical planning level, organizations face the critical decision of accepting or rejecting projects (Giebels, 2000; Zorzini et al., 2008; Aslan et al., 2012). This decision-making process directly impacts resource allocation and operational capabilities. Adequate capacity planning methods are essential to assess the ramifications of these decisions on the production system (Giebels, 2000; Gademann & Schutten, 2005; Hans et al., 2007; Sawik, 2009; Montreuil et al., 2013). The problem lies in developing methodologies that

effectively integrate project feasibility assessments with capacity planning strategies, ensuring alignment with organizational objectives and enhancing operational efficiency.

In their study, Kirkley and Squires (1999) underscore the importance of comprehending organizational capacity and its measurement in the context of designing a robust capacity management program. This becomes especially critical when capacity is governed by explicit limitations. The research problem centres on developing methodologies and frameworks that accurately assess and quantify organizational capacity, enabling the effective implementation of capacity management strategies that align with operational goals and constraints. Organizations often face challenges when accepting projects without adequately assessing their impact on resource capacity, which includes human resources, equipment, time, and other critical resources. This oversight can lead to resource overload, negatively affecting delivery performance and the profitability of production systems (Hans et al., 2007). Despite the availability of decision support tools in academic literature designed to address tactical planning problems, there remains a significant gap in their application in real-world settings. This gap translates into a lack of practical studies and examples demonstrating how these tools can effectively optimize resource allocation and project planning in organizational contexts. As a result, many organizations may miss opportunities to improve their operational efficiency and mitigate risks associated with resource constraints and project overcommitment. Above mentioned gap has been a recurrent theme in many papers (Buxey, 2003; 2005; Corti et al., 2006; Ramezanian et al., 2012; Sharda & Akiya, 2012; Jamalnia & Feili, 2013; Liu et al., 2013; Díaz-Madroñero et al., 2014)

According to (Aizaz et al., 2021), scope creep stands out as a critical factor contributing to the failure of traditional software development projects. Scope creep refers to the gradual increase in project requirements over time, typically occurring when new project requirements are introduced by clients or stakeholders after project execution has commenced. These changes often lack proper review, thereby placing additional tasks, deliverables, and milestones on the project team to be completed within the original resource and time constraints. Komal et al. (2019) emphasized that human factors contribute significantly to scope creep, leading to a lower success rate in construction projects. These factors encompass human capabilities, limited stakeholder involvement, lack of experience, change requests, and the personal capacities of project team members.

1.3 Purpose of Research

The purpose of this research is to explore and highlight various organizational practices and models that enhance quality, productivity, and resource efficiency while addressing concerns for both management and employees. According to (Madhuri & Rao, 2014), implementing continuous improvement and maturity models can lead to significant improvements in these areas. Starting from the year 2000, software companies have widely adopted the Capability Maturity Model, commonly known as CMMI, as noted by (Bhargava & Chakrabarti, 2003).

Additionally, (Ward et al., 1998) underscored the importance of studying manufacturing practices and strategies in operations management research to enhance organizational

production capabilities and overall performance. Furthermore, (Rudberg and Olhager, 2003) highlighted the necessity of achieving systematic production efficiency for long-term success in production firms, impacting competitive performance in terms of product quality, cost, delivery speed, and flexibility. (Aizaz et al., 2021), effectively managing and controlling changes within a project, especially concerning its scope, is pivotal for achieving project success. One significant objective of a capacity plan is to prevent scope creep in projects. This study aims to elucidate the fundamentals of agile capacity management and planning and underscore their significance in facilitating organizational goals during product development phases.

1.4 Significance of the Study

Moniruzzaman and Hossain (2013) emphasize Agile product management as a pivotal methodology among commonly used approaches in product development. It champions an incremental and iterative strategy for software delivery, allowing teams to promptly address evolving customer requirements. Originally designed to enhance software development efficiency, Agile principles are now increasingly applied across diverse work contexts. The study underscores a notable trend where many organizations are integrating Agile principles throughout their structures to bolster collaboration, increase adaptability to changes, and expedite project outcomes. Additionally, Moniruzzaman and Hossain's comparative study provides insights into how Agile Software Development Methodologies surpass traditional approaches. This comparison highlights Agile's advantages in

responsiveness, efficiency, and customer satisfaction, positioning it as a preferred method for modern organizational agility and success.

Heimickea et al. (2021) highlighted a significant trend in manufacturing companies where agile approaches are being increasingly integrated into their development processes. This adoption is expected to bring about several beneficial outcomes. Firstly, it aims to improve customer integration by fostering closer collaboration and feedback loops between manufacturers and their customers. Secondly, agile methodologies are anticipated to enhance responsiveness to changes within the development context, allowing manufacturers to adapt swiftly to market demands, technological advancements, and other evolving factors. Ultimately, the integration of agile practices is anticipated to lead to improvements in both process and product quality, enabling manufacturers to deliver higher-quality products more efficiently and effectively. This shift reflects a broader recognition within the manufacturing sector of the advantages of agile methodologies in driving innovation, flexibility, and customer satisfaction. Nangulu et al. emphasize the critical role of production capacity planning and management within organizations. They highlight that effective capacity planning is crucial for fostering organizational growth and optimizing performance. This process involves aligning the long-term capacity of production processes with the demand for their products or services. By strategically managing production capacity, organizations can ensure they have the resources and capabilities necessary to meet current and future market demands efficiently. This alignment not only supports operational stability but also enables companies to capitalize on opportunities for expansion and enhancement of overall performance metrics. Thus,

capacity planning emerges as a cornerstone of organizational strategy, directly influencing competitiveness, profitability, and sustainable growth.

1.5 Research Questions

Studies such as (Marnada et al, 2021) have explored general challenges in agile adoption, but there remains a lack of empirical evidence addressing the nuances of capacity management and its direct effects on agile project outcomes. To address this issue, the study will focus what correlations exist between effective capacity management practices and improvements in organizational outcomes such as product quality, delivery speed, and overall productivity. The study aims to investigate that in what ways do capacity management practices influence product development excellence, and how can these practices be optimized to enhance development processes. Also, this investigation centers on how different capacity management practices employed by Agile Product Management teams affect team dynamics and overall efficiency. Lastly, to explore the role of agile capacity management and planning play in preventing scope creep and ensuring project success, and how can these practices be optimized to align with organizational goals during product development phases. The answers to these questions are intended to provide insights and resolve the central issue of our research.

CHAPTER II:

REVIEW OF LITERATURE

2.1 Agile Product Management

The literature on agile software development highlights its rapid evolution and growing acceptance over the past two decades. Despite its popularity, the development and use of theories in agile research remain relatively low (Stray et al., 2022). Stray et al further pointed out that while analysing publications on agile software development in the Scopus database from the last decade, they found that only 7% of the papers used or developed a theory. This trend seems stable. However, it is encouraging that the majority of theory-centric studies either utilize existing theories or propose new ones to tackle the cognitive and behavioural aspects of individuals working in agile development.

Kittlaus (2012) emphasizes the importance of integrating agile approaches with product management to optimize development processes. They not only alter the manner in which development is carried out but also affect other stakeholders in development projects, particularly the software product manager. Software companies grapple with how to harmonize software product management and agile development effectively.

Moniruzzaman & Hossain (2013), noted that out of the most commonly used product development methodologies, Agile product management is that one promotes an incremental and iterative approach to software delivery. This approach surfaced as a means for software teams to swiftly address customer demands, and its application is expanding to various other domains of work. Moniruzzaman and Hossain (2013) further pointed out

that many companies are implementing agile principles across the entire organization to improve collaboration, adapt to change, and produce working results faster. Moniruzzaman and Hossain (2013) also provided a comparison study report of Agile Software Development Methodologies over Traditional SDMs.

In 2001, the "agile manifesto" was written by the practitioners reveals which items are considered valuable by ASDMs The twelfth principle of the Agile Manifesto states: "At regular intervals, the team evaluates how to enhance its effectiveness and then fine-tunes its behavior accordingly. Heimickea et al. (2021) observed that manufacturing companies are increasingly adopting agile methodologies in their development processes. This adoption is anticipated to bolster customer integration, improve responsiveness to changes in the development environment, and ultimately enhance both process and product quality.

2.2 Capacity Planning

Nangulu et al. emphasized that production capacity planning and its management within an organization play a crucial role in fostering organizational growth and performance. This involves aligning the long-term capacity of a process with the demand for its products. Aarabi and Hasanian (2014) described that Capacity planning is the first step when an organisation decides to produce more or new products required to meet the customers demand in time. Capacity planning and control is an issue which every operation is faced with and can profoundly affect the efficiency and effectiveness of the operation.

According to Shahin (2014), Available capacity management includes demand management as well as capacity management .In demand management issues such as price variation, changes in methods of promoting the product, change over delivery time (for example due to items Returns) and order complementary products are under consideration ; In the capacity management issues such as, the staff diversity, changes in equipment and procedures, changes in methods and redesign product to accelerate the process are of importance. Ceryan & Koren (2009) formulated the Optimal Capacity Selection Problem using mixed integer programming. They conducted numerical studies to offer insights into how these decisions are influenced by factors such as investment costs, product revenues, demand forecasting scenarios, and fluctuations in planning periods. Their findings demonstrated that optimal investment strategies favor greater involvement of flexible systems, particularly under lower flexibility investment costs, high product revenues, and significant product uncertainties over time.

Fang, Ho (2013), raised issues related to the consultation on allocation of capacity for multiple products. They used general reduced gradient method to obtain an optimal solution and modified it for the algorithm related to nonlinear model with constraints, that can obtain the optimal solution by random selection of a practical solution. They showed that marginal benefit, inventory holding cost, shortage cost, lack of surplus production and the market demands in an effort to explore the optimal allocation of capacity associated with various products should be considered. Steele *et al*.(2001) provided a resource modelling structure that integrated the analysis of product with behaviour of the physical productive resources (Embedded in the software applications methods) for product design,

process planning, production cost, quality control, resource acquisition, planning and production scheduling and implementation of shop-floor activities .This structure was based on a set of production resources classes that determine the structure of a resource modelling database . These classes are used for building object-oriented software package which implements various functions of engineering design.

Importance of Capacity Management

Kim & Uzsoy (2009) demonstrate ways to tackle operational performance measures for capacity planning problem and congestion in work-in-process. Wang and Chen (2009) addressed inter-factory capacity planning problems, while Jawahar and Balaji (2009) demonstrated methods to minimize total distribution costs through effective capacity management. Strategic capacity management enables industrial organizations to efficiently oversee their overall assets. Additionally, Sun Microsystems, Inc. (2007, p. 6) emphasized the importance of actively monitoring capacity and performance levels to detect issues before they escalate into incidents. The same source also points out that although it may be possible to realise capacity issues early, not all problems can be can be resolved by increasing capacity. Periodically reassessing critical areas of the business and making adjustments to operations and resource allocation can yield significant benefits. A well-structured capacity management initiative can effectively support business needs. Recently, focused paradigms such as the resource-based view and core competencies have emerged. These theories concentrate on managing a firm's resources, highlighting that diverse resources owned by a firm can provide sustainable competitive advantages

(Jeremy, 2001). However, the resource-based view is challenged by the difficulty in empirically identifying and measuring heterogeneous resources due to their qualitative nature, such as the expertise of design engineers (Jeremy, 2001, p. 16).

Capacity planning, management, and forecasting directly address the needs and success of industries. Incorporating these practices into business strategies can promote smart resource and capital utilization (Flynn et al., 1995). Modern technological advancements have streamlined capacity planning processes compared to the past reliance on paper spreadsheets and calculators. Today, technology-enabled planning practices efficiently handle planning data and information.

Capacity planning significantly enhances operational efficiency, positioning companies competitively (Occhino, 2010). It remains integral to business planning and management by aligning industries with their established projections (Schuler & MacMillan, 2006).

2.3 Capacity Planning Strategies

Nangulu (2020) emphasized on various capacity management strategies widely employed by organizations to meet the customer demands while enhancing competitiveness which are complemented by an effective and efficient organizational operation performance.

a) Lag strategy
b) Lead strategy
c) Match strategy
d) Level strategy

a) Lag strategy

Lag Capacity management Strategy: This is the opposite of lead capacity. In this strategy, organizations increase capacity only when it's running at optimum. Lag capacity management strategy yields to cost effective products (Olhager et al., 2001). A lagging capacity management strategy involves responding to demands as they arise. For instance, a company launching a software product initially staffs based on current budgetary needs. They only increase staffing when specific demands necessitate it, such as launching a new product requiring a new team of engineers or managing spikes in product demand that increase support needs.

Lag strategies reduce the risk of investing in underutilized resources. However, avoiding overspending introduces other risks. For example, an app that suddenly gains widespread popularity may experience outages and increased user issues, damaging the company's reputation precisely when it has an opportunity to expand market share and revenue.

Employees may also experience burnout if they are continually tasked with shouldering the workload while the organization is in the process of scaling up resources and hiring additional workers. Ultimately, those employing a lag capacity management strategy must be prepared to manage the delays inherent in acquiring new resources, including activities such as hiring and training, to ensure smooth operations and employee well-being.

b) **Lead strategy**

Lead Capacity Management Strategy involves organizations increasing their production capacity in anticipation of projected increases in customer demand. This proactive

approach ensures that the organization is prepared to meet future demand without delays or shortages. This strategy allows for the organization to rent its excess capacity to other companies in the same sector (Hayes and Wheelwright, 1984). A lead capacity management strategy aims to predict resource requirements and address them proactively ahead of time. If, for example, a company wants to expand its user base and grow its number of app installations, it might pre-emptively hire and train extra staff in anticipation of need. Those employing a lead strategy for capacity management must be prepared to adjust if their resources are not immediately required. This often manifests in the form of layoffs and adjustments to the forecasted demand. It also implies that the business missed opportunities to invest in other, potentially more valuable projects while its focus was directed elsewhere.

c) Match strategy

Match (Chase) Capacity Management Strategy: This is a more moderate strategy in which an organization increases its capacity in smaller increments in response to the market demand (Chase and Aquilano, 1985). This strategy minimizes the over and under capacity issues typically associated with lead and lag strategies (Gary, 2017). A match strategy for capacity management seeks to constantly adjust the number of available resources in order to accurately reflect current and near-future demands. This strategy is referred to as the "market equilibrium" approach, aimed at precisely aligning supply with demand. It is particularly suitable for organizations equipped with sophisticated resource calculation and planning capabilities. Such organizations must be prepared to compromise immediate

capacity availability (typical of lead strategies) or overall resource cost savings (common in lag strategies) in favor of achieving precise resource alignment.

d) Level strategy

Level Capacity Management Strategy: Level capacity management strategy helps organizations to maintain a steady input and production output rates over a planning period and work force rate as the surplus products inventory accumulated in the period of low demand are utilised to absorb the incremental demand (Jacobs and Chase, 2008).

2.4 PRODUCT LIFE CYCLE

Product development process management benefits from the adoption of the product life cycle (PLC) concept, which serves as a decision-making tool. The PLC is employed to track the product's performance across its various life stages, from initial development to eventual retirement, maximizing utility and profit potential at each phase of its lifecycle (Ryan and Riggs, 1996).

During its time in the market, the typical PLC phases include introduction, growth, maturity, and decline.With this in mind, the PLC becomes a representation of the product’s market history and each phase is characterized by the trend of sales volumes and profit performance (Cunningham, 1969). Giudice et al. 2006 noted that the environmental performance of a product throughout its life cycle is influenced by the interaction between all the actors involved, an effective solution to deal with the environmental concern must be evaluated within the broader community of stakeholders. The product life cycle (PLC) assesses the attributes of a product in terms of its life cycle (LC). The life cycle theory is

accepted as a decision-making tool in management (of organizational structures of manufacturing activities; market analysis and forecasting based on the advancement of technologies; and the development of novel products and their introduction to the market) (Giudice et al. 2006). The PLC identifies the following successive four stages through which products progress (Fullerton et al., 2003) (Meenaghan and Turnbull, 1981) (Yoo, 2009) (Anderson and Zeithaml,1984).

a) Introduction

This phase occurs once a new product is conceived, fabricated and made avail-able in the market (Robinson and Pearce,1986). During the introduction stage of a product, significant investment is necessary to maximize its profit potential. This phase is marked by a small market size, low sales (reflected in a gradual upward slope on the traditional PLC curve), and high costs associated with research and development. Initially, losses may occur before substantial profits are realized as sales begin to increase. Depending on the product category, this phase may also feature minimal competition and high prices. According to Aitken et al. (2003), key order winners (OW) during the introduction stage include lead time (the time from concept to design availability) and design capability.

b) Growth

As the product enters this phase, it experiences rapid gains, which is indicated by a sharp rise in the classical PLC (Robinson and Pearce,1986).. The main characteristic of this stage according to (Aitken et al., 2003) is increasing demand and that the main OW is service level (the ability of the product delivery system to respond to unpredictable demand). Marketing and promotional activities play a crucial role in generating and enhancing

customer demand during the growth phase of a product. Other notable characteristics of this phase include heightened competition, declining prices (due to increased market saturation with competitors), decreased support costs (as production scales up to meet rising demand), and a corresponding increase in profits resulting from reduced per-unit costs.

c) Maturity

At this phase, the PLC curve begins to flatten out, organizations are more concerned about maintaining their share of the market, and therefore the mere existence of the product is not given a second thought. The maturity stage, as noted by Robinson and Pearce (1986), is typically the longest phase of the product life cycle. During this stage, there is a decline in sales, increased competition, a reduction in market share, decreased profits, continued cost reductions, and a focus on innovation aimed at maintaining or improving market share. (Aitken et al., 2003) indicates that the main OW is cost after the product at this stage has been pushed to a kanban supply chain.

d) Decline

During the maturity phase, the market becomes saturated, leading to a gradual decline in demand and sales for the product. The rate of decline can vary significantly among different products. Some products may experience a rapid decline in sales, approaching zero over time, while others may maintain a steady but low level of sales for extended periods (Robinson and Pearce, 1986).

2.5 Capacity Planning in Product Management

(Wortmann et al. 1996) reviewed capacity planning techniques from which today's standard software packages for production control make their choice with the following techniques are discussed in the paper: four main variants to consider: rough-cut capacity check, capacity requirements planning with both infinite and finite loading, input/output planning with and without individual work orders, and various sequencing techniques. Further, (Wortmann et al. 1996) discussed that an important issue throughout the paper is the concept of robustness and nervousness of planning techniques, Aspects of interaction between techniques and human planners arc given. The human planner remains pivotal in capacity planning.

In product management, this process ensures teams align resources with current and future demand levels, mitigating the risk of supply shortages. Capacity planning serves as a critical tool for product managers (PMs) to mitigate the risk of not meeting demand whether that increases or decreases. This prevents over or under-allocating resources. This capability allows businesses to avoid potentially costly disruptions that can frustrate customers, impact reputation, and harm revenue.

Platje et al., stress that capacity in a multi-project organization cannot be managed in a traditional single project-oriented approach. They describe an organizational structure to manage a portfolio of projects in a multi-project organization, and call this project-based management. Project leaders, management, and resource managers collaborate as a unified portfolio management team. They must make important resource allocation decisions. The

portfolio management team plays a central role in project-based management. (Boer, 1998) has developed a prototype decision support tool to support the decisions of the portfolio management team quantitatively. De Boer distinguishes two planning levels for portfolio management. he initial level is referred to as rough-cut capacity planning (RCCP), while the subsequent level deals with the resource-constrained project scheduling problem (RCPSP). RCCPaddesses medium-term capacity planning problems. At this level, projects are split up in relatively large work packages, which are planned over time taking into account the availability of scarce resources. The RCPSP, or Resource-Constrained Project Scheduling Problem, indeed focuses on operational, short-term scheduling challenges within project management. To that extend, work packages are split up into smaller activities which are scheduled over time. The usual objective is making span minimization, constrained by the finite resource availability. Wicaksono and Ni (2020) presented an approach of automated manpower planning model which can be used by MTO operations to achieve a better transparency and synchronization of capacity load for short to medium planning horizons. Further, he approaches is implemented as a software tool to automate the data processing and analysis, which helps to dramatically reduce the corresponding data operation efforts and planning time.

In IT industry, companies increasingly adopt cloud computing and manage multi-project portfolios, effective capacity planning becomes essential for ensuring resource alignment with demand. Examine the role of capacity planning in cloud environments, where computing resources are dynamically allocated based on demand. Review how cloud providers manage and scale resources to meet fluctuating needs (Stauffer et al., 2021).

Analysing techniques and best practices used in cloud computing for capacity planning, including auto-scaling and resource provisioning strategies.

2.6 Operational Excellence

In an increasingly dynamic environment where change is a constant, operational excellence programs have become crucial for achieving improved performance results (Carvalho, 2017). Organizational excellence plays a critical role in the quest for sustainable success in today's competitive and globalized world (Evans & Jack, 2003). With customers setting higher standards than ever before, organizations must continuously enhance their performance and maintain a high level of quality to stay competitive in the twenty-first century. Excellence models offer one approach to achieving this goal by providing frameworks to guide organizational improvement efforts (Mohammad, Mann, Grigg, & Wagner, 2009). However, as organizations strive for success and growth, they must also consider whether they are on the right path to excellence and how their performance can be effectively assessed (Oakland, 2001).

Most assessment tools are designed with large organizations in mind and often do not cater to the specific needs of medium-sized enterprises (Ahsen et al., 2010). For smaller organizations, applying comprehensive models like the EFQM model can be particularly challenging due to limited time and financial resources, as well as the high effort required for preparation and execution. This highlights the clear need for simplified and user-optimized assessment tools that can better support the unique circumstances of smaller organizations (Rusjan, 2005).

CHAPTER III:

METHODOLOGY

3.1 Overview of the Research Problem

This research aims to investigate the implementation and impact of capacity management practices employed by various Agile Product Management teams. By leveraging a data-driven approach, the study will evaluate how these practices influence team dynamics and overall efficiency. The objective is to identify correlations between effective capacity management and improved organizational outcomes as well as product development excellence. Given the critical role of capacity planning in ensuring successful project delivery, understanding its impact within agile environments is essential. However, the specific mechanisms through which capacity planning influences agile project performance have not been thoroughly investigated, presenting a key area for further research. By examining how different approaches to capacity planning impact project outcomes, this research aims to provide actionable insights for improving agile practices and addressing existing gaps in the literature.

3.2 Research Purpose and Questions

In recent years, the integration of agile methodologies within product management has gained substantial attention due to its potential to enhance flexibility and efficiency in project execution. Despite its growing prominence, there remains a significant gap in understanding how capacity planning impacts the effectiveness of agile practices. While

existing literature extensively covers the principles and benefits of agile methodologies, there is limited research focusing on the specific role of capacity planning within agile frameworks. The primary research questions examined in this study are

a) What correlations exist between effective capacity management practices and improvements in organizational outcomes such as product quality, delivery speed, and overall productivity?

a) In what ways do capacity management practices influence product development excellence, and how can these practices be optimized to enhance development processes?
b) How do different capacity management practices employed by Agile Product Management teams affect team dynamics and overall efficiency?

c) What role does agile capacity management and planning play in preventing scope creep and ensuring project success, and how can these practices be optimized to align with organizational goals during product development phases?

To support these primary questions, further, questions were asked to individuals who work in related domains. Every above question was breakdown into 10-15 questions to give a better view of the individual experiences falling at minuscule level.

3.3 Research Design

The research adopts a mixed-method approach that combines qualitative and quantitative research techniques to provide a holistic examination of Agile capacity management practices.

a) Qualitative Methods:

Online Surveys: The qualitative section involves interviewing product managers, agile coaches, and team members in more detail. These interactions sought to uncover rich insights into their experiences and views on Agile Capacity Planning. It is through this method that the study looked into individual experiences, difficulties faced, and the benefits that accrue to capacity management as part of an agile framework.

b) Quantitative Methods:

Performance Metrics Analysis: Under quantitative analysis, performance metrics for teams adopting agile capacity management were explored. This included measuring various metrics before and after such practices were taken up by the teams to gauge their impact on team performance and efficiency levels. Statistical approaches are used in detecting statistically significant changes and relationships between organizational outcomes as influenced by capacity management practices.

a) Census Survey Study Design: To support the research, a census survey was conducted which involved examining every individual, everything or unit within a population. It

is referred to as a complete enumeration, indicating a comprehensive count of the entire population (Robbins, 2003). In this process, data was gathered from all the groups that deal with capacity and product management within the organization. The aim was to ensure that there is a holistic comprehension of how such teams apply capacity management practices and collect information from an unbiased sample of population.

b) Data Collection Tools:

o Structured Questionnaires: For the collection of the data used in this study, structured questionnaires were designed on specialized knowledge in operations management. These questionnaires aimed at fetching relevant details about the implementation and consequences associated with capacity management practices.

c) Data Sources and Collection Procedures:

- Observation of Agile Practices: Observations were made to understand practical application of agile capacity management in teams. This helped in identifying any deviations from the prescribed practices and their effects on team performance.
- Surveys: The participants belonging to different company were surveyed for collecting data. Furthermore, surveys were also carried out through different social media websites so as to get various opinions from different people who are concerned.
- Literature and Research: Existing literature and previous research studies were reviewed to contextualize findings and compare them with established knowledge in the field.

3.4 Population and Sample

This study took a positivist approach and used surveys to gather data. The data collection method used was surveys, which are an effective approach for quantitative research. The aim was to explore how capacity planning affects project success in agile projects, especially when dealing with complex projects. We collected data from individuals working on agile projects across various organizations, using online platforms.

3.5 Participant Selection

To ensure we got valuable insights, we targeted respondents who were well-acquainted with the product lifecycle, including project managers, consultants, product owners, project supervisors, engineers, developers, and clients from various roles and organizations.

3.6 Data Collection Procedures

The procedure followed to obtain the results was as follow:

1. Google Survey Form Questions were curated looking onto the Problem statement.
2. Linkedin & organization level groups & individuals were contacted to fill te survey form.

3.7 Data Analysis

Data results were collected and analysed on excel using formulas and analyzation functions of excel were used which involved:

- **Qualitative Analysis:** Thematic analysis was used to interpret responses from interviews and surveys. This process involved identifying recurring themes and patterns related to Agile capacity management practices.
- **Quantitative Analysis:** Statistical techniques was applied to analyse performance metrics, including pre-and post-implementation comparisons. Regression analysis and correlation tests were used to identify significant relationships between capacity management practices and team performance outcomes.

By combining these methodologies, the research provided a holistic understanding of how Agile capacity management practices influence team effectiveness and overall product development. The findings contribute to the existing body of knowledge and offer practical insights for enhancing Agile practices in organizational settings.

CHAPTER IV:

RESULTS

In this section, we present the findings from the survey aimed at evaluating how capacity planning is integrated into agile practices and its impact on operational efficiency. The results are organized to highlight significant trends and patterns observed in the data collected from participants. We provide a detailed analysis of both quantitative and qualitative responses, addressing the core research questions and objectives of the study.

4.1 Research Question One

What correlations exist between effective capacity management practices and improvements in organizational outcomes such as product quality, delivery speed, and overall productivity?

Correlation Analysis

To evaluate how various factors related to capacity management influence the quality of products, delivery speed, and overall productivity, the survey data was subjected to correlation analysis. A sample of data was analysed and correlation was establish between different factors to cater the above question.

Formula

$$r = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}$$

r = correlation coefficient

x_i = values of the x-variable in a sample

$\bar{x}$ = mean of the values of the x-variable

y_i = values of the y-variable in a sample

$\bar{y}$ = mean of the values of the y-variable

- Positive Correlation- The value of one variable increase linearly with an increase in another variable. This indicates a similar relation between both variables. So its correlation coefficient would be positive or 1 in this case.
- Negative Correlation- When there is a decrease in the values of one variable with an increase in the values of another variable, in that case, the correlation coefficient would be negative.
- Zero Correlation or No Correlation- When there is no specific relation between two variables.

To what extent do you believe that effective capacity management practices improve the quality of your products?	How frequently do you see improvements in product quality as a direct result of effective capacity management?	How has implementing capacity management practices impacted your team's delivery speed?	To what extent has capacity management optimization contributed to faster project delivery times in your organization?	In your experience, how closely is capacity management linked to overall productivity improvements in your organization?	How do you rate the impact of capacity management practices on your organization's overall productivity?	How satisfied are you with the improvements in product quality, delivery speed, and productivity resulting from your capacity management practices?
0	0	0	0	0	0	0
1	1	1	1	1	1	1
1	1	1	1	1	1	1
1	1	0	0	0	0	1
0	0	0	0	-1	0	0
1	1	0	0	-1	0	1
1	1	1	-1	1	1	1
0	0	0	0	0	0	1
0	0	1	0	0	0	1
1	1	0	0	-1	0	0
-1	-1	-1	1	0	0	-1
0	0	0	0	0	0	0
0	0	0	0	0	0	1
1	1	1	1	1	1	1
1	1	1	1	1	1	1
-1	-1	1	-1	-1	0	1
1	0	-1	-1	1	0	0
1	1	1	1	1	1	1
0	0	1	0	-1	1	0

4.1.1 Findings:

- It was found that there was a very strong correlation (0.945) between believing that effective capacity management enhances product quality and often observing improvements in product quality due to capacity management. This means that people who believe in good capacity management practice would be likely to witness better quality production.
- The relationship between implementing capacity management and its effect on group delivery speed is weak to moderate (0.241). Thus, these variables are less related.
- There is a moderate positive correlation (0.511) between the impact of capacity management on overall productivity and belief in their effectiveness.
- Satisfaction with improved product quality, expedited deliveries as well as better productivity arising from the implementation of capacity management has a moderate level of association with most other variables ranging from 0.445–0.662

- Satisfaction with the improvements in product quality, delivery speed, and productivity leading to capacity planning linked overall producticity shows a moderate correlation (0.511) with the belief that effective capacity management practices improve product quality. This indicates a fairly strong perceived connection between capacity management and productivity improvements.

Correlation Matrix Table

Variable 1	Variable 2	Correlation Coefficient
To what extent do you believe that effective capacity management practices improve the quality of products?	How frequently do you see improvements in product quality due to effective capacity management?	0.945
How frequently do you see improvements in product quality due to effective capacity management?	How has implementing capacity management practices impacted your team's delivery speed?	0.406
How has implementing capacity management practices impacted your team's delivery speed?	How do you rate the impact of capacity management practices on your organization's overall productivity?	0.59
To what extent has capacity management optimization impacted your organization's efficiency?	How satisfied are you with the improvements in product quality, delivery speed, and productivity?	0.662
How do you rate the impact of capacity management practices on your organization's overall productivity?	In your experience, how closely is capacity management linked to operational efficiency?	0.511
How satisfied are you with the improvements in product quality, delivery speed, and productivity?	To what extent do you believe that effective capacity management practices improve the quality of products?	0.445
How satisfied are you with the improvements in product quality, delivery speed, and productivity?	In your experience, how closely is capacity management linked to overall productivity improvements?	0.321

4.1.2 Results

This analysis indicates various levels of relationships between the surveyed aspects of capacity management and their perceived impacts on business outcomes. The strongest correlation is observed between belief in the effectiveness of capacity management and the frequency of observed improvements in product quality.

What aspects of capacity management do you believe have the most significant effect on improving product quality?	How does your organization measure the effectiveness of capacity management practices in relation to delivery speed?	In your opinion, which capacity management practices have had the most positive effect on productivity in your organization?

Detailed Analysis and Findings:

1. **Strong Correlations**:

- Observed improvements in product quality usually correlate strongly (0.945) with the belief in the effectiveness of capacity management practices, indicating that those who believe in these practices often see visible effects.

- The correlation between the belief in the effectiveness of capacity management and perceived overall productivity impact is also strong (0.494), suggesting that respondents feel that these measures can lead to higher levels of efficiency.

2. **Moderate Correlations:**
    - Overall, there is a moderately positive relationship (0.590) between how capacity management affects delivery speed and overall productivity which implies that this feature affects productivity through delivery time.

    - Satisfaction with this type of practice has a moderate correlation (0.662) with customer satisfaction for both service and manufacturing companies, meaning that customer satisfaction depends on the company's usage of these principles.

3. **Weak to Moderate Correlations:**
    - The assessment of some organizations is dependent on their perceptions regarding optimization of organizational efficiency against other relevant factors which may be used by them as determinants (r = 0.202).

- The linkage between capacity management and overall productivity improvements has a moderate correlation (0.511) with the belief in the effectiveness of these practices, reinforcing the idea that good capacity management is seen as beneficial for productivity.

4. **Low Correlations:**
    - Some correlations, such as the impact of capacity management optimization on overall satisfaction with improvements (0.035), are very low, indicating minimal perceived relationship between these specific variables.

This comprehensive analysis highlights the significant relationships between capacity management practices and various performance metrics, providing valuable insights for understanding the impact of these practices on organizational performance.

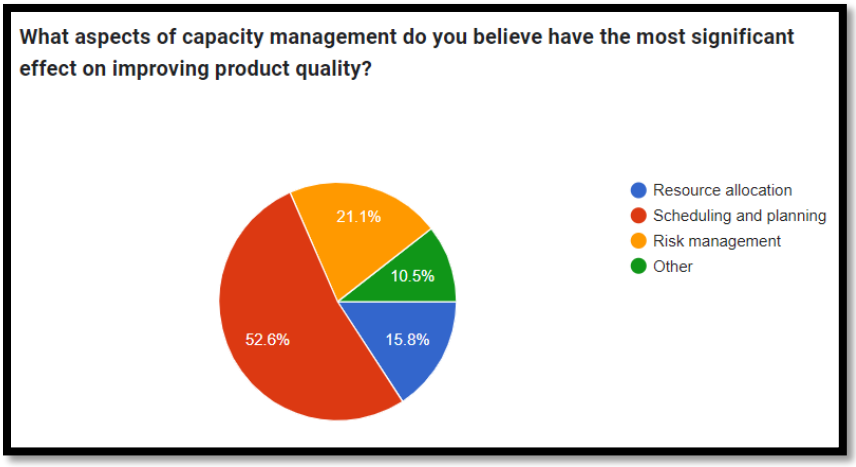
4.1.3 Indications

Based on the survey results, here's an analysis of how different aspects of capacity management correlate with improvements in organizational outcomes, specifically focusing on product quality, delivery speed, and overall productivity:

A. Impact on Product Quality

Aspects and Their Importance:

- Scheduling and Planning (52.6%): production quality is mostly affected by scheduling. When scheduling is effective, resources are allocated properly and the production process coordinated reducing errors and therefore improving the quality of final products.



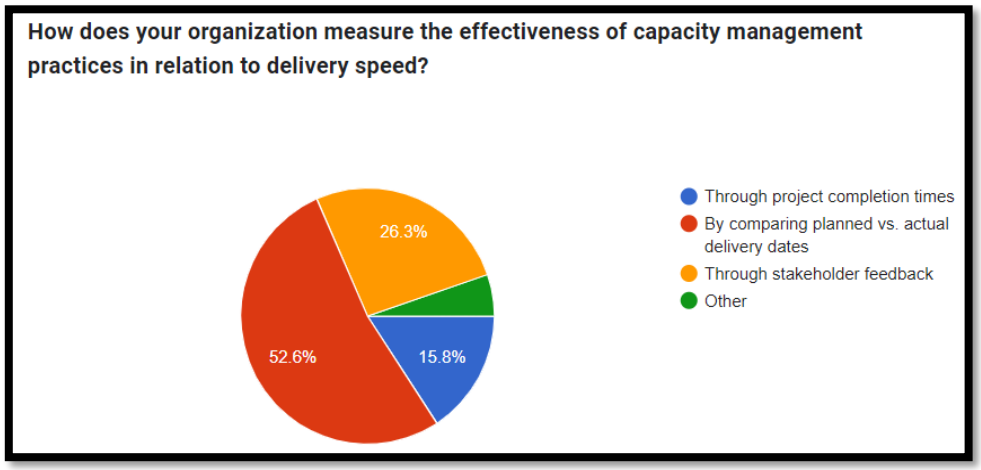
- Resource Allocation (15.8%): On the other hand, regarding resource allocation, it must be noted that this is an important factor in maintaining product quality but not as much as scheduling and planning.
- Risk Management (21.1%): However, risk management does not have a direct impact on scheduling and planning like other factors mentioned above.
- Other (10.5%): There could be some other practices or strategies that might influence the quality of goods in a similar way although people may not know how best to go about them or they may be difficult to implement widely.

The focus on scheduling and planning shows that systematic and timely management of production schedules as well as operations has been at the heart of enhancing product quality. With effective scheduling, quality standards can still be met by maintaining alignment between production timelines, resource utilization and quality control measures.

B. Measurement of Effectiveness in Delivery Speed

Methods and Their Significance:

- By Comparing Actual and Planned Delivery Dates (52.6%): This approach is the most popular for determining how successful delivery speed is. It gives a clear indication of efficiency by evaluating the capacity management's alignment with delivery targets.
- Through Stakeholder Feedback (26.3%): Although it may not be as accurate as quantitative measurements, feedback from stakeholders can offer qualitative insights into delivery performance.



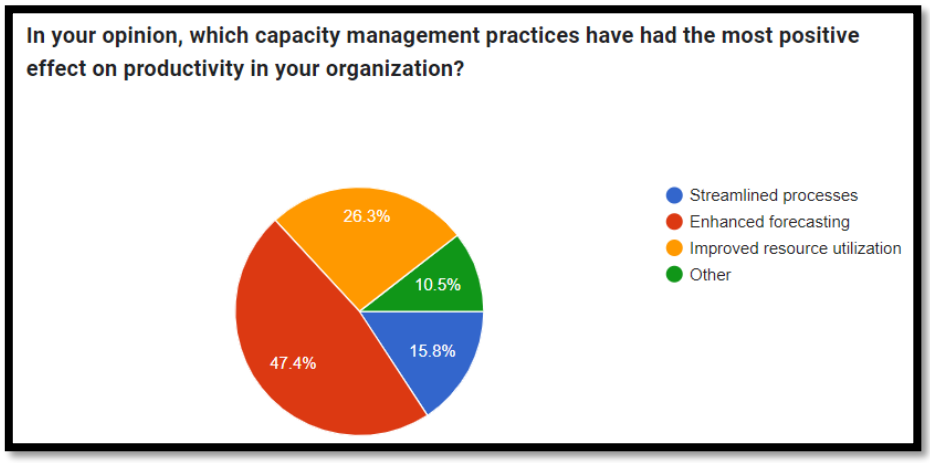
- Through Project Completion Times (15.8%): Although helpful, this approach is less frequently employed, maybe because it focuses less on delivery speed and has a wider scope than planned vs. actual delivery dates.
- Other (5.3%): This group comprises less common but potentially useful techniques.

The preference for comparing planned vs. actual delivery dates suggests that organizations prioritize quantitative and specific measures to gauge how well their capacity management practices support timely deliveries. This approach helps in identifying discrepancies and improving alignment between planning and actual performance.

C. Practices Affecting Productivity

Practices and Their Impact:

- Enhanced Forecasting (47.4%): This is thought to boost productivity the most. Precise forecasting enhances total productivity by minimizing inefficiencies, maximizing resource allocation, and anticipating demand.



- Enhanced Resource Utilization (26.3%): Productivity also depends on the effective utilization of resources. Efficient resource management optimizes productivity while minimizing waste.
- Streamlined Processes (15.8%): Although streamlining and optimizing processes might increase output, forecasting and resource use are thought to have a greater influence.
- Other (10.5%): This group may consist of extra productivity-boosting techniques that aren't as well-known.

The strong focus on improved forecasting suggests that predicting demand and making appropriate plans are essential for increasing productivity. By matching capacity to anticipated workload, forecasting reduces downtime and inefficiencies.

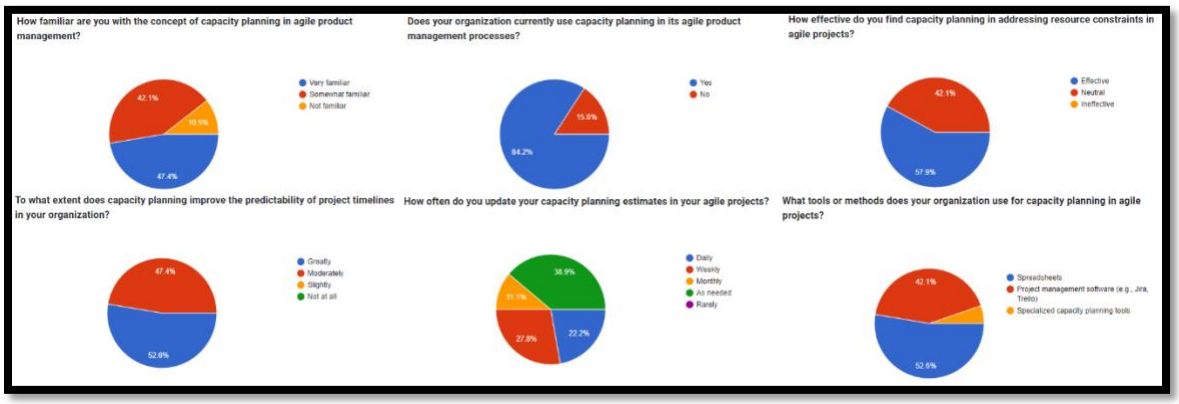
4.2 Research Question Two

“In what ways do capacity management practices influence product development excellence, and how can these practices be optimized to enhance development processes?”

4.2.1 Findings

26 sub-categorized questions were used to assess individuals' knowledge and experience related to capacity planning in agile product management. The findings reveal that 47.4% of respondents are "Very familiar" with the concept, while 42.1% are "Somewhat familiar," indicating a general understanding. In contrast, 10.5% of respondents are "Not familiar." The survey results reveal that a substantial majority of respondents, 84.2%, indicated that

their organization currently utilizes capacity planning within its agile product management processes. This finding highlights a strong prevalence of capacity planning practices among the surveyed organizations, suggesting that this approach is widely integrated into their agile frameworks. In contrast, 15.8% of respondents reported that their organizations do not use capacity planning. This smaller percentage indicates that while capacity planning is a common practice, there remains a segment of organizations that have yet to adopt this approach within their agile methodologies. The findings indicate that 57.9% of respondents find capacity planning to be "Effective" in addressing resource constraints in agile projects. Meanwhile, 42.1% of respondents are "Neutral" on its effectiveness, suggesting a balanced view or uncertainty about its impact. Notably, no respondents considered capacity planning to be "Ineffective."

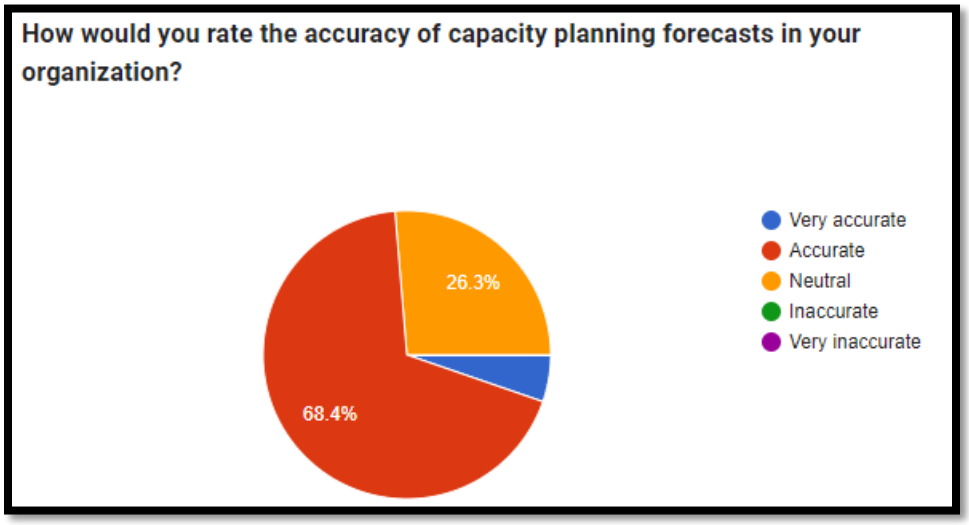


From survey results shown in above summary, 52.6% of respondents believe that capacity planning improves the predictability of project timelines "Greatly," 47.4% feel it does so "Moderately." These findings suggest that capacity planning is perceived as a significant factor in enhancing timeline predictability, with over half of the respondents seeing a

substantial impact. The remaining respondents also acknowledge its positive influence, though to a lesser extent. Overall, the data indicates a strong consensus on the effectiveness of capacity planning in improving project timeline predictability. Notably, no respondents indicated that capacity planning improves predictability "Slightly" or "Not at all." The Data indicate that 22.2% of respondents update their capacity planning estimates "Daily," while 27.8% do so "Weekly." A smaller proportion, 11.1%, update their estimates "Monthly," and 36.9% update them "As needed.". No respondents reported updating their estimates "Rarely."

The survey data reveals the distribution of tools and methods used for capacity planning in agile projects. More than half of the respondents use spreadsheets(52.6%) for capacity planning. This suggests that spreadsheets are a popular and accessible tool, likely due to their flexibility and ease of use for various calculations and tracking needs. However, reliance on spreadsheets may also indicate potential limitations in scalability and advanced features compared to other tools. A significant portion of respondents (42.1%) utilizes project management software such as Jira or Trello. This reflects a preference for integrated solutions that offer a range of features beyond capacity planning, including task tracking, collaboration, and reporting. These tools may provide more structured and comprehensive support for agile project management. Only 5.3% of respondents use specialized capacity planning tools. This lower percentage suggests that while specialized tools can offer tailored features for capacity planning, they are less commonly adopted compared to more general tools like spreadsheets and project management software. No respondents

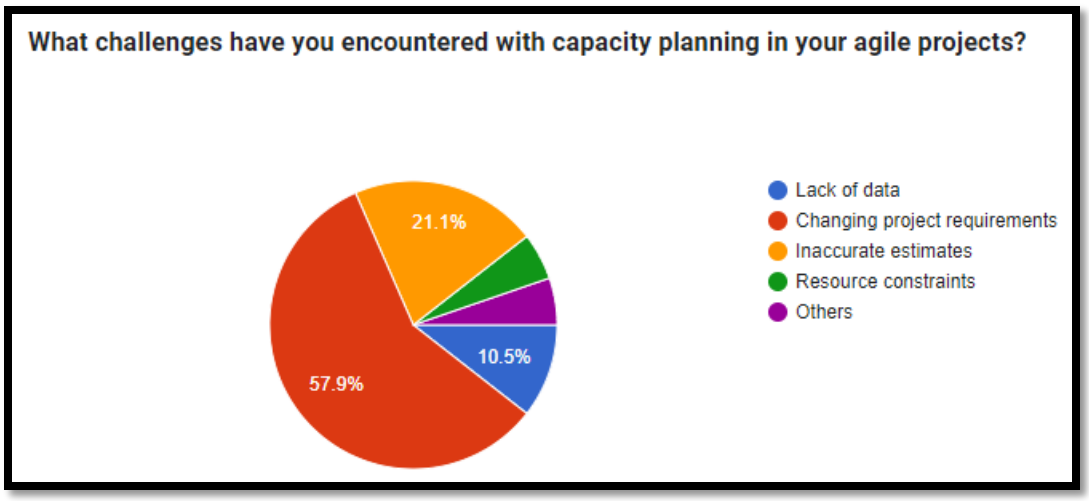
indicated the use of other tools or methods, suggesting a consensus on the use of the aforementioned tools and methods for capacity planning in agile projects.



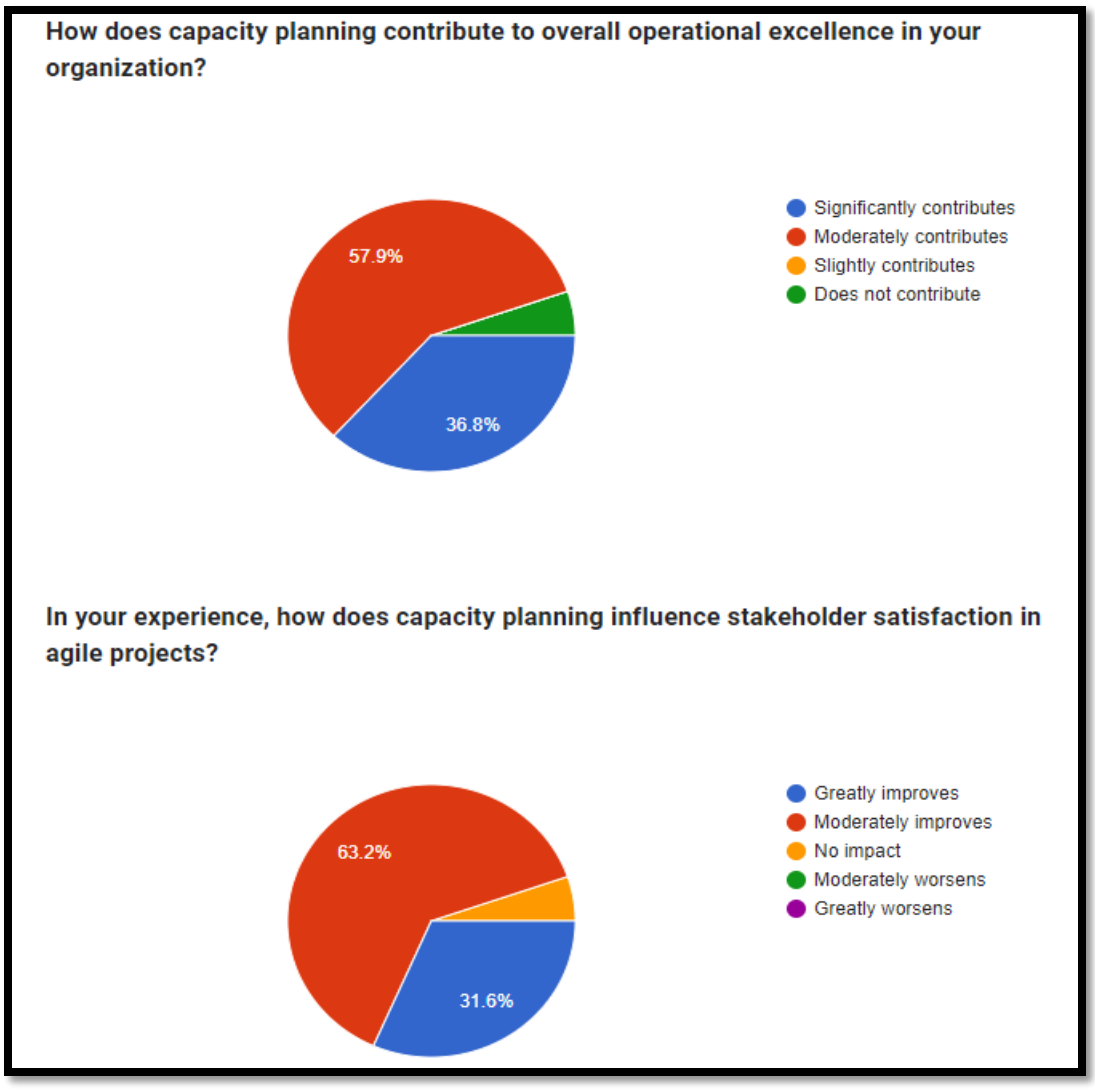
On asking accuracy of capacity planning forecasts in your organization, a small proportion of respondents, 5.3%, rated their capacity planning forecasts as "Very accurate." This indicates that a few individuals perceive their forecasts to be extremely precise and reliable. The majority of respondents, 68.4%, rated their forecasts as "Accurate." This suggests that most participants believe their capacity planning forecasts are generally reliable and meet the expectations for accuracy within their organization. A notable 26.3% of respondents chose a "Neutral" rating. This indicates that while these respondents do not have strong opinions about the accuracy of their forecasts, they might find the accuracy satisfactory or insufficient, but without strong conviction. No respondents rated their forecasts as "Inaccurate," suggesting that there are no strong feelings of dissatisfaction or recognition of significant issues with the accuracy of capacity planning forecasts. Similarly, no

respondents found their forecasts to be "Very inaccurate," indicating a general absence of severe concerns about forecasting inaccuracies.

While addressing the challenges encountered with capacity planning in agile projects, The most frequently cited challenge is "Changing project requirements," reported by 57.9% of respondents. From this it is suggested that frequent changes in project scope/requirements are a significant hurdle in effectively planning and managing capacity. 21.1% of respondents chose "Inaccurate estimates" as a challenge. This indicates that discrepancies between estimated and actual capacities can bring difficulties in effective capacity planning. A smaller proportion, 10.5%, reported "Lack of data" as a challenge. This suggests that insufficient or unreliable data may impact the accuracy and effectiveness of capacity planning. 5.3% of respondents highlighted "Resource constraints" as a challenge. This indicates that limitations in available resources can affect the ability to plan and allocate capacity effectively. An additional 5.3% mentioned "Other" challenges, implying that there are some less common or unclassified issues that may also affect capacity planning.



Capacity management plays an important role in enabling an organization to effectively meet its operational requirements. Survey results show that most respondents recognize the importance of capacity planning, with 36.8% indicating that it "makes a significant contribution" to overall business improvement, and 57.9% indicating that "little helpful" with a tiny percentage of 5.3% believing it to be so "Not helpful", indicating that there are areas where the impact of capacity planning is not fully realized or implemented.

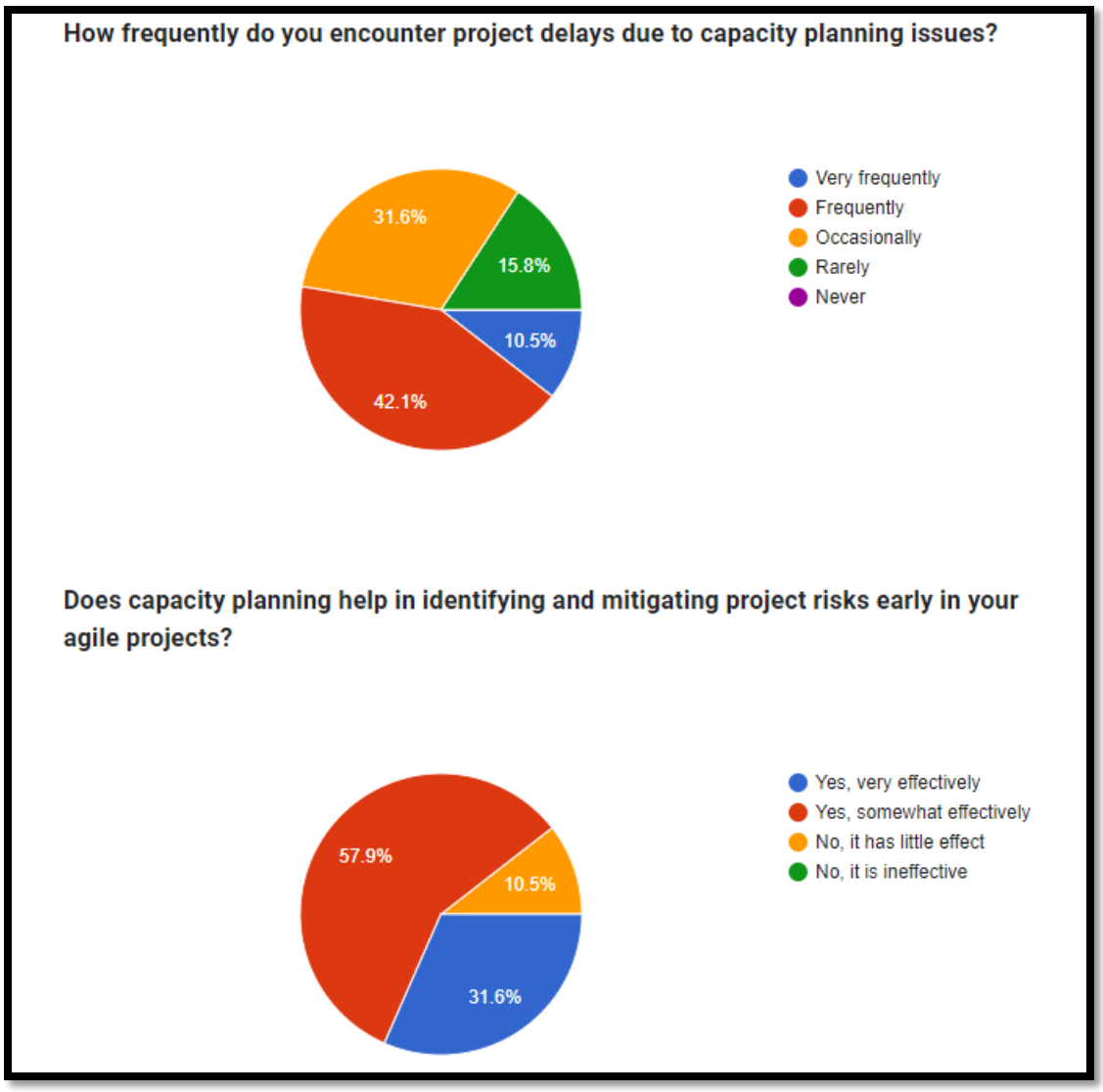


Capacity planning is an important aspect of agile project management, where resources, timelines and deliverables must be carefully balanced to ensure stakeholder satisfaction Survey results shows that a large proportion of the respondents believe that power systems have a positive effect on stakeholder satisfaction, with 31.6% stating that it "improves significantly satisfaction, 63 .2% also states that "it drives satisfaction effective in general" Notably, none of the respondents felt that power structure for stakeholder satisfaction

deteriorated, and only 5.3% felt that it had no impact . satisfaction, and only 5.3% believe it has no impact.

Project delays can cause significant impacts, affecting timelines, budgets and stakeholder satisfaction. Survey data reveal that capacity planning issues contribute particularly to project delays, with a total of 52.6% of respondents experiencing these delays "frequently" or "frequently" while 31.6%; another "occasionally" suffers from such delays, while 15.8% say the business shares information about capacity planning. rarely" encounter, they say. Notably, no respondent indicated that they never "encountered" such a delay.

Capacity planning is an important aspect of project management, especially in agile environments where the ability to adapt to change and manage risk is critical The survey findings show that most respondents accept deal that capability management plays a role in identifying and mitigating project risks early in agile internal processes. 31.6% thought it was "very effective" and 57.9% thought it was "somewhat effective". A minority of 10.5% considered capacity planning to have "minimal impact", and no respondents identified it as "ineffective".



The survey shows that capacity planning is generally perceived as a positive influence on supply chain quality, which a large proportion of respondents agree is important. While the integration of power systems with other agile practices is relatively difficult, there is still room for improvement. Most interviewees agreed that capacity planning is critical to long-term strategic success in agile projects, emphasizing its value. However, suggestions for

improvement indicate that there are areas where the current approach to capacity planning can be improved, especially in terms of data accuracy and instrumentation

4.2.2 Results & Indications

Familiarity results with the concept indicate that although most participants have a strong or moderate understanding of power structures, a notable minority benefits from innovation or education in relation to increasing understanding and general unknown knowledge of the concept suggests an important opportunity to consider potential benefits. Most participants view capacity planning as a valuable tool for managing resource constraints, with a smaller proportion remaining neutral. The lack of negative feedback confirms the generally positive view of the role of power structure in agile project management. Research on updating capacity planning estimates in agile projects shows that capacity planning is frequently updated, with a large proportion of respondents taking a flexible approach by updating estimates as needed This reflects a proactive approach how to manage capacity in agile projects.

The primary use of spreadsheets for power planning shows widespread acceptance due to their versatility and customization. However, it may also indicate that more comprehensive or integrated tools that can enhance power planning processes may not have been adopted. Adoption of project management software: The widespread use of project management software highlights the importance of managing agile projects. It is likely that these tools provide valuable resources that facilitate a more integrated approach to integrating capacity planning with other project management functions. The minimal use of specialized

capacity planning tools suggests that either these tools are not widely recognized, or organizations may not perceive them as necessary compared to more general-purpose tools. The absence of "Other" responses indicates that the tools listed are predominantly used, and there are no significant alternative methods being employed for capacity planning in the surveyed organizations.

The data show that the majority, 68.4%, consider their power planning forecasts to be "accurate", reflecting strong confidence in the reliability of their forecasts This indicates that methods and tools are generally considered a it is used to make the power system more efficient. Only 5.3% considered their prediction to be "very accurate", which means that although accuracy is usually good, very high accuracy is rarely achieved or known and this may indicate a potential area for improvement to reach the prediction high accuracy. Although most find their forecasts accurate, they could put effort into forecasting strategies to increase the number of their forecast showings as 26.3% of "very accurate" respondents lack each side had a segment of the staff that did not have a specific view of the accuracy of the forecast . This bias may reflect changes in forecasting performance or lack of participation in the forecasting process. Understanding the reasons behind neutral ratings can provide insight into possible improvements or changes in the accuracy of forecasts. Contacting these respondents may reveal areas that will increase the accuracy or perceived efficiency of power systems.The absence of negative evaluations ("inconsistent" and "inconsistent") indicates no issue there is about accurate prediction. This positive result indicates general satisfaction with current power planning policies.

The main challenge of the "requirements of the transition project" reflects a fundamental issue in maintaining a realistic and reliable power system. Agile projects are often characterized by changing requirements, which can disrupt capacity planning efforts and require frequent adjustments. Organizations need to develop strategies to optimize and adapt to the changing requirements of the business. This may require the use of flexible policies, increased communication with stakeholders, or adaptive policy strategies. The "wrong estimate" challenge highlights the difficulty of predicting capacity accurately. This issue can be due to a variety of factors, including insufficient historical data, statistical bias, or unexpected complexity. To reduce the incidence of miscalculation, organizations may need to refine their accounting procedures, make better use of historical data, or improve audit training programs Challenge associated with "lack of information" implies inadequate or unreliable Access to effective information can hinder effective capacity planning. Access to complete and accurate information is critical to capacity estimates and informed decisions. Ensuring reliable and comprehensive information is critical. Organizations can consider investing in better data collection and analysis tools to support capacity planning. Although less discussed, "resource constraints" implies that limitations on available resources (e.g., personnel, equipment) may affect capacity planning and that these constraints may ability to distribute power effectively. The "other" section highlights that there are some other, less common complications that may not be fully recognized by the criteria of choice. Understanding these challenges could provide further insights into the unique issues faced in capacity planning. Addressing resource constraints could involve

optimizing resource allocation, increasing resource availability, or enhancing resource planning processes to better support capacity planning efforts.

The survey results indicate that capacity planning is a critical factor in project execution, with a substantial portion of respondents encountering delays due to issues in this area. The data shows that:

- 10.5% of respondents experience project delays due to capacity planning issues "very frequently."
- 42.1% face these delays "frequently."
- 31.6% encounter delays "occasionally."
- 15.8% report that they "rarely" experience delays.
- 0% of respondents "never" face delays due to capacity planning issues.

This distribution suggests that while capacity planning is an ongoing challenge, it is not uniformly problematic across all projects, with some teams managing to mitigate its impact better than others.

Below is the summary of responses and indication on how capacity planning is linked

1. Impact on Quality of Deliverables:

- Significantly improves: 31.6%
- Moderately improves: 42.1%
- No impact: 26.3%

Indication: Most respondents (73.7%) agree that capacity planning has a positive or moderate impact on the quality of deliverables in agile projects. This suggests that effective capacity management is needed to ensure quality, as it may help teams allocate resources more efficiently and manage work better but the 26.3% who do not see an impact may indicate inadequate capacity management do not apply or cannot be effectively applied in their particular context

2. Integration with Agile Practices:

- Fully integrated: 42.1%
- Mostly integrated: 36.8%
- Somewhat integrated: 10.5%
- Not integrated: 10.5%

Indication: The data show that 78.9% of respondents report strong integration of power planning with other agile practices, such as sprint planning and post-track conditioning and that this high level of integration is likely to be conducive to work the coordinated and streamlined management efforts. However, the 21% of respondents reporting only partial or no integration highlights potential differences that could lead to inefficiencies or differences in planning and implementation in those projects.

3. Critical for Long-Term Strategic Goals:

- Strongly agree: 31.6%
- Agree: 57.9%
- Neutral: 10.5%

Indication: 89.5% of respondents strongly agreed or agreed that capacity planning is essential to achieving long-term performance goals in agile projects This strong agreement highlights the importance of capacity building structure for not only immediate project results but also for continuous improvement and strategic agility with the organization or Can be measured.

4. Suggested Improvements:

- Better tools and software: 26.3%
- More accurate data collection: 36.8%
- Improved training for team members: 15.8%
- More frequent updates and reviews: 10.5%
- Other: 10.5%

Indication: The proposed improvements identify key areas where capacity management can be improved. The first recommendation for more accurate data collection (36.8%) indicates the need for better forecasting and resource tracking strategies to support effective planning among 26.3% of respondents 26.3% prioritized the need for better tools and software, indicating that current tools may not fully meet the demand for agile teams. Furthermore, the emphasis on training (15.8%) and frequent updates (10.5%) suggest that

improved organizational design and responsiveness of team members' skill sets can drive effective capacity planning on.

4.3 Research Question Three

"How do different capacity management practices employed by Agile Product Management teams affect team dynamics and overall efficiency?"

4.3.1 Findings

On the basis of the survey, capacity management practices were implicated as having an impact on team cohesion and collaboration in Agile projects. There is mixed feedback in the responses; 42.1% believe it has had positive impacts/slightly positive impacts, 26.3% see no effect at all while 15.8 % view it slightly negative but still very limited. This mixed feedback suggests that capacity management can enhance teamwork in some cases but may present challenges or remain neutral depending on how it is implemented and integrated into the workflow of a team.

The data suggest that efficient resource allocation is essential to creating a positive climate among teams involved in Agile projects. By taking this approach, teams are able to get a clearer idea of their roles and the resources they can use as a result of greater cooperation efforts. However, fast running schedules and efficient communication are also important, albeit with different situational effects on implementation. With respect to the challenges associated with capacity estimation issues, it is important to understand that incorrect workload forecasts by teams add potential stress, burnout, and sometimes

inefficiency and these contradictions and divisions further complicate the issues of conflict between team members thus effectively interrupting the process.

The data show that changes in capacity management practices have a noticeable impact on team performance, with many respondents experiencing these changes occasionally or more frequently This suggests that capacity management is a normal process sharp, which, when tweaked, can make a difference in how well teams perform. Several informants, however, feel that these changes are modest, suggesting that in some cases capacity management may be inconsistent or ineffective in day-to-day operations Current capacity management practices are effective in supporting allowing teams to meet deadlines and achieve goals This reflects an overall reliance on established capacity management processes, although it also highlights the possibility of repetition changes in these practices again though

According to the data, capacity planning is a useful team productivity tool, with most of them reporting an increase in productivity since its implementation. This implies that capacity planning assists teams in resource allocation more efficiently thereby attaining improved performance. The fact that workload distribution can be balanced effectively by means of capacity planning indicates its significance in preventing overburdening employees and maintaining sustainable pace and diminishing burnout. However, although stakeholders are often communicated with on matters concerning capacity planning, it would be good if greater consistency or clarity could have been brought about to ensure all

parties are on board. Although some respondents find capacity planning beneficial in meeting deadlines, this shows its importance among Agile environments where delivery has time constraints but others consider it as a hindrance to their progress hence maybe there is need for some adjustment to suit certain situations.

4.3.2 Results & Indications

The data shows that capacity management practices can influence team dynamics in Agile projects, but the extent of this influence varies.

- Slightly positively: 15.8%
- Positively: 26.3%
- Slightly negatively: 15.8%
- No impact: 26.3%

Indication: The results show experiences with agile tasks related to capacity management. Positive or slightly positive responses accounted for 42.1% indicating that effective implementation strengthens team cohesion and fosters collaboration through team strategies using available resources in achieving project objectives in the field of responsibility. However, 26.3% see no impact and indicate that capacity management practices may not fully benefit all teams, may have a neutral effect 15.8% Somewhat misinformation highlights possible areas where capacity management can disrupt or undermine team achievement levels emphasis on existing Due to prior attention.

The results show that effective power management, especially clear resource allocation, has a strong positive effect on team performance. This means that when teams have a clear understanding of their capabilities and resources, they are better equipped to work together and work more effectively. The challenges identified, particularly those related to capacity audits, highlight areas where organizations need to improve their planning processes. Overcoming these challenges by streamlining audit procedures, improving communication, and ensuring flexible processes can improve team productivity and overall project efficiency.

The results suggest that although power management practices affect team effectiveness, the frequency of these effects varies. This means that teams generally respond to changes in capacity management, although the extent of this response depends on the specific changes that have been made Overall satisfaction with efficient use of capacity in terms of meeting deadlines and objectives indicates that these actions are closely aligned with the needs of the project. The data suggest that capacity management needs to be continuously analyzed and adjusted to ensure continued effective support of teams, particularly in more dynamic environments where efficiency may change frequently.

The results of the study indicate that power structure significantly influences team performance and workload balance; That is, when used properly, it can make many positive differences among functional groups. Overall, it shows that a pervasively effective capacity structure encourages adherence to deadlines and is an essential part of successful Agile project management. However, mixed responses to interactive and

periodic interventions suggest that the scope may creep up and require more flexible or tailored capacity planning processes for units or industries various types. This could include improving how capacity planning information is communicated and changing how planning is integrated into agile business processes.

4.4 Research Question Four

What role does agile capacity management and planning play in preventing scope creep and ensuring project success, and how can these practices be optimized to align with organizational goals during product development phases?

4.4.1 Survey Findings

The data reveals that scope creep is a common issue in Agile projects, with most respondents indicating that it impacts their capacity planning processes at least occasionally, and for many, it is a frequent concern. The regular occurrence of scope creep implies that Agile projects are inherently subject to alterations in scope since teams work incrementally and stakeholders' expectancies change over time. The notion that scope creep affects project success is important, with many respondents claiming moderate to extreme effects on their projects. Consequently, efficient capacity planning becomes vital at these points so as to manage the changes and prevent the disruption from affecting project timelines, budgets, and team productivity.

When it comes to the effectiveness of current power planning practices in handling scope array, most respondents find these practices to be at least moderately effective This shows that although different teams have different ways of dealing with scope creep, there is still room for improvement. The most important challenges identified relate to resource modification and scope modification, which are important elements of power planning. These challenges mean that teams can struggle with the dynamic nature of Agile projects, where what can be done can change rapidly, requiring quick and effective adjustments to resources and timelines

The data strongly support the importance of optimized power management to manage scope creep. Most respondents believed it was critical to critical, reflecting widespread recognition that scope creep without effective capacity management could lead to business degradation and lead to missed deadlines, funding over-scheduling and declining team morale. Current strategies implemented, such as changing project timelines and increasing communication channels, indicate that teams are actively seeking ways to reduce the impact of scope array but mixed satisfaction with these efforts suggests that although progress has been made, more needs to be done

4.4.2 Results & Indications

The data gathered from the survey provides rich insights into how scope creep affects capacity planning, and subsequently affects Agile projects As often as scope creep affects capacity planning processes, it often can be a constant concern for many teams. Very few respondents reported that they "never" or "rarely" experience scope creep, highlighting

the pervasive nature of this issue. The majority experience it "sometimes" or more frequently, suggesting that Agile projects are inherently prone to scope changes, which must be carefully managed to avoid project overruns.

The results are equally important when examining how scope creep affects the success of Agile projects. A large portion of respondents acknowledges that scope creep has at least a moderate impact on their projects, with many citing it as a considerable or extreme factor. This suggests that scope creep is not just a problem and rather it is a huge challenge that can affect both the process and the outcome of Agile projects. Recognizing the impact of scope creep on success underscores the critical importance of effective management strategies and practices.

The study also sheds light on the effectiveness of current power planning practices in handling scope array. Although most consider these interventions to be highly effective, there is a notable share of respondents who find them somewhat or not at all effective This difference suggests that when some groups have ways to mitigate the effects of scope array through capacity planning, others have experienced changes from where they operate struggle to adapt to the challenges of resource efficiency and define changes in the materials sector, particular emphasis has been placed on the difficulties encountered in determining material adaptation and spatial variability, suggesting that these are key areas where current practices fail.

Another important outcome of the study is the need for an optimal power system to overcome the creep in scope. Most respondents believe distances are very or exceptionally important in improving those practices. This strong concept suggests that

the need to use the best gear, methods and techniques to manage dynamic Agile projects can gain greater prominence policy revision is the most common way to deal with scope creep, followed by communication channel improvements and general scope review reveals the s, albeit with a mixture of interesting factors, viz. however, there is room for improvement.

Finally, research responses related to interest in capacity planning and optimization efforts are evident. While most respondents are satisfied with their current efforts, the broader segment remains neutral, indicating that although progress has been made, many groups feel that there is nonetheless extra that can be achieved. The effect of scope creep on normal operational excellence in Agile tasks is likewise great, with many respondents reporting a moderate to extreme impact. This suggests that scope creep is not just a task-particular trouble however one that can affect the wider fulfilment and efficiency of Agile methodologies inside an business enterprise.

4.4.3 Case Study 1- The Denver-International Airport's automated-baggage handling system Failure

Summary

The Denver International Airport’s automated baggage handling system (BHS) was an ambitious project designed to revolutionize airport operations through advanced technology. Initially envisioned to handle a substantial portion of the airport's baggage automatically, the system aimed to enhance efficiency, reduce manual labor, and manage growing passenger traffic with minimal delays. However, the BHS project faced

numerous challenges, including significant technical issues, operational disruptions, and cost overruns. These issues were exacerbated by scope creep—an expansion of the project's scope beyond its initial plans—which played a crucial role in the project's difficulties.

Image taken from IT680 Software Engineering Project Blogs

Role of Agile Capacity Management and Planning:

1. Scope Creep and Complexity: Scope creep refers to the out of control changes or non-stop increase in a task's scope. In the BHS assignment, scope creep substantially impacted the system’s functionality and integration. As extra functions and requirements

have been introduced without right adjustment to the mission's resources or timelines, the complexity of the device increased dramatically, main to integration demanding situations and operational disasters (Flyvbjerg, 2006). Agile capacity control should have helped mitigate those issues by means of implementing iterative reviews and adjustments to align the scope with sensible venture constraints (Sullivan, 2000).

2. Capacity Management Practices: Agile capability management entails adapting sources and planning in reaction to evolving mission needs. For the BHS assignment, the failure to regulate capacity and aid allocation in response to emerging problems contributed to its operational issues (Hickson, 2003). Agile practices, which includes iterative planning and non-stop comments, could have facilitated higher dealing with of scope changes and technical challenges, improving universal venture overall performance (Klein, 2005).

3. Planning and Optimization: The BHS mission suffered from unrealistic timelines and insufficient planning, main to frequent technical problems and operational disruptions. Agile ability management practices, such as iterative development, continuous stakeholder engagement, and adaptive useful resource allocation, could have optimized task effects by aligning improvement with organizational goals and addressing troubles proactively (Flyvbjerg, 2006; Sullivan, 2000).

Result & Indication

Role of Agile Capacity Management and Planning:

The Denver International Airport BHS project highlights the critical importance of capacity management and planning in preventing scope creep and the project's failure to manage capacity and adjust in response to unexpected challenges great business disruption and cost overruns ensued

Tips for the project:

-Need for agile practices: The BHS project highlights the importance of adopting agile practices to manage scope creep and complex project requirements. Iterative development, continuous feedback, and exchange programs are critical to meeting evolving needs and mitigating disruption (Hickson, 2003).

-Optimize practices: Effective capacity management and planning should include continuous review and adjustment to align project objectives with organizational objectives.

Implication

The implications of the Denver International Airport BHS project for Agile capacity management and planning are profound. The project's failure shows why companies need to use Agile methods to handle scope creep and make projects work. The Denver International Airport BHS project proves why good Agile methods are needed to handle scope creep and make projects more successful. The main takeaways are:

-Better Project Planning: Companies should focus on careful planning and realistic budgets, with ways to deal with scope changes. Agile methods like step-by-step development and updating the to-do list can help keep projects on track (Sullivan 2000). --Ability to Change: Agile capacity management helps projects stay flexible and able to change, which you need to run big projects. By using these ideas, companies can handle surprise changes better and make sure projects meet their big-picture goals (Flyvbjerg, 2006).

-Ongoing Enhancement: Regular check-ins and input from stakeholders play a key role to improve capacity management methods. Setting up ways to keep getting better can tackle new problems and make sure project results line up with what the organization wants to achieve (Hickson 2003; Klein 2005).

Conclusion

The Denver International Airport BHS project teaches us a lot about how scope creep affects things and why Agile capacity management and planning matter. The project's hurdles show why it's so important to use Agile methods to handle complex situations, stop scope from growing too much, and make sure projects turn out well.

Combining step-by-step planning ongoing input, and flexible resource use helps companies better handle big tech projects. The BHS project shows why solid planning, adaptability, and involving key people matter to finish projects well and meet company aims. Good capacity control and planning are key to deal with today's complex projects.

Using Agile methods can boost a company's ability to handle changes in scope and reach its main goals.

4.4.3 Case Study 2-NHS Civilian IT-Civilian Computer System

Summary

The NHS Civilian IT-Civilian Computer System (NHS IT-Civilian) was a big IT project the National Health Service (NHS) in the UK started to update and join its IT systems. The project aimed to create one efficient system to handle patient files, schedules, and other vital tasks across NHS sites. But the NHS IT-Civilian project ran into big problems, like delays high costs, and working issues because the scope grew too much and capacity wasn't managed or planned well.

The project had a bold aim to build and set up a full IT system for many healthcare providers, each with its own current setup and ways of working. This complexity was resulted by frequent changes to project requirements, insufficient stakeholder engagement, and a lack of adaptive planning. These factors responsible in a system that struggled to meet its goals and ultimately led to the project's failure.

Daily Mail COMMENT

VASTLY expensive, utterly unfit for purpose, the NHS computer scheme will go down in history as the most egregious of countless examples of the last Labour Government's incompetence and waste.

It was only our money, after all.

How bitterly telling it is that the £12billion ministers squandered on this vanity project is exactly the size of the black hole identified this week in the Chancellor's deficit reduction plan.

And how starkly this saga underlines yesterday's rare moment of insight from Nick Clegg, when he told delegates at the Lib Dem conference: 'Never, ever, trust Labour with our economy again.'

Image taken from Dailymail.co.uk

Analysis-Role of Agile Capacity Management and Planning:

1. **Scope Creep and Complexity**

   Scope creep had a big impact on the NHS IT-Civilian project. It happens when a project grows beyond its original plan. At first, they wanted to build a strong IT system. But as they worked, they kept adding new features without changing deadlines or adding more people to help. Agile capacity management could have helped. It focuses on step-by-step development and checking project goals often. This approach helps control changes and adapt to them (Leffingwell, 2018).

2. **Capacity Management Practices**:

   Capacity Management Practices: To manage capacity well in Agile, you need to keep an eye on resources and plans. You should adjust them to fit what the project needs. In the NHS IT-Civilian project, the inability to manage capacity

dynamically in response to evolving requirements and technical challenges contributed to its problems. Agile practices, such as iterative cycles and regular stakeholder feedback, could have facilitated better alignment between project goals and the actual capacity available (Highsmith, 2010).

3. **Planning and Optimization**: The NHS IT-Civilian project suffered from poor planning and an unrealistic timeline, exacerbated by inadequate stakeholder involvement and lack of flexibility. Agile capacity management practices emphasize iterative planning and adaptive resource allocation, which could have improved the project's alignment with organizational goals and helped address emerging challenges more effectively (Scrum Alliance, 2020).

Result & Indication

The NHS IT-Civilian project underscores the critical role of Agile capacity management and planning in managing scope creep and achieving project success. The project's failure to effectively control scope changes and adapt to evolving needs resulted in significant operational disruptions and financial losses.

Indications from the Project:

1. Need for Agile Practices: The challenges faced by an NHS IT civilian project highlight the importance of adopting agile practices to manage scope creep and complex project requirements Iterative improvements, continuous feedback and flexible planning needed to manage change and ensure projects stay on track (cited by Leffingwell , 2018).

2. Optimizing Practices To align capacity management and strategy with organizational objectives, it is important to use Agile methodologies that focus on continuous assessment, flexible processes and stakeholder engagement will be involved together. The NHS IT-Civilian project's issues emphasize the need for a more flexible and responsive approach to project management (Highsmith, 2010).

Implication

The NHS IT-Civilian project emphasizes the need for effective Agile practices to manage scope creep and enhance project success. Key implications include:

1. Enhanced Project Planning: Organizations should prioritize detailed planning that includes mechanisms for managing scope changes. Agile practices such as iterative development and backlog refinement can help maintain project focus and alignment with goals (Leffingwell, 2018).
2. Flexibility and Adaptability: Agile capacity management promotes flexibility and adaptability, which are crucial for managing complex projects. Adopting Agile principles can help organizations handle unexpected changes and ensure that projects meet their strategic objectives (Highsmith, 2010).
3. Continuous Improvement: Implementing processes for continuous improvement, including regular reviews and stakeholder feedback, is essential for optimizing capacity management practices. This approach can address emerging issues and align project outcomes with organizational goals (Scrum Alliance, 2020).

Conclusion

The NHS IT-Civilian project illustrates the significant impact of Agile capacity management and planning on preventing scope creep and ensuring project success. The project's challenges highlight the importance of adopting Agile practices to manage complexity, adapt to scope changes, and achieve organizational objectives.

Integrating iterative planning, continuous feedback, and adaptive resource allocation can enhance an organization’s ability to handle large-scale IT projects effectively. The lessons from the NHS IT-Civilian project emphasize the value of Agile methodologies in navigating complex projects and achieving successful outcomes.

CHAPTER V:

DISCUSSION

5.1 Discussion of Results

Capacity Planning in Product Management:

- Resource Allocation: Assess how capacity planning helps product managers (PMs) ensure that resources align with current and anticipated demand, thus preventing over- or under-allocation. Discuss the implications of effective capacity planning on avoiding disruptions, maintaining customer satisfaction, and protecting revenue.
- Impact on Business Operations: Review the potential consequences of inadequate capacity planning, including operational disruptions, customer frustration, reputational damage, and revenue loss.

5.2 Discussion of Research Question One

Summary and Correlation Insights:

- Product Quality: Scheduling and planning are most critical for improving product quality. Ensuring that production processes are well-organized and timed reduces errors and enhances consistency.

- Delivery Speed: Measuring effectiveness through the comparison of planned vs. actual delivery dates is key. This method provides a direct and clear measure of how well capacity management practices align with delivery targets.
- Productivity: Enhanced forecasting is viewed as the most significant factor in improving productivity. Accurate demand predictions enable better resource allocation and process optimization.

Overall, the survey results suggest that effective capacity management practices, particularly scheduling and planning, accurate forecasting, and comparing planned vs. actual outcomes, play a significant role in enhancing organizational outcomes such as product quality, delivery speed, and productivity.

5.2 Discussion of Research Question Two

The results reveal that capacity planning is widely regarded as a key factor in operational excellence within the organization. The combined **94.7%** of respondents who believe capacity planning contributes either significantly or moderately suggest that the organization understands the importance of aligning resources, production capabilities, and demand forecasts. This alignment is crucial for maintaining efficiency, meeting customer expectations, and avoiding both underutilization and overburdening of resources. The **5.3%** of respondents who do not see capacity planning as contributing to operational excellence could indicate a lack of awareness or integration of capacity planning in certain departments or operational levels. It may also suggest that these

respondents work in areas where the direct impact of capacity planning is less visible, or where other factors are perceived as more critical.

The results suggest a strong consensus that capacity planning plays a vital role in improving stakeholder satisfaction within agile projects. A combined **94.8%** of respondents believe that capacity planning either greatly or moderately improves satisfaction, reflecting an understanding that effective capacity planning helps agile teams deliver on commitments, manage expectations, and adapt to changes more effectively. The **5.3%** of respondents who feel that capacity planning has no impact might be working in contexts where other factors, such as team dynamics, communication, or external dependencies, are perceived as having a more significant influence on stakeholder satisfaction. This could indicate that while capacity planning is important, it is not the sole determinant of success in these environments.

The high frequency of project delays due to capacity planning issues points to several potential underlying causes. These could include inaccurate forecasting of resource needs, unforeseen changes in project scope, or inadequate communication between teams. The fact that no respondents reported never encountering delays due to capacity planning suggests that this is a universal challenge within the organization, though its severity varies. The **31.6%** who only "occasionally" face delays may indicate that some teams have more effective capacity planning processes in place or that they operate in less volatile project environments. Conversely, the **52.6%** who encounter delays "very frequently" or "frequently" might be dealing with more complex projects or more significant resource constraints.

The effectiveness of capacity planning in risk management within agile projects is likely tied to its ability to forecast resource availability, anticipate potential bottlenecks, and allocate resources efficiently. The **31.6%** of respondents who find it "very effective" likely have robust processes in place that allow them to proactively address risks before they escalate. The **57.9%** who see it as "somewhat effective" might encounter limitations, such as incomplete data or challenges in adapting plans quickly enough to mitigate risks fully. This suggests that while capacity planning is helpful, it may not always be sufficient on its own and could benefit from being paired with other risk management practices. The **10.5%** of respondents who believe capacity planning has "little effect" may work in environments where risks are driven more by external factors or where other forms of planning, such as strategic or financial planning, play a more prominent role in risk mitigation.

The results show a clear recognition of the benefits that capacity planning brings to agile projects, particularly in improving deliverable quality and contributing to strategic goals. The strong integration of capacity planning with agile practices in many organizations highlights its perceived value, though the existence of partial or non-integration in some cases points to potential areas for improvement. The emphasis on better tools, data accuracy, and training suggests that while capacity planning is valued, there are challenges in execution that need to be addressed to maximize its effectiveness.

5.3 Discussion of Research Question Three

The mixed results highlight that the impact of capacity management on team cohesion and collaboration is not straightforward and may depend on how these practices are integrated into Agile workflows. For teams that experience positive effects, capacity management likely helps in clarifying roles, responsibilities, and workloads, thereby fostering a collaborative environment. On the other hand, teams that see little to no impact might not be experiencing the full benefits of capacity management, possibly due to insufficient integration or lack of alignment with their specific Agile processes. The slightly negative experiences could indicate issues such as rigidity in capacity planning that conflicts with the Agile principles of flexibility and adaptability, leading to stress or miscommunication within teams.

The results underscore the importance of clear resource allocation as a foundational element for successful team dynamics in Agile projects. When teams know what resources they have and how to allocate them, they are likely to function more effectively. However, the challenges related to capacity estimation reveal a significant pain point. Overestimation or underestimation of capacity can lead to mismanaged workloads, either overburdening teams or leaving them underutilized. This not only affects project efficiency but can also strain team relationships and morale. The issues of resource misalignment and communication gaps further suggest that capacity management practices need to be more adaptive and integrated with the overall Agile framework to be truly effective.

The mixed frequency of changes in team efficiency due to capacity management adjustments highlights the importance of flexibility and adaptability in these practices.

Teams that experience frequent changes in efficiency may benefit from more consistent and stable capacity management approaches, while those that rarely see changes might need more dynamic adjustments to stay agile. The overall positive, though varied, perception of capacity management practices in supporting deadlines and project goals suggests that while these practices are generally effective, they might not be fully optimized across all teams or projects. It's possible that some teams require more tailored approaches that better fit their specific workflows and challenges.

The overall positive response to capacity planning highlights its importance in Agile project management, particularly in enhancing productivity and balancing workloads. These benefits are crucial in fast-paced environments where teams must remain agile and responsive. However, the areas where capacity planning is seen as less effective, such as communication with stakeholders and occasional impacts on progress, suggest that there is a need for continuous refinement of these practices. Ensuring that all team members and stakeholders are on the same page regarding capacity planning could improve overall project alignment and effectiveness. Additionally, the mixed impact on meeting deadlines indicates that while capacity planning is beneficial, it must be implemented in a way that supports the specific dynamics of each team.

5.4 Discussion of Research Question Four

The results of the survey provide a comprehensive overview of how scope creep is managed within Agile projects and the effectiveness of capacity planning in mitigating its effects. Scope creep, characterized by the gradual expansion of project scope without

corresponding adjustments in resources or timelines, is a well-known challenge in project management, particularly in Agile environments where flexibility and adaptability are key. The frequency with which scope creep impacts capacity planning processes suggests that it is an inevitable part of Agile project management, one that requires ongoing attention and strategic management.

The significant impact of scope creep on project success, as indicated by the survey results, highlights its potential to disrupt project timelines, budgets, and overall project outcomes. In an Agile surroundings, where adjustments are expected, the capability to quickly and accurately adjust assets is important. However, if teams are struggling with this aspect, it suggests that their capability making plans procedures may not be absolutely ready to deal with the dynamic nature of scope modifications.

The significance of optimizing ability making plans to manage scope creep efficiently cannot be overstated. The survey results indicate a sturdy consensus among respondents that that is a essential region for improvement. This highlights a popularity that modern-day practices, whilst beneficial, won't be sufficient to fully address the challenges posed by scope creep. The techniques which can be currently being applied, which includes adjusting task timelines and improving communique channels, are critical steps in the right route. However, the combined degrees of pleasure with these efforts advise that there is nonetheless extra work to be executed. Teams may additionally need to discover extra strategies, inclusive of investing in higher equipment and technologies,

enhancing training and resources for team participants, and undertaking greater frequent stakeholder meetings to make sure alignment and clarity round scope changes.

The effect of scope creep on normal operational excellence in Agile venture control is some other important place highlighted by using the survey. The reality that many respondents file a moderate to severe impact shows that scope creep isn't always just a localized trouble but one that can affect the broader success of Agile methodologies inside an enterprise. This factors to the want for a more included method to capacity planning that no longer only addresses the on the spot demanding situations of scope creep but also helps the lengthy-term fulfillment and sustainability of Agile practices. By improving capacity planning tactics, companies can better manage the risks associated with scope creep, ensure that tasks are brought on time and inside price range, and maintain high levels of crew productiveness and morale.

In end, the survey outcomes offer treasured insights into the demanding situations and possibilities associated with managing scope creep in Agile projects. While capacity planning practices are generally seen as effective, there are significant areas for improvement, particularly in adjusting resources and defining scope changes.

The Denver International Airport BHS project provides a comprehensive case study on the impact of scope creep and the role of capacity management and planning in technology projects.

a) Scope Creep Impact: Scope creep led to increased complexity and operational difficulties for the BHS project. The uncontrolled expansion of requirements without proper adjustments to project scope or resources contributed to the system's failure (Flyvbjerg, 2006). Agile practices, such as defining clear scope boundaries and implementing change control mechanisms, could have better managed these expansions (Hickson, 2003).

b) Agile Capacity Management: Agile ability control emphasizes flexibility and flexibility in response to changing assignment wishes. The BHS project's struggles highlight the benefits of Agile practices in handling scope creep and technical challenges. Iterative improvement and regular remarks could have improved the system's functionality and decreased operational disruptions (Sullivan, 2000).

c) Optimization of Practices: To optimize ability control and planning, businesses have to integrate Agile methodologies that focus on iterative evaluations, stakeholder engagement, and adaptive planning. Regularly reassessing assignment development and adjusting plans in response to feedback can help prevent scope creep and make certain alignment with organizational goals (Klein, 2005; Flyvbjerg, 2006).

The NHS IT-Civilian undertaking underscores the crucial lessons concerning scope creep and the function of Agile ability control in handling complex IT tasks efficiently.

a. Scope Creep Impact: The NHS IT-Civilian mission skilled vast issues because of scope creep, which caused an growth in complexity and implementation

difficulties. As new capabilities and requirements were delivered without corresponding adjustments to the project's assets or timelines, the system confronted operational disasters and giant price overruns. Effective Agile practices, including clearly defining scope barriers and implementing strong exchange manage techniques, could have mitigated these demanding situations and decreased the associated dangers (Scrum Alliance, 2020).

b. Agile Capacity Management: Agile potential management is focused on flexibility and adaptableness to evolving task requirements. The difficulties encountered inside the NHS IT-Civilian project spotlight how Agile methodologies might have been beneficial in dealing with scope creep and addressing technical challenges. By employing iterative improvement and keeping ordinary remarks loops with stakeholders, the task should have progressed its capability and ensured better alignment with its objectives (Leffingwell, 2018).

c. Optimization of Practices: To enhance capacity management and making plans, companies need to adopt Agile practices that focus on iterative critiques, adaptive making plans, and active stakeholder engagement. Regularly assessing assignment development and making adjustments based totally on remarks are important strategies to save you scope creep and make sure that initiatives stay aligned with organizational dreams (Highsmith, 2010; Scrum Alliance, 2020).

CHAPTER VI:

SUMMARY, IMPLICATIONS, LIMITATIONAND CONCLUSION

6.1 Summary

The survey data highlights the crucial role of capacity planning in agile projects, touching on its impact on deliverable quality, integration with other agile practices, and its perceived importance for achieving long-term strategic goals. The results indicate that capacity planning significantly or moderately improves the quality of deliverables for **73.7%** of respondents, while **26.3%** see no impact. Regarding integration, **78.9%** report that capacity planning is fully or mostly integrated with other agile practices, while **21%** see it as only somewhat or not integrated. A strong majority, **89.5%**, believe that capacity planning is critical for achieving long-term strategic goals in agile projects, with only **10.5%** remaining neutral. When asked about improvements, **36.8%** suggest more accurate data collection, **26.3%** prefer better tools and software, **15.8%** advocate for improved training, **10.5%** recommend more frequent updates and reviews, and **10.5%** propose other unspecified enhancements.

The survey results reveal insights into the impact of capacity management practices on team dynamics and the challenges faced in their implementation within Agile projects. The most positively influential practice identified is clear resource allocation, which is seen as a key factor in enhancing team dynamics. Other practices like agile sprint planning and effective communication channels also play significant roles, but to a lesser extent. However, the survey also highlights challenges, with the most common issue being the overestimation or underestimation of capacity, which affects both team

dynamics and project efficiency. Misalignment of resources and ineffective communication are additional hurdles that teams face, along with a lack of flexibility in planning.

The survey reveals varied experiences and perceptions regarding the impact of capacity management practices on team efficiency and the ability to meet deadlines and achieve project goals. Respondents reported that changes in team efficiency due to adjustments in capacity management practices occur with some regularity, though opinions differ on the frequency of such changes On the other hand, current capacity management practices are generally viewed as helping teams meet deadlines and achieve their goals, although there is room for improvement In general, the adoption of power structures has had a positive impact on team performance, with most respondents indicating increased productivity. Power structure also plays an important role in balancing work among team members, many find it effective or moderately effective in this respect. Communication of capacity planning details and updates to stakeholders is generally well-handled, although some see room for improvement. Additionally, capacity planning is seen as beneficial for meeting deadlines in Agile projects, with most respondents reporting that it improves their ability to meet deadlines, though a small portion finds it hinders their progress.

The survey data provides a thorough examination of how scope creep impacts capacity planning in Agile projects and its subsequent effect on project success and operational excellence. The responses indicate a range of experiences and perceptions, from how frequently scope creep occurs to the effectiveness of current capacity planning practices in mitigating its effects. The majority of respondents experience scope creep with some

regularity, and many recognize its impact on the success of their Agile projects. Capacity planning practices are generally seen as moderately effective in dealing with scope creep, though there are notable challenges, particularly in adjusting resources and defining scope changes. The importance of optimizing capacity planning to manage scope creep is widely acknowledged, with several strategies already implemented by teams to address these issues.

6.2 Implications

The results imply that capacity planning is generally well-regarded, there may be opportunities to enhance its impact across the organization. For example, improving communication about the benefits of capacity planning, integrating it more deeply into strategic decision-making, or providing additional training on how to effectively implement and utilize capacity planning could further improve operational excellence. Additionally, addressing the concerns of the small percentage who do not see its value could help in refining the capacity planning process, making it more relevant and impactful for all areas of the organization.

These findings imply that capacity planning should be an integral part of agile project management strategies, as it clearly contributes to enhancing stakeholder satisfaction. Organizations may benefit from focusing on refining their capacity planning processes to ensure that resources are optimally allocated and that teams have the ability to respond to changes without compromising on deliverables.

Additionally, understanding why a small percentage of respondents see no impact could help in identifying areas where capacity planning may need to be better integrated or communicated. It could also highlight the need for a more holistic approach to project management, where capacity planning is one of several key factors considered.

The implications of these findings are clear: capacity planning needs to be a focal point for improvement to reduce project delays and enhance overall project efficiency. Organizations might consider investing in better tools for capacity forecasting, training for project managers, and more robust communication channels to ensure that capacity issues are identified and addressed early.

Addressing capacity planning issues can lead to more predictable project timelines, which in turn can improve stakeholder satisfaction and project outcomes. Additionally, understanding the specific reasons behind frequent delays can help tailor solutions to the unique challenges faced by different teams or projects.

While capacity planning is broadly recognized as a valuable tool for early risk identification and mitigation, there is potential to improve its effectiveness across the board. Organizations could benefit from refining their capacity planning processes to make them more predictive and responsive to change.

For those who find capacity planning less effective, exploring why it is not fully meeting their needs could lead to enhancements in how risks are identified and managed. This might involve better integration of capacity planning with other project management tools, more frequent updates to plans, or increased collaboration among team members.

The implications of these findings are significant for organizations looking to enhance their agile project management processes. The identified need for better tools and data accuracy suggests that investing in advanced capacity planning software and improving data collection methodologies could yield substantial benefits. Additionally, the call for improved training indicates that building team capacity in this area is crucial for ensuring that capacity planning is both effective and aligned with other agile practices.

The implications of the findings suggest that the capacity management has the potential to enhance team cohesion and collaboration, its success depends on careful implementation. Organizations may need to tailor capacity management practices to fit the specific needs and workflows of their Agile teams, ensuring that these practices support, rather than hinder, collaboration. For teams experiencing negative impacts, reviewing and adjusting the approach to capacity management could help alleviate any pressures or conflicts that arise. Additionally, teams that see no impact might benefit from better integration of capacity management practices to unlock their potential benefits.

These results imply that organizations should prioritize clear resource allocation as a capacity management practice to enhance team dynamics. However, they must also address the significant challenges related to capacity estimation. Improving estimation accuracy, ensuring better alignment of resources, and fostering open communication channels are critical steps. Additionally, increasing flexibility in planning could help teams adapt to changes more smoothly, reducing the negative impact on dynamics and efficiency. By addressing these aspects, organizations can create an environment that is

more supportive of their Agile teams, leading to better results. The findings suggest that capacity management practices should continue to be examined and adapted to better suit the needs of private sectors and businesses. Organizations may need to explore more flexible or adaptive capacity management strategies to minimize inefficiencies and better align practices with the dynamic nature of Agile projects. Additionally, the general adequacy of these practices suggests that they provide a solid foundation, but there is potential for enhancements that could further improve team efficiency and success in meeting project goals.

From survey, capacity planning should remain a core practice in Agile project management due to its significant benefits for productivity and workload management. However, organizations should focus on improving the communication of capacity planning details and consider the specific needs of different teams when implementing these practices. By addressing the areas where capacity planning might hinder progress or be less effective, organizations can ensure that these practices fully support their Agile processes and contribute to more successful project outcomes.

The implications of these findings are clear: scope creep is a significant factor in Agile project management, and it requires effective capacity planning to manage its impact. Organizations should put money into improving their capability making plans practices, specifically in areas like useful resource adjustment and scope definition, to better handle the challenges posed through scope creep. This may additionally contain adopting new equipment and technology that offer better visibility into project resources and timelines,

in addition to providing greater education and sources to teams to assist them navigate the complexities of scope changes.

Moreover, enhancing conversation with stakeholders is crucial to making sure that everybody is at the equal page with regards to scope modifications and their impact at the project. This ought to contain extra frequent meetings, clearer documentation of scope modifications, and a more proactive technique to stakeholder engagement. By addressing these regions, organizations can enhance their potential making plans practices and higher control the effect of scope creep on their Agile tasks.

6.3 Research Design Limitations

-Modest Sample Size:

A survey with a limited number of respondents may not adequately represent the broader population, leading to results that may not be generalizable.

-Self-Selection Bias:

Participants who choose to respond may have different characteristics or opinions compared to those who do not.

6.4 Conclusion

Acknowledging these limitations in the thesis helps to provide a balanced view of the research findings. The conclusions drawn in small sample size may not be applicable

to other groups or contexts outside your sample that is why questions are kept unambiguous which can confuse respondents or lead them toward particular answers. To avoid Self-selection bias, survey was done to broader audience at varied degnation/roles to capture the full range of opinions or levels of familiarity.

Capacity planning is identified as a significant contributor to operational excellence through the majority of the employer, with 94.7% of respondents acknowledging its effective impact. However, there may be nonetheless room for improvement in making sure that the advantages of potential planning are completely understood and applied throughout all departments. By addressing the gaps in focus and integration, the company can similarly decorate its operational performance and basic performance.

Capacity making plans is extensively diagnosed as a key thing in enhancing stakeholder satisfaction in agile initiatives, with 94.8% of respondents acknowledging its tremendous effect. The absence of any respondents indicating that capability making plans worsens delight reinforces its price in agile environments. However, there's nevertheless room to explore why a small minority does not see its effect, that could result in in addition enhancements in how ability planning is carried out and perceived across specific groups and projects. By persevering with to refine and integrate potential planning techniques, agencies can in addition decorate their ability to meet stakeholder expectations and supply successful agile initiatives.

Capacity planning troubles are a widespread contributor to assignment delays, with 52.6% of respondents experiencing those delays regularly. The fact that no respondents indicated they by no means face such delays underscores the significance of focusing on capability making plans as a key region for improvement. By addressing the basis reasons of potential planning challenges and enforcing greater effective strategies, businesses can lessen the frequency of project delays, main to greater a hit assignment results and extra stakeholder delight.

Capacity planning is largely visible as a powerful method for identifying and mitigating mission dangers early in agile tasks, with 89.5% of respondents acknowledging its high-quality effect. However, there's room for improvement, in particular for the ten.5% who discover it has little impact. By enhancing capability making plans processes and making sure they may be well-incorporated with different chance management practices, groups can further reduce challenge dangers and improve overall assignment achievement. The strong positive reaction indicates that continuing to invest in ability planning will possibly yield blessings in phrases of assignment balance and danger management.

Capacity making plans is identified as a key driver of fulfillment in agile projects, with sturdy links to the exceptional of deliverables and the success of lengthy-term strategic desires. While the bulk of respondents view it as an imperative part of their agile practices, there may be a clean want for enhancements, in particular inside the regions of statistics accuracy, tool performance, and team education. By addressing these areas,

agencies can in addition leverage ability making plans to optimize their agile strategies and deliver more fee of their projects.

Capacity control practices can definitely influence team cohesion and collaboration in Agile initiatives, as indicated by means of 42.1% of respondents. However, the varied responses underscore the significance of a thoughtful approach to implementation. While a few teams advantage from stepped forward alignment and collaboration, others might also enjoy no sizable exchange or maybe mild bad outcomes. To maximize the blessings, agencies should don't forget how ability control practices align with their Agile methodologies and be prepared to alter them to better assist their groups' dynamics and collaboration efforts.

Capacity control practices, especially clear resource allocation, have a positive have an impact on on team dynamics in Agile projects. However, demanding situations like faulty ability estimation and useful resource misalignment present barriers that want to be addressed. By specializing in improving these regions, organizations can decorate the effectiveness of their capacity management practices, main to better team collaboration, task performance, and normal success in Agile environments.

Capacity management practices have a discernible impact on team performance, with various frequencies of exchange skilled by unique groups. While those practices are usually visible as supportive in assembly deadlines and achieving venture desires, there is room for improvement. By refining and adapting potential management strategies to

better match the particular desires of teams and initiatives, agencies can beautify ordinary performance and effectiveness, making sure that teams are better equipped to navigate the demanding situations of Agile undertaking environments.

Capacity making plans has a normally positive impact on team productiveness, workload stability, and the capability to fulfill time limits in Agile tasks. While the practice is effective in lots of regions, there are opportunities to enhance verbal exchange with stakeholders and to regulate capability planning approaches to higher fit the wishes of person groups. By refining these regions, companies can maximize the advantages of capacity making plans and ensure it continues to guide Agile challenge success.

Scope creep is a not unusual and impactful difficulty in Agile tasks, affecting capability planning strategies and, in the long run, the fulfilment of tasks. While cutting-edge capability making plans practices are fairly effective, there are tremendous challenges that want to be addressed, especially round aid adjustment and scope definition. The significance of optimizing potential making plans to control scope creep is broadly recognized, with many organizations already enforcing strategies to deal with this difficulty. However, there may be nonetheless extra work to be achieved to enhance the effectiveness of these practices and make sure that teams have the gear, sources, and communique channels they want to effectively manipulate scope creep and deliver a success Agile projects. By that specialize in those areas, organizations can enhance their capability planning practices, higher manipulate scope creep, and reap greater success of their Agile projects.

APPENDIX A

SURVEY COVER LETTER

Subject: Request for Collaboration on Research on Capacity Planning in Agile Product Management

Dear Sir/Madam,

I hope this message finds you well.

I am a research student at the Swiss School of Business and Management(SSBM) Geneva, currently conducting a study under the guidance of Dr.Aaron Nyanama. My research focuses on the impact of adopting capacity planning within agile product management and its potential to drive operational excellence. Additionally, I am examining the challenges and failures that may arise from not incorporating capacity planning at the design stage.

Given the significance of this topic, I am reaching out to explore potential collaboration opportunities or to seek insights from experts in this field. If you or your organization have experience or expertise in agile product management and capacity planning, I would greatly appreciate the opportunity to discuss this research further.

I respectfully request your participation in a brief questionnaire related to this research. Please be assured that all data collected will remain confidential, and no firm, organization, or individual will be identified in any thesis, report, or publication resulting

from this study. If desired, a summary report of the findings will be made available to you.

Thank you for considering my request. I am looking forward to the possibility of working together and gaining valuable insights that could contribute to the overall success of this research.

Thanks for your cooperation and valuable contribution to this research.

Best regards,

Deepika

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REFERENCES

- Aarabi, M., Hasanian S. (2014), Capacity planning and control: a review.
- Ahsen A. Bewertung von Innovationen im Mittelstand (2010), Evaluation of Innovation for medium- sized businesses, Berlin, Heidelberg: SpringerVerlag Berlin Heidelberg.
- Aitken, J., Childerhouse, P., Towill, D. (2003), The impact of product lifecycle on supply chain strategy. International Journal of Production Economics 85, 127-140
- Anderson, C.R., Zeithaml, C.P. (1984), Stage of the product life cycle, business strategy, and business performance. Academy of Management Journal 27, 5-24
- Antti Tenhiälä (2011), Contingency theory of capacity planning: The link between process types and planning methods, Journal of Operations Management, Volume 29, Issues 1–2, Pages 65-77, ISSN 0272-6963
- Armistead, C. G. and Graham, C. (1994), The "Coping" Capacity Management Strategy in Services and the Influence on Quality Performance, International Journal of Service Industry Management, Vol. 5, No. 2, pp. 5-22.
- Aslan, B., Stevenson, M., & Hendry, L. (2012). Enterprise Resource Planning systems: an assessment of applicability to Make-To-Order companies. Computers in Industry, 63(7), 692-705.

- Bhargava, P. M. & Chakrabarti, C. (2003) The Saga of Indian Science since Independence-in a nutshell, Orient Blackswan publisher, pp.92.
- B. M. Moniruzzaman and D. S. A. Hossain (2013), Comparative Study on Agile software development methodologies, vol. V, no. 3, pp. 37–56.
- Bushuev, M. (2014). Convex optimization for aggregate production planning. International Journal of Production Research, 52(4), 1050-1058.
- Buxey, G. (2003). Strategy not tactics drives aggregate planning. International Journal of Production Economics, 85(3), 331-346.
- Buxey, G. (2005). Aggregate planning for seasonal demand: reconciling theory with practice. International Journal of Operations & Production Management, 25(11), 1083-1100.
- Carvalho, A. N., Scavarda, L. F., & Oliveira, F. (2017). An optimisation approach for capacity planning: modelling insights and empirical findings from a tactical perspective. Production, 27, e20170014.
- Ceryan, O., Koren, Y. (2009), Manufacturing capacity planning strategies, CIRP Annals - Manufacturing Technology, 58, 403–406.
- Corti, D., Pozzetti, A., & Zorzini, M. (2006). A capacity-driven approach to establish reliable due dates in a MTO environment. International Journal of Production Economics, 104(2), 536-554.

- Crandall, R. E. and Markland, R. E. (1996) Demand management – today's challenge for service industries, Production and Operations Management, Vol. 5, No. 1, pp. 106-120.
- Cunningham, M.T. (1969) The application of product life cycles to corporate strategy: Some researchfindings. British Journal of Marketing3, 32-44
- D. Lovallo & D. Kahneman (2003), Delusions of success: How optimism undermines executives' decisions, Harv. Bus. Rev., vol. 81, pp. 56–63, Jul..
- de Boer (1998), Resource-Constrained Multi-Project Management. PhD thesis, University ofTwente, Enschede, The Netherlands.
- de Borba, J. C. R., Trabasso, L. G. , & Pessoa, M. V. P. (2019), Agile management in product development. Research-Technology Management 62(5): 63–67.
- Díaz-Madroñero, M., Mula, J., & Peidro, D. (2014). A review of discrete-time optimization models for tactical production planning. International Journal of Production Research, 52(17), 5171-5205.
- Evans, J. R., & Jack, E. P. (2003). Validating key results linkages in the Baldrige performance excellence model. Quality Management Journal, 10(2), 7–24.
- Aizaz F., Khan, S. U. R., Khan, J. A. , Inayat-Ur-Rehman, J. A. L. I. & Akhunzada, A. (2021), "An empirical investigation of factors causing scope

creep in agile global software development context: a conceptual model for project managers," IEEE Access, vol. 9, pp. 109166–109195.

- Fitzsimmons, J. A. & Fitzsimmons, M. J. (1998) Service Management: Operations, Strategy and Information Technology, New York: McGraw-Hill, Inc.
- Flynn, B., Schroeder, R., & Sakakibara, S. (1995). The impact of quality management practices on performance and competitive advantage. Decision Sciences, 26(5), 659-691.
- Flyvbjerg, B. (2006). The Oxford Handbook of Project Management. Oxford University Press.
- Fullerton, R.R., McWatters, C.S., Fawson, C. (2003), An examination of the relationships between JIT and financial performance. Journal of Operations Management 21, 383-404.
- Gademann, N., & Schutten, M. (2005). Linear-programming-based heuristics for project capacity planning. IIE Transactions, 37(2), 153-165.
- Giebels, M. (2000). EtoPlan a concept for concurrent manufacturing planning and control: building holarchies for manufacture-to-order environments (PhD thesis). University of Twente, Enschede.
- Giudice, F., La Rosa, G., Risitano, A. (2006), Product Design for theEnvironment [Electronic Resource] : ALife-Cycle Approach/Fabio Giudice, Guido La Rosa, Antonino Risitano.Hoboken: CRC Press.

- Grobler, A. and Grubner, A. (2006). An empirical model of the relationship between manufacturing capabilities. International Journal of Operations and production Management, 26(5): 458-85.
- Hans, E. W., Herroelen, W., Leus, R., & Wullink, G. (2007). A hierarchical approach to multi-project planning under uncertainty. Omega, 35(5), 563-577.
- Heimicke J., Kaisera S., Albersa A. (2021), Agile product development: an analysis of acceptance and added value in practice.
- Hendro Wicaksono,Tianran Ni (2020). An Automated Information System for Medium to Short-Term Manpower Capacity Planning in Make-To-Order Manufacturing. Procedia Manufacturing;52(9--10):319-324
- Hickson, C. (2003). Project Management in Practice. Wiley.
- Highsmith, J. (2010). Adaptive Software Development: A Collaborative Approach to Managing Complex Systems. Dorset House Publishing.
- Ho, J.W. & Fang, Ch.Ch., Production capacity planning for multiple products under uncertain demand conditions, Int. J. Production Economics ,141, 593–604, 2013
- Ika, L. A., Love, P. E. D., & Pinto, J. K. (2020). Moving Beyond the Planning Fallacy: The Emergence of a New Principle of Project Behavior. IEEE Transactions on Engineering Management PP (99):1-16
- Jacobs and Chase (2008). Operations and Supply Management: The Core McGraw-Hill/Irwin series operations and decision sciences. 415.

- Jaeger, K. Matyas, W. Sihn (2014), Development of an Assessment Framework for Operations Excellence (OsE), based on the Paradigm Change in Operational Excellence (OE), Procedia CIRP, Volume 17, Pages 487-492
- Jamalnia, A., & Feili, A. (2013). A simulation testing and analysis of aggregate production planning strategies. Production Planning & Control. The Management of Operations, 24(6), 423-448.
- Jawahar, N. and Balaji, A. N. (2009) A genetic algorithm for the two-stage supply chain distribution problem associated with a fixed charge, European Journal of Operations Research, Vol. 194, pp. 496-537.
- K.L. Madhuri and J. J. Rao (2014), "Effect of Scope Creep in Software Projects – Its Bearing on Critical Success Factors," International Journal of Computer Applications., vol. 106, no. 2, pp. 975–8887.
- Kim, S. and Uzsoy, R. (2009) Heuristics for capacity planning problems with congestion, Computers & Operations Research, Vol. 36, pp. 1924-1934.
- Kirkley, J. and Squires, D. (1999). Measuring capacity and capacity utilization in fisheries. FAO Fisheries Technical Report No. 386. Food and Agriculture Organization of the United Nations, Rome.
- Kittlaus, H.(2012), Software Product Management and Agile Software Development: Conflicts and Solutions.

- Klein, P. (2005). Managing Complex Projects: A Case Study Approach. Springer.
- Komal, U.I. Janjua, T.M. Madni (2019), Identification of scope creep factors and their impact on software project success, Paper Presented at the 2019 International Conference on Computer and Information Sciences (ICCIS)
- Krajewski, L. J., Ritzman, L. P., & Malhotra, M. K. (2013). Operations management. Pearson Education UK.
- Leffingwell, D. (2018). SAFe 4.5 Reference Guide: Scaled Agile Framework for Lean Enterprises. Pearson Education.
- Lengnick-Hall, C., Lengnick-Hall, M., & Abdinnour-Helm, S. (2004). The role of social and intellectual capital in achieving competitive advantage through enterprise resource planning (ERP) systems. Journal of Engineering and Technology Management, 21(4), 307-330.
- Lingitz, L., Morawetz, C., Gigloo, D. T., Minner, S., & Sihn, W. (2013). Modelling of flexibility costs in a decision support system for midterm capacity planning. Procedia CIRP, 7, 539-544.
- Liu, J., Lin, Z., Chen, Q., Mao, N., & Chen, X. (2013). A decision support to assign mould due date at customer enquiry stage in computer-integrated manufacturing (CIM) environments. International Journal of Computer Integrated Manufacturing, 26(6), 571-582.

- Marnada, P., Raharjo, T., Hardian, B., & Prasetyo, A. (2022). “Agile project management challenge in handling scope and change: A systematic literature review”. Procedia Computer Science, 197, 290-300.
- Meenaghan, A., Turnbull, P.W. (1981), The application of product life cycle theory to popular record marketing. European Journal of Marketing 15, 1-50.doi:10.1108/EUM0000000004881
- Mohammad, M., Mann, R., Grigg, N., and Wagner, J. P. (2009). Selection of qualityimprovement initiatives: An initial conceptual model. Journal of QualityMeasurement and Analysis 5.2, 1-14
- Montreuil, B., Labarthe, O., & Cloutier, C. (2013). Modelling client profiles for order promising and delivery. Simulation Modelling Practice and Theory, 35, 1-25.
- Mourtzis, D., Doukas, M., Fragou, K., Efthymiou, K., & Matzorou, V. (2014). Knowledge-based estimation of manufacturing lead time for complex engineered-to-order products. In Proceedings of the 47th CIRP Conference on Manufacturing Systems; Procedia CIRP 17, Ontario, Canada.
- Nangulu, E., Magutu, P. O. and Ongeri, R. N. (2020) Capacity Management Strategies and Operational Performance of Sugar Manufacturing Firms in Kenya, Noble International Journal of Business and Management Research, Vol. 04, No. 02, pp. 09-19

- O. Hirschman (1967), Development Projects Observed. Washington, DC, USA: Brookings Institution.
- Oakland JS. (2001) Total organizational excellence: Achieving world-class performance. Oxford, Woburn, Mass: Butterworth-Heinemann.
- Occhino, T. (2010), Capacity planning model: the important inputs, formulas, and benefits: Advanced Semiconductor Manufacturing Conference and Workshop. New York: IEEE/SEMI.
- Pes¨amaa, O., Zwikael, O., HairJr, J., Huemann, M. (2021), Publishing quantitative papers with rigor and transparency. Int. J. Proj. Manag. 39 (3), 217–222.
- Platje, A., Seidel, H, & Wadman, S (1994), Project portfolio planning cycle: Project basedmanagement for the multi-project challenge. International Journal of Project Manage-ment, 12(2):100-106.
- Ramezanian, R., Rahmani, D., & Barzinpour, F. (2012). An aggregate production planning model for two phase production systems: solving with genetic algorithm and tabu search. Expert Systems with Applications, 39(1), 1256-1263.
- Robbins, K. J. W. (2003). Introduction to Survey Sampling. Sage Publications. ISBN: 978-0761953773
- Robinson Jr., R.B., Pearce II, J.A. (1986). Product life-cycle considerations and the nature of strategic activities in entrepreneurial firms. Journal of Business Venturing 1, 207-224.doi:10.1016/0883-9026(86)90015-7

- Rudberg, M. and Olhager, J. (2003). Manufacturing networks and supply chains: an operations strategy perspective. Omega. International Journal of Management Science, 31: 29-39.
- Rusjan B. (2005), Usefulness of the EFQM excellence model: Theoretical explanation of some conceptual and methodological issues. In: Total Quality Management & Business Excellence. p. 363–380.
- Ryan, C., Riggs, W.E. (1996), Redefining the product life cycle: The five-element product wave. Business Horizons 39, 33.
- Sawik, T. (2009). Multi-objective due-date setting in a make-to-order environment. International Journal of Production Research, 47(22), 6205-6231.
- Schuler, R., & MacMillan, I. (2006). Gaining competitive advantage through human resource management practices. Human Resource Management, 23(3), 241- 255.
- Scrum Alliance. (2020). The Scrum Guide. Retrieved from https://www.scrumguides.org
- Shahin, A. (2014), Operations Management, Process Strategy and Capacity Planning, Quality Management Research Group.
- Sharda, B., & Akiya, N. (2012). Selecting make-to-stock and postponement policies for different products in a chemical plant: a case study using discrete event simulation. International Journal of Production Economics, 136(1), 161-171.

- Slack, N. & Chambers, S.& Johnston, R., “Operations Management”, Person Education, capacity planning and control, fourth edition, Chapter 11,
- Stauffer, J.M. Megahed, A. &Sriskandarajah, C. (2021), Elasticity management for capacity planning in software as a service cloud computing. IISE Trans, 53, 407–424, doi:10.1080/24725854.2020.1810368
- Steele, J. & Son, Y.J.& A. Wysk, R. (2001), Resource Modelling for the Integration of the Manufacturing Enterprise, Journal of Manufacturing Systems, Vol19 , No.6.
- Sugumaran K. Shishank S., Dekkers R. (2009), Strategic Capacity Management & Inconsummate Information: An Outsourcing Framework
- Sullivan, J. (2000). Technology Management:Text and Cases.McGraw-Hill.
- Suwa H, Morita D (2014). Stability-based Short-term Capacity RequirementPlanning under Uncertainty. Procedia CIRP ;19:123-128
- Viktoria Stray, Rashina Hoda, Maria Paasivaara, Valentina Lenarduzzi, Daniel Mendez(2022), Theories in Agile Software Development: Past, Present, and Future, Volume 152, 107058, ISSN 0950-5849
- Wang, K. and Chen, M. (2009) Cooperative capacity planning and resource allocation by mutual outsourcing using an algorithm in a decentralized supply chain, Expert Systems with applications, Vol. 36, pp. 2831-2842.

- Ward, P. T., McCreery, J. K., Ritzman, L. P. and Sharma, D. (1998). Competitive priorities in operations management, Decision Sciences, 29(4): 1035-46.
- Wortmann JC, Euwe MJ, Taal M & Wiers VCS (1996), A review of capacityplanning techniques within standard software packages. Production Plan-ning & Control; 7:2:117-128.
- Yoo, C.S. (2009), Product life cycle theory and the maturation of the Internet (SSRN Scholarly Paper No. ID1511853). Social Science Research Network, Rochester, NY.
- Zorzini, M., Corti, D., & Pozzetti, A. (2008). Due date (DD) quotation and capacity planning in make-to order companies: results from an empirical analysis. International Journal of Production Economics, 112(2), 919-933.

APPENDIX A: SURVEY FORM

GOOGLE FORMS-SURVEY SHEET

A Survey Form-Research based

I am a research student at the SSBM, currently conducting a study and my research focuses on the impact of adopting capacity planning within agile product management. Given the significance of this topic, I am reaching out to explore potential collaboration opportunities or to seek insights from experts in this field. If you or your organization have experience or expertise in agile product management and capacity planning, I would greatly appreciate the opportunity to discuss this research further by filling this short survey form. I respectfully request your participation in a brief questionnaire related to this research. Please be assured that all data collected will remain confidential, and no firm, organization, or individual will be identified in any thesis, report, or publication resulting from this study. If desired, a summary report of the findings will be made available to you.

1. Name *

2. Email Address *

3. LinkedIn ID

4. Organization Name

5. Designation*

* Indicates required question

6. **How familiar are you with the concept of capacity planning in agile product management?** *

Mark only one oval.

Very familiar

Somewhat familiar

Not familiar

7.**Does your organization currently use capacity planning in its agile product management processes?** *

Mark only one oval.

Yes

No

8.**How effective do you** find **capacity planning in addressing resource constraints in agile projects?** *

Mark only one oval.

Effective

Neutral

Ineffective

9.**To what extent does capacity planning improve the predictability of project timelines in your organization?** *

Mark only one oval.

Greatly

Moderately

Slightly

Not at all

10. **How often do you update your capacity planning estimates in your agile projects?**

Mark only one oval.

Daily

Weekly

Monthly

As needed

Rarely

11.**What tools or methods does your organization use for capacity planning in agile projects?** *

Mark only one oval.

Spreadsheets

Project management software (e.g., Jira, Trello)

Specialized capacity planning tools

12.**How would you rate the accuracy of capacity planning forecasts in your organization?** *

Mark only one oval.

Very accurate

Accurate

Neutral

Inaccurate

Very inaccurate

13.**What challenges have you encountered with capacity planning in your agile projects?** *

Mark only one oval.

Lack of data

Changing project requirements

Inaccurate estimates

Resource constraints

Others

14. **How does capacity planning contribute to overall operational excellence in your organization?** *

Mark only one oval.

Significantly contributes

Moderately contributes

Slightly contributes

Does not contribute

15.**In your experience, how does capacity planning in**fl**uence stakeholder satisfaction in agile projects?** *

Mark only one oval.

Greatly improves

Moderately improves

No impact

Moderately worsens

Greatly worsens

16.**How frequently do you encounter project delays due to capacity planning issues?** *

Mark only one oval.

Very frequently

Frequently

Occasionally

Rarely

Never

17.**Does capacity planning help in identifying and mitigating project risks early in your agile projects?** *

Mark only one oval.

Yes, very effectively

Yes, somewhat effectively

No, it has little effect

No, it is ineffective

18.**How does capacity planning impact the quality of deliverables in your agile projects?** *

Mark only one oval.

Significantly improves

Moderately improves

No impact

Moderately worsens

Significantly worsens

19.**How integrated is capacity planning with other agile practices in your organization (e.g., sprint planning, backlog grooming)?** *

Mark only one oval.

Fully integrated

Mostly integrated

Somewhat integrated

Not integrated

20.**Do you believe that capacity planning is critical for achieving long-term strategic goals in agile projects?** *

Mark only one oval.

Strongly agree

Agree

Neutral

Disagree

Strongly disagree

21.**What improvements would you suggest for enhancing capacity planning indoor organization?** *

Mark only one oval.

Better tools and software

More accurate data collection

Improved training for team members

More frequent updates and reviews

Other

22.**How do you think the implementation of capacity management practices impacts team cohesion and collaboration in your Agile projects?** *

Mark only one oval.

Negatively

Slightly negatively

No impact

Slightly positively

Positively

23.**To what extent do you** f**ind that effective capacity management improves the overall e**ffi**ciency of your Agile team?** *

Mark only one oval.

Not at all

A little

Moderately

Significantly

Extremely

24.**Which capacity management practice has most positively influenced team dynamics in your Agile projects?** *

Mark only one oval.

Regular capacity reviews

Clear resource allocation

Agile sprint planning

Effective communication channels

Other

25.**How often do you experience changes in team efficiency as a result of adjustments in capacity management practices?** *

Mark only one oval.

Never

Rarely

Sometimes

Often

Always

26.**In your opinion, how well do current capacity management practices support your team in meeting deadlines and achieving project goals?** *

Mark only one oval.

Poorly

Fairly

Adequately

Well

Very well

27.**What challenges have you encountered with capacity management practices that have affected team dynamics or project efficiency?** *

Mark only one oval.

Misalignment of resources

Ineffective communication

Overestimation or underestimation of capacity

Lack of flexibility in planning

Other

28.**How has the adoption of capacity planning affected your team's productivity?** *

Mark only one oval.

Greatly increased productivity

Moderately increased productivity

No impact

Moderately decreased productivity

Greatly decreased productivity

29.**To what extent does capacity planning help in balancing workload among team members?** *

Mark only one oval.

Greatly

Moderately

Slightly

Not at all

30.**How well does your team communicate capacity planning details and updates to stakeholders? ***

Mark only one oval.

Very well

Well

Neutral

Poorly

Very poorly

31.**How does capacity planning impact your team's ability to meet deadlines in agile projects?**

*

Mark only one oval.

Significantly improves

Moderately improves

No impact

Moderately hinders

Significantly hinders

32.**How frequently does scope creep impact your capacity planning processes in agile projects?**

*

Mark only one oval.

Never

Rarely

Sometimes

Often

Always

33.**To what extent do you believe scope creep affects the success of your agile projects?**

*

Mark only one oval.

Not at all

A little

Moderately

Very much

Extremely

34.**How effective are your current capacity planning practices in addressing issues related to scope creep?**

*

Mark only one oval.

Not effective

Slightly effective

Moderately effective

Very effective

Extremely effective

35.**What challenges do you encounter when dealing with scope creep in your capacity planning?**

*

Mark only one oval.

Defining scope changes

Adjusting resources

Communicating with stakeholders

Other

36.**How important is it to optimize capacity planning to manage scope creep effectively?**

*

Mark only one oval.

Not important

Slightly important

Moderately important

Very important

Extremely important

37.**What strategies have you implemented to optimize capacity planning in response to scope creep?**

*

Mark only one oval.

Regular scope reviews

Adjusting project timelines

Enhancing communication channels

Other

38.**How satisfied are you with the results of your capacity planning optimization efforts in managing scope creep?**

*

Mark only one oval.

Very dissatisfied

Dissatisfied

Neutral

Satisfied

Very satisfied

39.**In your experience, how does scope creep impact the overall operational excellence of agile product management?**

*

Mark only one oval.

No impact

Minimal impact

Moderate impact

Significant impact

Extreme impact

40.**How often do you review and adjust your capacity planning processes to address scope creep?**

*

Mark only one oval.

Never

Occasionally

Sometimes

Frequently

Always

41.**What improvements do you think could be made to better handle scope creep and improve capacity planning in agile projects?**

*

Mark only one oval.

Improved tools and technologies

Better training and resources

More frequent stakeholder meetings

Other

42.**To what extent do you believe that effective capacity management practices improve the quality of your products?**

*

Mark only one oval.

Not at all

A little

Moderately

Significantly

Extremely

43.**How frequently do you see improvements in product quality as a direct result of effective capacity management?**

*

Mark only one oval.

Never

Rarely

Sometimes

Often

Always

44.**What aspects of capacity management do you believe have the most significant effect on improving product quality?** *

Mark only one oval.

Resource allocation

Scheduling and planning

Risk management

Other

45.**How has implementing capacity management practices impacted your team's delivery speed?** *

Mark only one oval.

No impact

Minimal impact

Moderate impact

Significant impact

Major impact

46.**To what extent has capacity management optimization contributed to faster project delivery times in your organization?** *

Mark only one oval.

Not at all

A little

Moderately

Significantly

Extremely

47.**How does your organization measure the effectiveness of capacity management practices in relation to delivery speed?** *

Mark only one oval.

Through project completion times

By comparing planned vs. actual delivery dates

Through stakeholder feedback

Other

48.**In your experience, how closely is capacity management linked to overall productivity improvements in your organization?** *

Mark only one oval.

Not linked at all

Slightly linked

Moderately linked

Strongly linked

Extremely linked

49.**How do you rate the impact of capacity management practices on your organization's overall productivity?** *

Mark only one oval.

Very low impact

Low impact

Moderate impact

High impact

Very high impact

50. **In your opinion, which capacity management practices have had the most positive effect on productivity in your organization?** *

Mark only one oval.

Streamlined processes

Enhanced forecasting

Improved resource utilization

Other

51. **How satisfied are you with the improvements in product quality, delivery speed, and productivity resulting from your capacity management practices?**

Mark only one oval.

Very dissatisfied

Dissatisfied

Neutral

Satisfied

Very satisfied