Implementation of an Enterprise Portfolio Management System at a 'Take-off' Stage Biopharma Company

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Abstract

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The case company operates in the highly competitive generic biopharmaceutical industry where key success factors are 'time to market', 'cost reduction', and 'meeting quality and regulatory targets'. Project and portfolio management enable these through balancing scope-time-cost constraints. The case company is a pre-revenue, 'take-off' stage start-up, transitioning to maturity with an expanding product pipeline and an IPO on the horizon. There is a need for better command and control of the portfolio with 'one-speed-portfolio progression'. The outcome of the study is to development of an enterprise portfolio management system (EPMS) product for the case company.

The study surveys academic literature in the areas of project management and its connection to strategy, project management knowledge areas, design thinking, agile methodology, and change management. Existing frameworks and tools within these domains are synthesized to develop an integrated framework for the thesis work. The study had the following objectives: (a) to understand the business value of this transformation project, (b) to customize the product for the case company, and (c) to identify success factors to implement the product and drive the change in the case company.

The study follows an action research methodology with participatory observation in group workshops. The participant mix consisted of 17 colleagues from the program management business unit (n=8), representatives from business verticals (n=6) like clinical, regulatory, manufacturing, and R&D, function head, project sponsor, and vendor. Data collection was qualitative and interpretive from recorded sessions with qualitative content analysis for the analysis of data. The workshops aimed to understand the current process and gaps and to collectively envision the future state process using EPMS.

The findings from the research are: (a) theoretical frameworks and tools chosen are appropriate for the study, (b) implementation of EPMS brings value by enabling efficient portfolio execution and strategic decision making, (c) EPMS must follow agile development with modules such as project management, timecard, risks/issues/presentation, budget management, resource management, and dashboard,(d) developed in phases with a product rolled out at the end of each phase, and (e) change management must be carefully planned by defining stage and goals appropriately. The thesis work outcomes are the customization of the EPMS product in the case company and the demonstration of capabilities to the CEO and business leaders in Q1 2022.

Keywords
Portfolio management, design thinking, agile transformation, change management

Table of contents

1 Introduction

The first chapter introduces the reader to the thesis by presenting the background and motivation for carrying out the work. This is followed by the statement of objectives and research questions that will clarify the topic and scope of the study to set boundaries for the research. The last section describes the structure of the thesis to orient the reader to the storytelling.

1.1 Background and motivation

According to Shenhar and co-workers, projects and project portfolios are “powerful strategic weapons” to implement strategy (Shenhar *et al.*, 2001, p. 5). Companies typically realize about 63% of the potential value of their strategy (Mankins and Steele, 2005, p. 64) while two-thirds of developed strategy is never implemented! (Johnson, 2004, p. 1). This indicates the difficulty in implementing, compared to formulating strategy. A project portfolio is a collection of projects that are executed under the sponsorship of the firm and share and compete for its resources. Project portfolio management (PPM) is defined as the simultaneous management of the whole collection of projects as one large entity. It is hence vital for PPM to evaluate, prioritize, and select projects on an ongoing basis, in line with strategy (Archer and Ghasemzadeh, 2007, p. 237), thereby balancing projects in consideration of the firm’s capabilities and maximizing the financial value of the portfolio (Martinsuo and Lehtonen, 2007, p. 57).

“Activities, then, are the basic units of competitive advantage” (Porter, 1996, p. 85). Operational excellence plays a vital role in ensuring a firm’s competitive advantage in the marketplace by maximizing value to stakeholders by improving output (productivity) or reducing cost (efficiency) as every activity carried out by the company incurs a cost. In organizations at the start-up stage, improved performance means achieving and sustaining competitive advantage and growth with fewer resources. To this end, technology helps companies use resources wisely and improve operational excellence, which is the intended outcome of this thesis – to leverage technology tools to improve portfolio management processes in the case company. The thesis work will focus on activities that enable the outcome i.e., the design and deployment of an enterprise portfolio management system (EPMS) to optimize project management processes in the case company.

This is anticipated to benefit the company by streamlining the communication to the management and external partners, leading to better control over the portfolio. This also benefits the corporate goal of *One-Speed-Portfolio* progression; to move from executing one program at a time to executing multiple programs simultaneously with a *Single-Point-of-Truth* on metrics, status, and scorecards. The learning outcome from the thesis is the application of strategic management concepts to lead business transformation projects in a working environment.

The research project involves the portfolio and alliance management (PAM) business function of the case company. The software that is implemented will impact all line functions (technical, regulatory, quality, and manufacturing) within the company, fulfil the requirements from an organizational perspective to streamline operations, and enable the author to successfully conclude the thesis requirements. The research is novel as it spans the domain of business strategy, portfolio, and stakeholder management, in the generic biopharmaceutical industry.

1.2 Research objectives, questions, and scope

The objective of the thesis is *to develop an enterprise portfolio management system to manage program activities, timelines, and budgets in one place and in real-time by understanding the current state of project management processes and envisioning the desired future state with stakeholders using design thinking approaches and agile practices*.

The research objective can be decomposed into corresponding discrete research questions as shown in Table 1 below:

Table 1: Research objectives and questions

Research Objective	Research Question
RO1: Establish the business case for EPMS in the case company	RQ1: What is the value of using EPMS for portfolio management?
RO2: Develop product design and implementation plan for EPMS	RQ1: How should EPMS be customized for the case company to deliver value to stakeholders?
	RQ2: How should EPMS be implemented to effect business transformation with success?

To gather insight into the research questions, the author used material from discussions in workshops and meetings during the planning and execution stages. The method and process are described in Section 3.2, data collection in Section 3.3, and data analysis in Section 3.4. The empirical part of the thesis serves to shed light on current end-user experience, the positives and gap areas, and future expectations using EPMS and project management processes.

The scope of thesis work includes project management processes, in the case company that is maturing from start-up to build mode (‘take-off’ stage company) and operates in the generic biopharmaceutical industry. The thesis work will evaluate PPM processes for fit into EPMS and result in developing the product for the case company with high level plan for implementation of the change process.

The thesis work will not evaluate processes outside project management like human resources (HR), research and development (R&D), information technology (IT), manufacturing, clinical, regulatory affairs, or quality, which are the other line functions in the case company that work closely with the project management function. The work will not involve de-novo process design but

merely seek to understand best practices for process optimization. Lastly, the work will not involve organizational rollout or the technical aspects of software development or configuration. The chosen frameworks: agile methodology and design thinking, have their pros and cons with each capable of being applied wholly or partly to solving organizational challenges. In this research work, the concepts that will be used to execute the project are presented in Section 2.

1.3 Structure of the thesis

The thesis comprises five main chapters. The first chapter introduces the background, motivation, and intended outcomes of the study. The second chapter outlines the theoretical framework and concepts used for the thesis work and comprises three subsubsections: project management, design thinking/agile methodology, and business transformation/change management. The third chapter discusses the research methodology, context, approach, data collection, and data analysis. The fourth and fifth chapters present study results and discuss the conclusions, respectively.

2 Theoretical framework

The review of prior literature is divided into three sections. The first section describes the theoretical concepts and framework behind project and portfolio management, governance, and the linkage with strategy. The second section delves deeper into design thinking and agile methodology to identify tools that are relevant to the study and their integration. The third and final section deals with the conduct of business transformation projects, challenges/success factors and change management.

2.1 Project, Program, and Portfolio management

Organizations have traditionally been functional organizations with several line functions or business verticals reporting directly to the management. As organizations typically develop several products at various stages of maturity (development, marketed, etc.), the complexity and resource requirements spurred the development of dedicated teams for each product, drawing technical expertise from the business functions and managed by an unbiased leadership function (project management group) that reported directly to the CEO. In the 1960s, organizations in the aerospace industry in the United States transformed into matrix organizations which are defined as one in which there is dual or multiple managerial accountability and responsibility (Stuckenbruck, 1979, p. 22). The project team comprises members drawn from line functions and brings subject matter expertise to the project team to progress the project goals. The team members report to the functional manager as well as the project manager for the duration of the project post which they are released to the line function to work on other projects. This concept is shown in Figure 1:

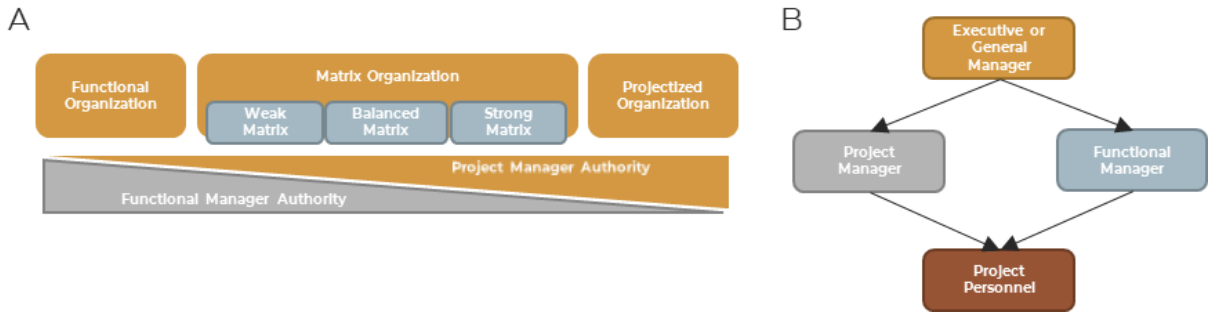


Figure 1: A. Organizational structures: functional, projectized and matrix organizations, and B. Basic unit of a matrix organization (adapted from Stuckenbruck, 1979, p. 22)

The advantages of a matrix organization are clear communication of project goals, accountability, effective information flow, resource utilization, and team morale. Matrix organizations typically have an independent portfolio management function reporting directly to the CEO.

2.1.1 Connecting portfolio to strategy

Portfolio management is a strategic activity that connects a business vision and mission to its operations to optimize profits by balancing risk and return effectively (Piney, 2007, p. 3). A project portfolio can be defined as a collection of 'project components' like projects, programs and other work that are combined to manage the work effectively and meet strategic business objectives. Projects are short term cross-functional undertakings with a defined goal (scope), budget (cost), and due date. These are called the triple constraints where any change in a component will trigger a change in the others. The role of the project manager is to balance them effectively to deliver value. Programs are a collection of projects and other work (operations) that when combined with other programs together constitute the portfolio as shown in Figure 2:

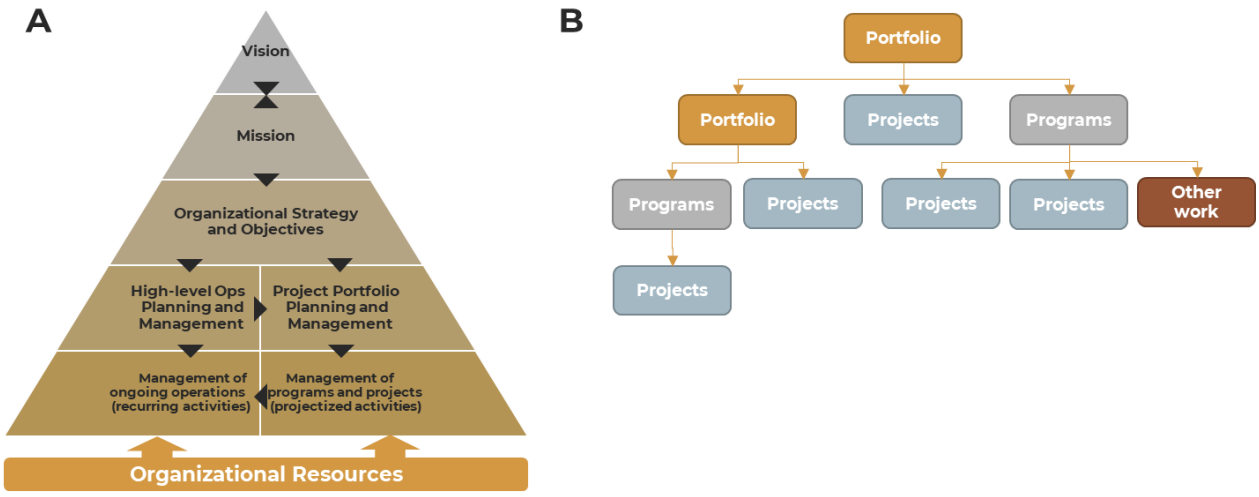


Figure 2: A. Portfolio drives strategy, and B. Projects, programs, and portfolio

In the pharmaceutical industry, programs typically refer to a product or asset, while projects are often a subset of programs with defined goals e.g., manufacture for clinical studies, clinical trials, etc.

2.1.2 Project management knowledge areas and process groups

The Project Management Institute (PMI®) provides a framework for structured project management by identifying and measuring PM work across 10 knowledge areas and 5 project process groups (PMI PMBOK®, 2017, p. 23). The process groups are initiation, planning, execution, monitoring and control, and closure. The knowledge areas cover the aspects of project management and the process groups as shown in Figure 3:

Knowledge Areas	Project Management Process Groups				
	Initiating Process Group	Planning Process Group	Executing Process Group	Monitoring and controlling Process Group	Closing Process Group
4. Project Integration Management	4.1 Develop Project Charter	4.2 Develop Project Management Plan	4.3 Direct and Manage Project Work	4.4 Monitor and Control Project Work 4.5 Perform Integrated Change Control	4.6 Close Project or Phase
5. Project Scope Management		5.1 Plan Scope Management 5.2 Collect Requeriments 5.3 Define Scope 5.4 Create WBS		5.5 Validate Scope 5.6 Control Scope	
6. Project Time Management		6.1 Plan Schedule Management 6.2 Define Activities 6.3 Sequence Activities 6.4 Estimate Activity Resources 6.5 Estimate Activity Durations 6.6 Develop Schedule		6.7 Control Schedule	
7. Project Cost Management		7.1 Plan Cost Management 7.2 Estimate Costs 7.3 Determine Budget		7.4 Control Costs	
8. Project Quality Management		8.1Plan Quality Management	8.2 Perform Quality Assurance	8.3 Control Quality	
9. Project Human Resource Management		9.1 Plan Human Resource Management	9.2 Acquiere Project Team 9.3 Develop Project Team 9.4 Manage Project Team		
10. Project Communications Management		10.1 Plan Communications Management	10.2 Manage Communications	10.3 Control Communications	
11. Project Risk Management		11.1 Plan Risk Management 11.2 Identify Risks 11.3 Perform Qualitative Risk 11.4 Perform Quantitative Risk 11.5 Plan Risk Responses		11.6 Control Risk	
12. Project Procurement Management		12.1 Plan Procurement Management	12.2 Conduct Procurements	12.3 Control Procurements	12.4 Close Procurements
13. Project Stakeholder Management	13.1 Identify Stakeholders	13.2 Plan Stakeholder Management	13.3 Manage Stakeholder Egagement	13.4 Control Stakeholder Egagement	

Figure 3: Project management knowledge areas and process groups (PMI PMBOK®, 2017, p. 23)

Project Integration management unifies the processes and activities in each process group. Middle-level and lower-level managers spend the most time implementing the project which requires a clear statement of objectives, action plans, timetables, policies, and procedures. Project Risk Management deals with the identification, analysis, planning, mitigating, and controlling of project risks. Project Procurement Management deals with purchasing or acquiring products and services. Project scope management ensures that the strategy is focused and avoids expending resources on

activities not contributing to project outcomes. Project time management deals with ensuring the project is completed on time while Project cost management ensures that the project execution is cost-efficient and avoids budget overruns. Project quality management ensures activities comply with the company's and industry regulatory and quality standards. Project human resource management deals with people handling and stakeholder management. Project communications management deals with keeping the project team, sponsor, management, and other stakeholders aligned throughout the project. The activities here include recording meeting outcomes, project status updates, reports on deliverables, and other project-related documentation. The project knowledge areas and process groups provide the framework to understand the project management processes that need to be optimized. This forms the backbone of this thesis.

2.1.3 Project management techniques

This section focuses on project management as a practice using recent research to understand best practices. The role of a project manager is paramount in the success of the project which is evident during the discourse that occurs during project team meetings where the opening meeting remarks that lay out the goals such as 'strategic opportunities' and 'desired innovations' and the stipulated deadline (Clegg *et al.*, 2018, p. 766). The team meetings can be considered as enactments where words and images create a storyline understood by team members. Close attention to language use, rhetoric, categories in use, and projection of emotions will enable appropriate positioning. The PPM meeting is a key arena of action: in meetings, strategies can be unveiled, resistance sniffed out, support garnered, or opposition incubated. These project meetings can promote self-actualization, dialogue and concreteness, enabling greater participation (Jarzabkowski and Seidl, 2008, p. 8). Thus, the structure and organization of meetings play an important role in implementing strategy. Gemünden and colleagues have developed a model for project-oriented organizations with three core components – structure, people, and values – shown in Figure 4 (Gemünden, Lehner and Kock, 2018, p. 150):

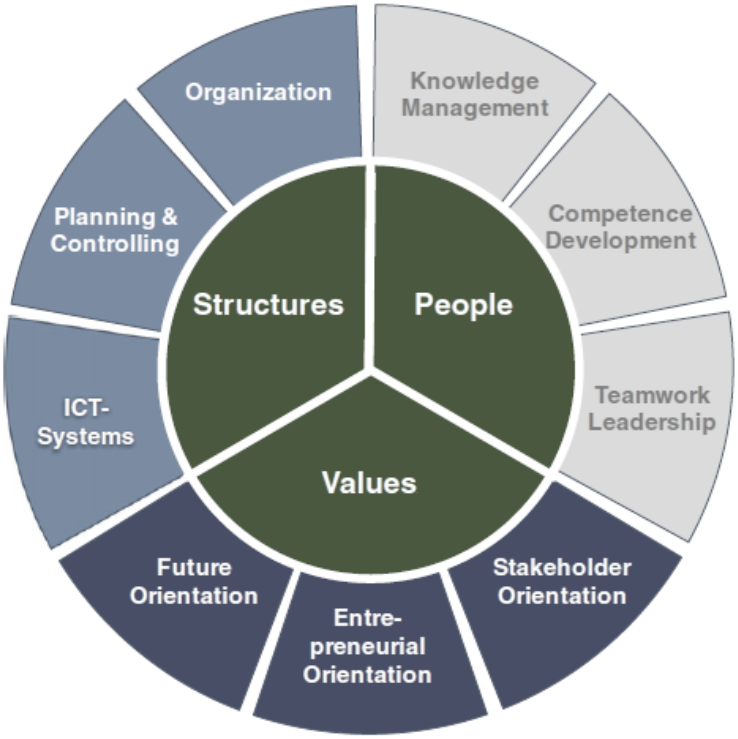


Figure 4: Model of the project-oriented organization (Gemünden, Lehner and Kock, 2018, p. 151)

Project-oriented organizations need to control and coordinate complex project landscapes, align strategy to the portfolio, select winning projects, manage risks, optimize resource utilization, and adapt to change through portfolio management. This requires the **structure** to include three components (a) organizing of structures and processes, (b) planning and controlling, and (c) information and communication technology (ICT) systems to support decision-making. Organization of structures include support by the Project Management Office (PMO) which performs coordination, planning and controlling, to increase project performance by enabling project governance and decision making by portfolio review boards at different levels. Formalization of processes introduces structure, sequence, and clarity to projects and improves the quality of information and coordination. Clear definition of roles and responsibilities of project team members or leaders and empowerment of team improves performance. The second aspect of structure is planning and control which is provided by the management quality construct (Jonas, Kock and Gemünden, 2013, p. 17) comprising of three facets: cooperation quality, information quality, and allocation quality. Cooperation quality measures the quality of cross-project cooperation between different project managers and project teams which encourages knowledge sharing. Information quality consists of relevance, understandability, accuracy, conciseness, completeness, currency, timeliness, and usability of the information, which can be used by decision-makers and enables better resource allocation and risk management. Allocation quality measures the effectiveness, speed, stability, and conflict handling quality of human resource allocation decisions. Planning and control also include risk management

which has two components (1) Creating transparency about risks, and (2) Establishing the capacity to cope with risks, which is correlated to project success. The project-oriented organization should formalize the process of identifying, analysing, and mitigating risks. The last structural aspect is the use of ICT tools for multi-project (portfolio) management which improves project success. The authors however caution that the organization must reach a level of process maturity for ICT tools to provide value. The second component is **people**, essentially team members working in a cross-functional matrix environment. It is vital to have efficient knowledge sharing and enable self-management and shared leadership and invest in grooming project leaders. Another aspect is knowledge management through formal systems like 'lessons learned' that are captured and utilized to guide future projects which enables organizational learning. The third component '**values**' has three aspects: future orientation, entrepreneurial orientation, and stakeholder orientation. Future orientation is the thinking of prioritizing future success over current wins and invokes the attributes of empowerment, accountability, and responsibility. The corresponding attributes of entrepreneurial orientation are innovativeness, proactiveness, and risk-taking. Finally, stakeholder orientation involves keeping in mind the internal and external stakeholders and the value created for them while designing and delivering processes. In aggregate, the model provides a good structural framework for project-oriented organizations to develop processes that are best practices, meeting or surpassing industry standards.

2.2 Design thinking and agile frameworks

2.2.1 Design thinking

Design thinking is a problem-solving approach that keeps the end-user in mind during all stages of product development resulting in solutions that people like. Tim Brown, President and CEO of IDEO, which is one of the first companies to practice design thinking concept in different domains, defines it as a human-centred approach to innovation that draws from the designer's toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success (Brown and Katz, 2009). Innovation thus lies at the intersection of viability (business), desirability (human), and feasibility (technological). The methodology stresses empathy while developing a product and uses techniques from ethnography, sociology, and psychology, to clearly define the user and their needs. There are different schools of thought with the primary being the IDEO organization and Stanford D-School in the US and the Design Council in the UK. The stages of design thinking driven product development according to the D-school framework are shown in Figure 5:

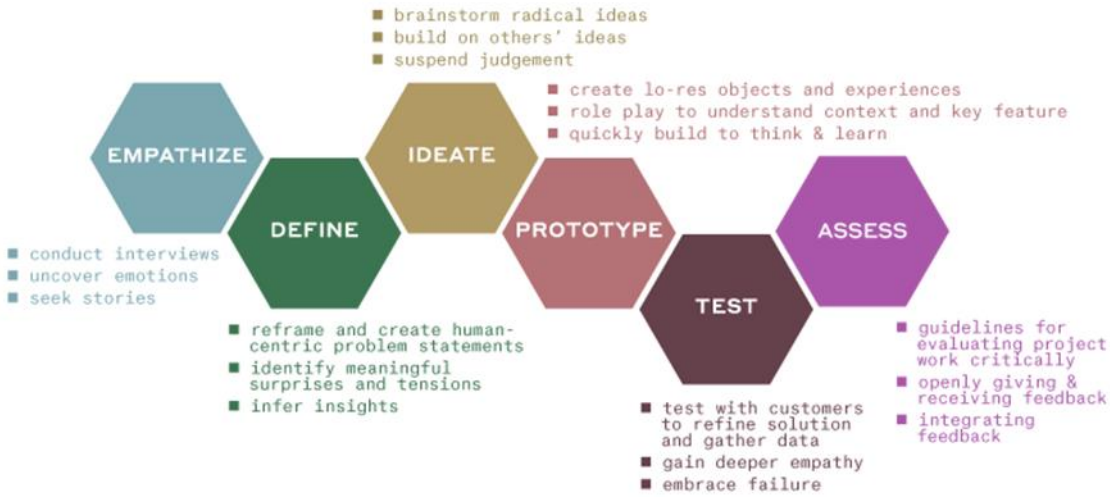


Figure 5: The Stanford D-school Design Thinking framework (Figure from the website: dschool.stanford.edu)

The design thinking process consists of the following steps: empathize, define, ideate, prototype, test, and implement according to the Stanford D-school (Meinel and Leifer, 2011).

Empathize: This step is central to the design thinking process and emphasizes listening to the requirements of customers to solve the problem. The findings and learnings from this step are saved systematically as empathy maps.

Define: Collate the information collected from customers and synthesize it to generate insights and define the problem. Framing the problem is essential to explore opportunities and devise solutions.

Ideate: Search for methods to address the problem using the problem definition and brainstorm ideas. The process involves listening to all ideas, great and trivial, to develop the concept. The stage ends with choosing the best ideas to carry forward.

Prototype: This stage gives shape to the idea using methods such as sketching, rapid prototyping, etc. The purpose of the stage is to create rough sketches of solutions that are simple, quick, and economical.

Test: Field test the prototype with users or customers and gather feedback to qualify the prototype for the next stage or to go back to the development cycle.

Implement: Rollout of the product or service. The design thinking cycle can be continued to further refine the product or add features and enhancements.

A useful model and tool for applying design thinking are provided by the UK-based Design Council, called the 4D or Double Diamond – a clear, comprehensive, and visual description of the design

process, first launched in 2004 (Tschimmel, 2012, p. 9). This model includes key principles that let designers model the design process and consists of two diamonds that represent the process of exploring a problem widely or deeply (divergence) and taking focused action (convergence). There are four stages – discovery, define, develop, and deliver. In the discover stage, the problem is explored from different points of view of the participants. This is followed by the define stage, where the gathered insights are structured to define the problem. In the develop stage, the participants provide solutions from respective perspectives which are collected, analysed, and prioritized. In the final stage, the solutions are tested to keep or further develop the promising solutions. This is not a linear process and often involves back and forth between different phases drawing upon a core set of design principles and methods as shown in Figure 6 below:

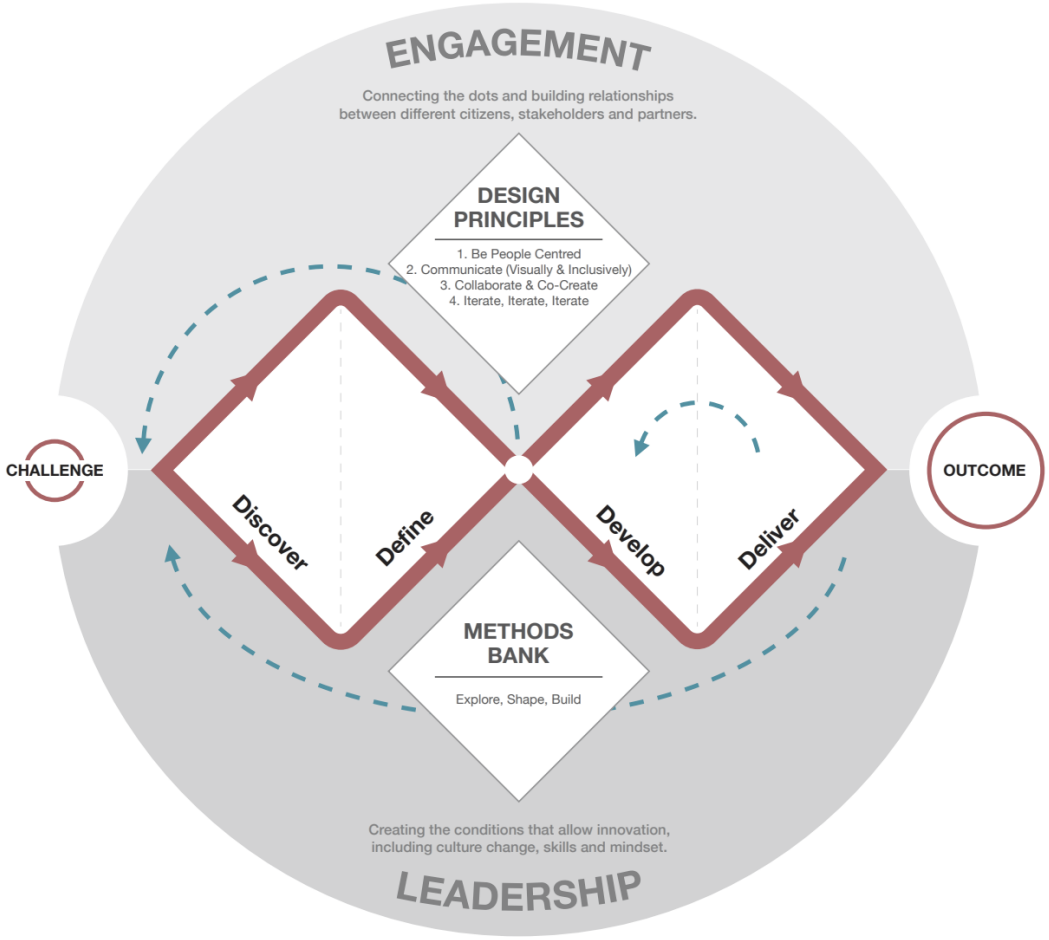


Figure 6: Double Diamond© model by Design Council (Figure from the website: www.designcouncil.org.uk)

In this thesis work, the Double Diamond tool is used for exploring the design space for solution definition and development.

2.2.2 Agile methodology

The agile development approach utilizes the collaborative effort of self-organizing cross-functional teams and end-users to gather requirements and develop solutions iteratively. It advocates adaptive planning, evolutionary development, early delivery, and continuous improvement, and encourages rapid and flexible response to change. The term ‘agile’ started appearing in the 1990s in software development with the congregation of like-minded software developers who produced the ’agile manifesto’ in response to the practices at that time more commonly called ‘waterfall’ development (Poppendieck and Cusumano, 2012, p. 27). According to the manifesto, agile development has four core values that are paramount and supersede values that guide more traditional development methodology: individuals and interactions (over processes and tools), working software (over comprehensive documentation), customer collaboration (over contract negotiation), and responding to change (over following a plan). While applying these values in practice, the manifesto outlines twelve principles (Beck *et al.*, 2001, p. 2):

1. Our highest priority is to satisfy the customer through the early and continuous delivery of valuable software.
2. Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.
3. Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.
4. Businesspeople and developers must work together daily throughout the project.
5. Build projects around motivated individuals. Give them the environment and support they need and trust them to get the job done.
6. The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.
7. Working software is the primary measure of progress.
8. Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.
9. Continuous attention to technical excellence and good design enhances agility.
10. Simplicity--the art of maximizing the amount of work not done--is essential.
11. The best architectures, requirements, and designs emerge from self-organizing teams.
12. At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behaviour accordingly.

In this method, product development is decomposed into small increments to reduce the burden of initial planning. Frequent and periodic iterations, called sprints, are performed by stakeholders from represented functions: planning, analysis, design, coding, testing, and acceptance, to demonstrate a working prototype. At the end of each iteration, the prototype is evaluated by developers and

customer representatives for rollout or the next development cycle. Multiple iterations may be required to develop a stable product but reduce the risk of failure and increase es chances of acceptance. The customer representative, also called the product owner, acts on behalf of the program sponsor and stakeholders to work with the development team.

A key feature of agile development is the short daily catch-up to review the actions performed in the previous day to improve quality and agility. The agile approach is shown in Figure 7:

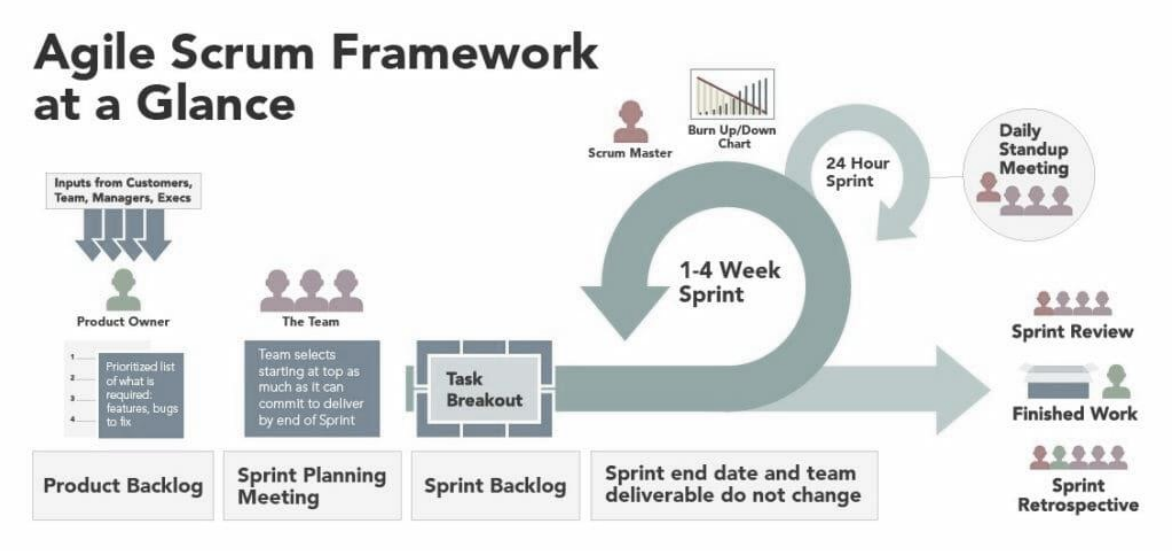


Figure 7: The Agile Scrum framework (*Basics and Benefits of Agile Method | Planview LeanKit*, 2021)

A good example of agile methodology in action in the product development world is mobile phone manufacturers like Apple releasing a new version of the iPhone every six months. Customer feedback from the initial months is used to make iterative changes to the product, which is then released, and the cycle continues.

2.3 Business transformation

2.3.1 Enterprise portfolio management systems

EPMS increase the visibility to project attributes across the stakeholder mix and improve decision making in aligning portfolio to business strategy, prioritization, resource allocation, and risk management. However, EPMS implementation across companies has met with limited success and in some cases, failure as project management processes in organizations are not mature to take full advantage of IT solutions and the field itself is a complex managerial discipline with human interface (Kock *et al.*, 2020, p. 229). Project portfolio management deals with the selection of the right projects, prioritization of projects for efficient resource allocation, steering the projects by providing

governance, managing negotiations, resolving conflicts, leveraging synergies across projects, managing risks, fostering cross-functional learning, and developing competencies. To this end, these applications can be classified into three phases: portfolio structuring, resource allocation, portfolio steering (Beringer, Jonas and Kock, 2013, p. 832), and portfolio learning.

Portfolio structuring: The objective of this phase is to use established organizational methods and tools to evaluate and prioritize projects by balancing strategic fit, short and long term goals and returns, and risks (Cooper, Edgett and Kleinschmidt, 2001, p. 9). Stakeholders e.g., CEO vs functional heads, will view the project from different viewpoints with their agenda, thus portfolio structuring should serve to align stakeholders transparently. EPMS should support portfolio structuring by enabling a consistent approach for portfolio prioritization and project selection, capabilities for mathematical modelling and predictive data analysis tools to avoid wrong correlation (Costantino, Di Gravio and Nonino, 2015, p. 1745), and identify synergies between projects by effective visualization and scenario analysis (Killen, Geraldi and Kock, 2020, p. 267), and provide a transparent and traceable view of complex project information to stakeholders.

Resource allocation: This is often a major challenge for organizations to manage resources effectively and avoid resource burnout, hogging, or bottleneck (Melchiors *et al.*, 2018, pp. 1–2). Resource management strives to forecast project resource demand accurately and tie resource competency and availability to project demand transparently. EPMS can support these tasks by documenting project resource (time and competency) requirements over time and organizational resource capacity in a database and enable analysis and monitoring to identify bottlenecks early and enable decision making e.g. resource prioritization or hiring (Abrantes and Figueiredo, 2015, p. 1275).

Portfolio steering: This phase deals with coordinating and steering the project with appropriate governance. Changes to projects should not be handled independently but at the portfolio, level to further the goals of the organization. Risks can be handled more efficiently across projects at the portfolio level by ensuring information flow and addressing issues from projects in a consistent manner (Teller, Kock and Gemünden, 2014, pp. 67–68). EPMS can enable this by consolidated aggregate portfolio level reporting, overview, and analyses to monitor and compare project performance and terminate underperforming projects if needed. Project and portfolio risk can be analysed and modelled by documenting identified risks and risk management or mitigation plans for decision making (Ahmadi-Javid, Fateminia and Gemünden, 2020, p. 93).

Portfolio learning: Projects are temporary endeavours. Learning organizations need to ensure that the knowledge and experiences from ongoing and completed projects are documented in a carefully managed process to drive organizational learning and gaining competencies (Duffield and

Whitty, 2016, p. 1291). EPMS can be used to gather, document, and disseminate information thereby making the knowledge transparent and accessible.

The key takeaway is that for EPMS to be beneficial, organizations should have reached a state of maturity of process, namely, single project management, portfolio management and risk management processes and secondly there should be task complexity in terms of the size of portfolio and interdependencies and dynamics between projects.

2.3.2 Challenges and success factors

The execution of transformational projects in organizations is fraught with challenges due to the involvement of multiple individuals. A literature review of challenges in agile business transformation projects revealed several themes with change resistance at the top of the pile with over 38% of projects reporting this challenge (Dikert, Paasivaara and Lassenius, 2016, p. 95). The same authors classified challenges into nine major types and minor themes as shown in Table 2 below:

Table 2: Challenges to large scale transformation projects grouped into themes with supporting references

Challenge: Major theme	Minor themes	Supporting References
Change resistance	General resistance to change	(Kalenda, Hyna and Rossi, 2018, p. 8)
	Scepticism toward a new way of working	(Gandomani *et al.*, 2014, p. 183) (Mahanti, 2006, p. 199)
	A top-down mandate creates resistance	
	Management unwilling to change	(Faisal Abrar *et al.*, 2020, p. 9)
Agile is difficult to implement	Misunderstanding agile concepts	
	Lack of guidance from the literature	(Hajjdiab and Al Shaima Taleb, 2011, p. 3)
	Agile customized poorly	
	Reverting to the old way of working	
	Excessive enthusiasm	(Hajjdiab and Al Shaima Taleb, 2011, p. 4)
Integrating non-development functions	Other functions unwilling to change	
	Challenges in adjusting to the incremental delivery pace	(Gandomani *et al.*, 2014, p. 183), (Kalenda, Hyna and Rossi, 2018, p. 17)
	Challenges in adjusting product launch activities	(Gandomani *et al.*, 2014, p. 184)

	Rewarding model not teamwork centric	(Kalenda, Hyna and Rossi, 2018, p. 17)
Requirements engineering challenges	High-level requirements management largely missing in agile	(Faisal Abrar *et al.*, 2020, p. 7) (Boehm and Turner, 2005, pp. 31–33)
	Requirement refinement challenging	(Kalenda, Hyna and Rossi, 2018, p. 10)
	Creating and estimating user stories hard	(Gandomani *et al.*, 2014, p. 183) (Kalenda, Hyna and Rossi, 2018, p. 12)
	Gap between long- and short-term planning	
Hierarchical management and organizational boundaries	Middle managers' role in agile unclear	
	Management in waterfall mode	(Kalenda, Hyna and Rossi, 2018, p. 20) (Boehm and Turner, 2005, p. 36) (Mahanti, 2006, p. 197)
	Keeping the old bureaucracy	(Faisal Abrar *et al.*, 2020, p. 9)
	Internal silos kept	
Coordination challenges in a multi-team environment	Interfacing between teams difficult	(Faisal Abrar *et al.*, 2020, p. 8) (Kalenda, Hyna and Rossi, 2018, p. 9)
	Autonomous team model challenging	(Hajjdiab and Al Shaima Taleb, 2011, p. 3)
	Global distribution challenges	(Kalenda, Hyna and Rossi, 2018, p. 8)
	Achieving technical consistency	(Hajjdiab and Al Shaima Taleb, 2011, p. 4)
Lack of investment	Lack of coaching	(Kalenda, Hyna and Rossi, 2018, p. 9) (Hajjdiab and Al Shaima Taleb, 2011, pp. 2–3)
	Lack of training	(Faisal Abrar *et al.*, 2020, p. 8) (Gandomani *et al.*, 2014, p. 185) (Kalenda, Hyna and Rossi, 2018, p. 9) (Mahanti, 2006, p. 199)
	Too high workload	(Kalenda, Hyna and Rossi, 2018, p. 9)
	Old commitments kept	
	Challenges in rearranging physical spaces	
Different approaches emerge in a multi-team environment	Interpretation of agile differs between teams	(Hajjdiab and Al Shaima Taleb, 2011, p. 3)
	Using old and new approaches side by side	(Boehm and Turner, 2005, p. 31)
Quality assurance challenges	Accommodating non-functional testing	
	Lack of automated testing	(Faisal Abrar *et al.*, 2020, p. 8)
	Requirements ambiguity affects QA	(Boehm and Turner, 2005, p. 34)

These challenges are explained below to cover the technical and human aspects.

Change resistance as people in organizations do not adapt to change especially when the impact is not well understood, clearly communicated, or is perceived to be difficult. Organizations differ in their appetite for change agility with the expectation that there will be some employees who will never adapt to the new normal. This is further exacerbated by employee worry about taking additional roles or acquiring new skills, and scepticism and distrust in the transformation process and outcome due to misconceptions about agile processes like working without a plan or governance. The messaging also plays an important role to communicate, else, risk being interpreted as a top driven mandate for an unrequested change. Change resistance amongst management could also be a major problem with the team losing organizational support during the project execution due to a shift of responsibilities and perception of loss of power. Since fear of change is usually associated with a sense of loss, most people would protest agile introduction and try to undermine any related efforts (Mahanti, 2006, p. 199). During the transformation phase, this could be a major drain on productivity and time.

Agile is difficult to implement is a common challenge due to a misunderstanding of agile concepts, lack of guidance from the literature, poor customization of agile, reverting to old working styles, or excessive enthusiasm. A misunderstanding arises when the tools of agile methodology are emphasized more than the process or are misinterpreted to be a non-standard working style (e.g., a way to do things without proper documentation). There is a perceived lack of literature or handbook that prescribes agile execution leading to errors in running agile projects. There is also the tendency to think agile as the ultimate solution leading to high expectations resulting in disillusionment with early failure and reverting to the older way of working. Ways to solve this challenge include ensuring team members get agile training, agile coaching and championing, cross-team observation, and validation of agile practices, and assessing agility in terms of value to the company and not practice adherence.

Integrating non-development functions is a challenge as agile transformation, though spearheaded by the development function, impacts the entire organization. Challenges in this category include the unwillingness of other functions to change to the agile way of working, resulting in tension with the development team. Typically, the agile way of development means that the product is not fully mature when exposed to the customers or consumers. This can lead to non-acceptance of the product or deeming it not useful. It is a challenge to adjust the teams to the incremental delivery pace of the agile process. There could also be challenges in adjusting product launch activities as agile’s emphasis is on short time horizons and prioritization flexibility which may be alien to teams used to product launches at maturity. On the other hand, the need to have a mature product for launch from management can lead to frustration with the development team. Lastly, HR can play a role in slowing adoption by rewarding personal performance and thereby discouraging team-centric work. These problems can be avoided by ”involving non-agile teams early in the planning

process” (Kalenda, Hyna and Rossi, 2018, p. 9) and improvement of continuous integration and test automation systems.

Requirements engineering challenges as agile methods generally vary in their structured approach to requirements but for most methods, projects require a high-level requirements management especially when the product is complex or has several stakeholder groups. The product owner alone cannot support all requirements, requiring the responsibility to be divided among others (Kalenda, Hyna and Rossi, 2018, p. 10). The challenge could be with the development team not having access to the appropriate stakeholder matrix due to distribution. At the next stage, challenges can arise in refining the high-level requirement into tasks, usually how much to do, and when to do it. The creation and estimation of user stories (feedback) are challenging due to ambiguity in requirement gathering and incorrect effort estimation to collect the right feedback within short development or iteration cycles. Lastly, the gap between short- and long-term planning needs to be balanced appropriately as collecting too many requirements at one stage could destroy agility but too few could lead to insufficiency during the development cycle. The negative effects of ambiguous requirements led to low poor quality and schedule overruns (Hajjdiab and Al Shaima Taleb, 2011, p. 2).

Hierarchical management and organizational boundaries can pose challenges to agile implementation in many ways. While larger organizations need to have several layers of management with supervision, agile teams may find this hampering in not being free to operate without being micromanaged. Teams should resist the desire to have long meetings and detailed plans resulting in management in a waterfall model, the direct opposite of the agile mindset. The problem with manager positions could be solved by phasing out roles related to the older way of working with roles suitable for agile development. An operating style that retains the old bureaucracy should be avoided to avoid duplication of efforts caused by retaining both processes. Internal silos are a challenge as well, with teams operating with differing agendas and priorities and with critical resources reorganized around projects making long term planning difficult. Traditional organizational culture creates issues because changing the entire organizational culture is a huge feat (Faisal Abrar *et al.*, 2020, p. 8).

Coordination challenges in a multi-team environment are another aspect when teams need to work with other teams and parts of the broader organization with difficulty in coordination. There could be challenges in achieving technical consistency between teams distributed globally in a real-time manner which could be solved by local teams. The typical agile workspace requires pair-programming stations, walls for status charts and assignments, a layout that allows team members to easily converse to share information, and sufficient equipment to support continuous integration and regression testing (Boehm and Turner, 2005). Agile development emphasizes constant

communication and team spirit which leads to transparency and trust, which is difficult to achieve with distributed teams (Kalenda, Hyna and Rossi, 2018, p. 9).

Lack of investment signifies deficiency in the organization committing to the success of agile implementations due to lack of training and coaching and keeping old commitments which tie up resources from fully being invested in adapting to the new way of working. Teams typically have regular work commitments during the transformation phase and hence need training and coaching to be provided in their real work environment. Arranging this training which requires individuals to take time off work may be a challenge. Often, the demand to coach teams exceeds the capacity resulting in lower penetration of change. Almost all references reviewed cited this in one form or the other. Gandomani and colleagues have recorded participants emphasizing providing ’transition facilitators’ to help deal with the challenges like ’on-site coaching’ and ’agile champions’ to create a positive environment for change (Gandomani *et al.*, 2014).

Different approaches emerge in a multi-team environment which could cause problems owing to the different interpretations of agile between teams causing tensions. Since resources are typically moved between projects, the agile culture must be similar between teams. Also using old and new methods together is problematic throughout the organization as waterfall methods require the design to be finalized at the beginning while agile methodology evolves design over time. One way to tackle this challenge is to strive to have multiple ’bought-in’ developers on each team and to collect and share successful adoption experiences (Hajjdiab and Al Shaima Taleb, 2011, p. 3). Another interesting way to manage the challenge of agile and non-agile co-existence is to identify incompatible (model clashes) and compatible (synergies) assumptions between conventional and agile methods within the company processes and work to remove clashes and promote synergies (Boehm and Turner, 2005, p. 35).

Quality assurance challenges in agile development owing to the inability to integrate quality assurance testing side-by-side with development. In a traditional setup, the quality assurance department steps in during the end of development for testing and any identified problems would be routed to development teams to fix. Agile methods use incremental innovation for development which makes the integration of testing activities complex and resource-intensive. While it may be beneficial to have a dedicated QA team supporting development in tandem, these relationships and processes need to be defined clearly. Another way to mitigate this would be to build in automatic testing, the lack of which would pose a challenge. Kalenda and colleagues have proposed the creation of an ’Undone department’, comprising cross-functional team members from design to quality assurance to aid development teams (Kalenda, Hyna and Rossi, 2018, p. 9).

The research around challenges in large scale agile transformation projects has also delved into the learnings from both successful and unsuccessful projects to derive the success factors for transformation projects. These are divided into three categories for understanding: development process, business process, and people process. The development process comprises factors inherent to the agile development process or framework aspects, while the business process comprises the implementation and transformation, and lastly, the people category comprises the human component of the transformation process. The categories of factors, the major and minor themes within, the guidelines for practice, and supporting references are shown in Table 3:

Table 3: Success factors for agile transformation projects

Success factor major themes	Minor themes	Supporting references
Category: Development process		
Choosing and customizing the agile approach	Acquire knowledge and customize the agile approach mindfully Conform to a single approach Keep it simple and map to the old way of working to ease adaptation Evaluate risks Prepare framework and action plan	(Kalenda, Hyna and Rossi, 2018, p. 10) (Boehm and Turner, 2005, pp. 31–32) (Gandomani *et al.*, 2014, p. 185)
Mindset and Alignment	Concentrate on agile values in addition to processes Arrange social events and cherish agile communities Align the organization	(Kalenda, Hyna and Rossi, 2018, p. 10), (Conboy and Carroll, 2019, pp. 47–48) (Mahanti, 2006, p. 204)
Requirements management	Recognize the importance of the Product Owner's role Invest in learning to refine the requirements	
Category: Business process		
Commitment to change	Communicate that change is non-negotiable Show strong commitment Evaluate risks	(Boehm and Turner, 2005, p. 33)
Management support	Ensure management support and address HR issues Make management support visible Educate management on agile Provide sufficient resources	(Boehm and Turner, 2005, pp. 34–35) (Mahanti, 2006, p. 201) (Kalenda, Hyna and Rossi, 2018, p. 10)
Piloting	Start with a pilot to gain acceptance Gather insights from a pilot	(Gandomani *et al.*, 2014, p. 185) (Boehm and Turner, 2005, p. 37) (Mahanti, 2006, p. 201)
Communication and transparency	Communicate the change intensively Make the change transparent Create and communicate positive experiences in the beginning	(Boehm and Turner, 2005, p. 38)

Training and coaching	Provide training on agile methods Coach teams as they learn by doing	(Gandomani *et al.*, 2014, p. 185)
Solid engineering practices	Including QA and testers in development teams and having established tolerance levels	(Kalenda, Hyna and Rossi, 2018, p. 11)
Category: People		
Leadership	Recognize the importance of change leaders Engage change leaders without the baggage of the past	(Mahanti, 2006, p. 204)
Engaging people	Encourage, motivate, support, and reward people Start with agile supporters Include persons with previous agile experience Engage everyone in the organization and empower affected employees	(Gandomani *et al.*, 2014, p. 182), (Boehm and Turner, 2005, p. 38) (Kalenda, Hyna and Rossi, 2018, p. 10) (Mahanti, 2006, p. 200)
Team autonomy	Allow teams to self-organize Allow grassroots level empowerment	(Gandomani *et al.*, 2014, p. 182), (Hajjdiab and Al Shaima Taleb, 2011, p. 3)

2.3.3 Change management

There are several models to manage organisational change. Lewin´s change model (Lewin, 1951) suggests working with the so-called forces; increase those forces pushing for change, decrease those forces maintaining the current state or apply some combination of both. Action Research Model is focusing on the planned change as a cyclical process in which initial research about the organization provides information to guide subsequent action. The third model is the Positive Model where the focus is on the organization´s problems and they can be solved so it functions better. It focuses on positive dynamics in organizations that give rise to the extraordinary outcome. The fourth and last model is the Kotter model.

One of the early models of planned organizational change was given by Kurt Lewin in the 1950s. He conceived of change as modification of those forces that keep the system’s behaviour stable.

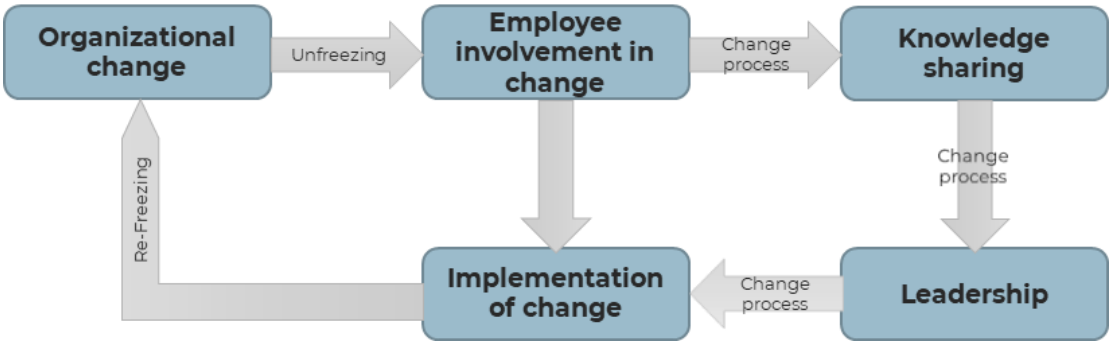


Figure 8: Lewin's 3-stage model (Hussain *et al.*, 2018, p. 126)

Stage 1: Unfreeze: Focuses on the need to challenge the underlying assumptions and status quo. When this happens the existing structures, beliefs and habits become fluid and thus easier to shift. Unfreezing is sometimes accomplished through the process of "psychological disconfirmation". By introducing information that shows discrepancies between behaviours desired from the members of the organization and those exhibited currently. This creates motivation for change.

Stage 2: Change: This stage shifts the behaviour of the organization to a new level. It is a critical stage of considerable uncertainty and flux. The new structures and ways of working are set up and tested with employee engagement, knowledge sharing, communication, and leadership.

Stage 3: Refreeze: This is the steady-state when stability is re-established with new monitoring and continuous improvement apparatus in place. This is done using supporting mechanisms that reinforce the new organizational state, such as culture, incentives, and structures.

The Lewin model was criticized for its oversimplification of the organizational change process giving way to future models like the Action Research Model. This is an iterative cycle of research and action involving collaboration between the units of the organization that drive the change and those that are impacted by it. The emphasis is on gathering preliminary data, diagnosing, and planning action followed by executing the planned actions to effect the change resulting in a behavioural change that can be measured through data to effect further iterative changes (Cummings and Worley, 2009). This model overcomes the oversimplification of previously described Lewin's 3 stages model.

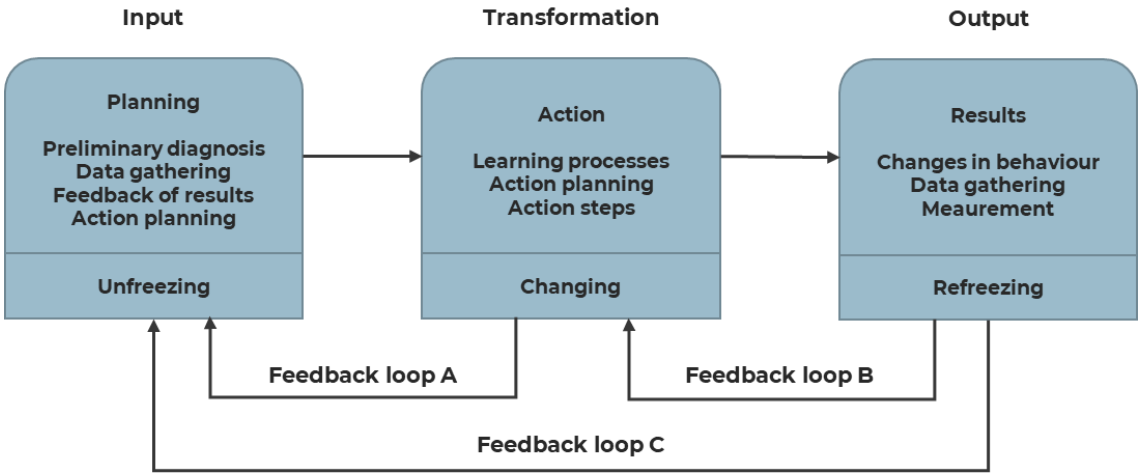


Figure 9: Systems Model of the action-research process (Cummings and Worley, 2009)

The Positive Model focuses on current organizational strength areas (best practices) by establishing an understanding of what works well. This is also where the model differs from the others which focus on the negatives and finding ways to remove them. This model is applied to planned changes through a process termed appreciative inquiry (AI). As a “reformist and rebellious” form of social constructionism, AI explicitly infuses a positive value orientation into analysing and changing organizations (Cummings and Worley, 2009, p. 27). It involves five phases summarized in Figure 10:

Step 1 Initiate the inquiry
- Determine the subject of change
- Engage employees to identify aspects that are most energized to address

Step 2 Inquire into best practices
- Gather the information on the 'best of what is' within the organization
- Build a knowledge repository of these practices

Step 3 Discover the themes
- Members analyze the collected cases and derive common themes that enable success
- The themes represent the basis for moving from 'what is' to 'what could be'

Step 4 Envision a preferred future
- Members collectively visualize the organization's future and develop propositions
- Identify changes that must be undertaken to support the emergence of the envisioned future

Step 5 Design and deliver ways to create the future
- Execute changes identified to reach desired state in controlled manner
- Continuous monitoring and adjustments

Figure 10: Positive model of change (Cummings and Worley, 2009, p. 27)

Finally, the Kotter model provides a defined set of steps for executing organizational transformation (Kotter, 1995, p. 61). According to the model, transformation or change occurs in eight steps. The first step is to create a sense of urgency to change and convince stakeholders that staying with the *status quo* is riskier than initiating change. The team needs to exit denial and acknowledge the problem or gap and the need to solve it. This activity involves moving people out of their comfort zone with the assurance that the change will be positive. The second step is to bring together individuals committed to the change and powerful individuals, typically senior executives, who also act as sponsors, to support the initiative. The individuals need to be seasoned team players who are also capable of working in a non-hierarchical or matrix environment towards the goal. Failure in setting up an empowered and performing team can allow the opposition (to change) to coalesce and endanger the project. The third step involves creating a vision that is simple, clear, and concise followed by the strategy to achieve the vision. At the lower level, the drill-down includes plans, directives, and documents, aligned to the strategy and the vision. Paraphrasing Kotter, *"If you can't communicate the vision to someone in five minutes or less and get a reaction that signifies both understanding and interest, you are not yet done with this phase of the transforming process"*. The next step is to communicate the vision to gather supporters using several communication modes and by using the coalition as guides by walking the talk. These two actions go hand in hand, as an effective communication campaign can go to waste if the team does not embody the change. The modes of communication could be through emails, newsletters, speeches, or workshops. Change introduction is also successful if the individuals or groups that are impacted negatively by the change are offered other opportunities to succeed. A change involves sacrifice and employees will not make the sacrifice, even if they are not happy with the *status quo* unless the change is perceived to be useful. The fifth step is to empower others to act on the vision by creating credibility that the organization and stakeholders are committed to the new process. This needs to be demonstrated not only by the above steps including communicating the vision and gathering supporters but also to empower the supporters and remove obstacles that they may be facing to work towards the change. These obstacles could be a mere mental block to change or real impediments like the need for training or supervisors not being aligned with the change initiative. The project team needs to be cognizant of these impediments and proactively eliminate them through appropriate actions. Failure to do this can lead to losing supporters and ultimately credibility. The sixth step is to plan for and create short term wins for immediate gratification. Driving an organizational change is a long-term process that may take a long time to demonstrate results. There is the possibility for the organization to be disillusioned with the lack of results after the initial hype, leading to falling back to the older way of working and growing resistance. This step preaches that instead of waiting for the results to showcase to the organization, it is important to envision and create short term wins using appropriate markers of success to show a positive effect of the transformation. It may be helpful recognizing and reward the individuals who have contributed to the change and

incentivize adoption. Failure to execute this step risks losing morale or traction. To quote Kotter, *"when it becomes clear to people that major change will take a long time, urgency levels can drop. Commitments to produce short-term wins help keep the urgency level up"*. The seventh step is to consolidate improvements and produce more change or in other words, resist the temptation to declare success and cement the change as process and mindset change can take a long time. It is useful to build upon the short-term wins to tackle bigger problems and to assess the systems and structures that were pre-existing and not in alignment with the change. Change agents or colleagues with a change agile mindset can be recruited across line functions and incentivized appropriately to drive further change. Colleagues who resist change may look for opportunities to identify faults with the new system and use it as a powerful excuse to revert to old ways. Thus, amplifying the change exponentially helps to keep this behaviour in check. The final step is to institutionalize new approaches by anchoring the change in the organization's culture as change sticks when it becomes "the way we do things around here". The new behaviour should be rooted in social norms and shared values. Instead of waiting for colleagues to make the connection between the positive effect of a change, it is useful to articulate the connection between the new behaviours and corporate success. Lastly, leaders must ensure the new generation of leaders and employees who join the organization are trained in and personify the new approach as changes can be lost if new management does not believe in or understand it.

Table 4: Eight steps to transforming an organization (Kotter, 1995, p. 61)

Stage	Actions	Risks
Establish a sense of urgency	Examining market and competitive realities Identifying and discussing crises, potential crises, or major opportunities	Underestimating efforts required to move people out of their comfort zone Becoming paralyzed by risks
Form a powerful guiding coalition	Assembling a group with enough power to lead the change effort Encouraging the group to work together as a team	Prior teamwork experience lacking at the top Designating lead role to HR, quality, or strategy planning executives instead of line manager
Create a vision	Creating a vision to help direct the change effort Developing strategies for achieving that vision	Vision too complicated or ambiguous
Communicate the vision	Using every vehicle possible to communicate the new vision and strategies Teaching new behaviours by the example of the guiding coalition	Not communicating vision properly or actions contradicting vision
Empower others to act on the vision	Getting rid of obstacles to change	Failure to remove powerful individuals resistant or not aligned to change

	Changing systems or structures that seriously undermine the vision Encouraging risk-taking and non-traditional ideas, activities, and actions	
Plan for and create short term wins	Planning for visible performance improvements Creating those improvements Recognizing and rewarding employees involved in the improvements	Not deliberately orchestrating short-term successes Failure to score early success to boost morale
Consolidate improvements and produce more change	Using increased credibility to change systems, structures, and policies that don't fit the vision Hiring, promoting, and developing employees who can implement the vision Reinvigorating the process with new projects, themes, and change agents	Celebrating success too early Expecting resistors to turn into advocates
Institutionalize new approaches	Articulating the connections between the new behaviours and corporate success Developing the means to ensure leadership development and succession	Failure to create new social norms and shared values aligned to change Promoting non-adherents into leadership positions ('slipping back' risk)

The Kotter model was criticised by later researchers as being a one size fits all generalized advice that perhaps needs to be adapted to the context giving way to the contingency theory (Palmer et. al. 2022) that seeks to customize the change management plan individually applying management action where required and other knowledge of organization like size, agility, change resistance of stakeholders, etc. For the research work, the Kotter model was chosen as the best suited due to its simplicity, effectiveness, and widespread reporting in literature.

2.4 Integrating the concepts

This thesis work lies at the intersection of the three sections: portfolio management, design thinking, agile methodology, and change management. The thesis work is undertaken to rethink how the portfolio should be managed in the case company to implement strategy, using design thinking tools to define the process and agile framework to customize the product, and change management tools to affect the business transformation. The first section dealt with how portfolio management connects to strategy implementation and the knowledge areas within program management and the techniques. The second section dealt with the philosophy of design thinking to generate innovative ideas in collaboration with stakeholders from business verticals in the case company to redefine the process. As Roger Martin mentions in his book "The Design of Business", innovation

is not seeing the world as it is but as how it should be, exploring the ‘wicked problems’ whose solutions cannot be found in prior experience or data (Martin, 2009, p. 142). The double diamond methodology for design thinking is chosen as management is not completely an analytical exercise driven by data (convergent thinking) and requires the type of thinking to solve a new or abstract problem with many possible outcomes (divergent thinking). The tool was also chosen as it is well suited for online collaboration and provides an engaging platform for both types of thinking. Since the EPMS itself is an ICT tool, the customization will be done in iterations, also called sprints in agile methodology. The agile methodology is chosen as the project is intended to be an incremental innovation with new iterations released to users on a rolling basis. This ensures the audience is engaged and helps keep the commitment to management. The final section dealt with the academic literature behind the business transformation, challenges/success factors, and change management which will drive the rollout of EPMS in the case company. The concepts presented in the preceding and their relevance to the thesis work are shown in Figure 11 below:

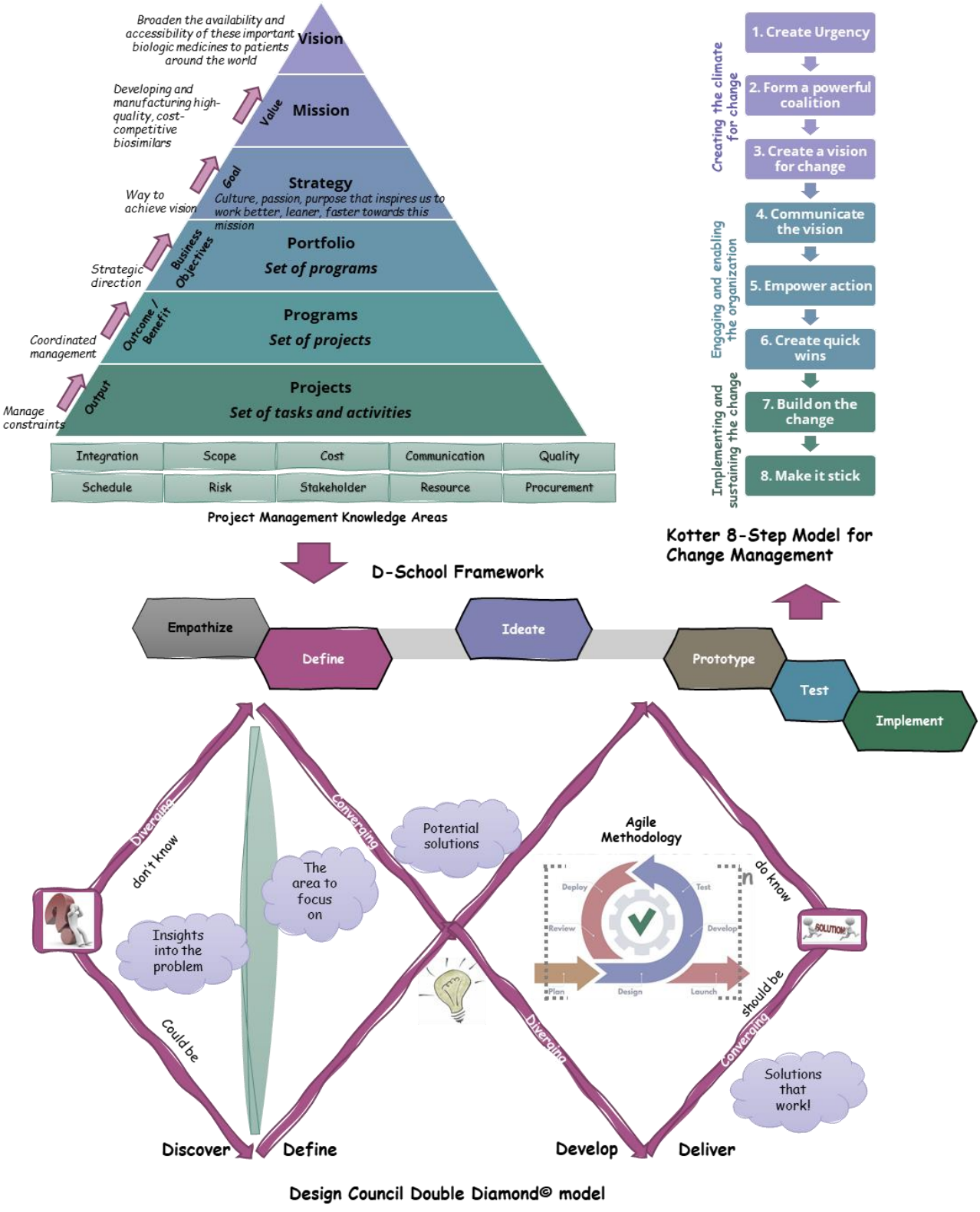


Figure 11: Integration of concepts for a combined theoretical framework

3 Methodology

This chapter discusses the research methodology followed in the thesis. The research context comprising the case company, unit, and project timelines are presented. This is followed by an introduction to the research approach. The chapter is concluded with the presentation of data collection and analysis methods.

3.1 Research context

3.1.1 Case company, industry, and business unit

The case company, Alvotech hf.(*Alvotech - Setting a new standard in biosimilars*, 2021), is an Iceland headquartered mid-size generic biopharmaceutical ("biosimilar") company that is transitioning from start-up to build mode and is preparing for an international IPO in the near term. The company was founded in 2013 and has a current headcount of 900+ employees based in 5 sites across 4 countries – Reykjavik (Iceland), Julich (Germany), Hanover (Germany), Zurich (Switzerland), and Virginia (USA) and home-based worldwide. The Reykjavik site houses R&D and manufacturing teams, while the sites in Germany, Switzerland, and USA house R&D, clinical, and regulatory teams respectively.

The pharmaceutical industry develops medicinal products of chemical origin which are typically administered orally (tablets) or topical (ointments). Within this industry category are the 'generics' manufacturers that develop 'copycat' versions of the innovator's off-patent medicines. Governments around the world have established pathways that allow companies to develop and manufacture these 'copycat' drugs to enable price competition and improve medicine access to patients. The biopharmaceutical industry is a subset of the pharmaceutical industry that specializes in complex medicinal products of biological origin. Examples of biopharmaceutical products include insulins, erythropoietin, monoclonal antibodies, etc., which are also typically injected drugs. Like generics in the pharmaceutical world, 'biosimilars' or 'follow-on biologics' are new biopharmaceutical agents that are similar but not identical to a reference biopharmaceutical product (Mellstedt, Niederwieser and Ludwig, 2008, p. 412). Unlike pharmaceutical products, the characteristics of biopharmaceutical product are heavily dependent on the manufacturing process which vary with the manufacturer and cannot be duplicated, making them unique products. The regulatory framework that approves such similar drugs relies heavily on the totality of evidence to demonstrate similarity to claim marketing approval.

The case unit is the program and alliance management (PAM) business unit that manages internal stakeholders through programs and portfolio management and external stakeholders through alliance partnership management. The project stakeholder matrix consists of internal and external

stakeholders from the case company and vendor. The author is an employee in the program and alliance management (PAM) business function of the case company. The other stakeholders are the program manager peer-group colleagues in the PAM function in the case company, representatives from the human resources, finance, information technology, research and development, manufacturing, clinical affairs, and regulatory affairs business functions in the case company, and representatives from the software vendor company. The organization can be summarized using Figure 12:

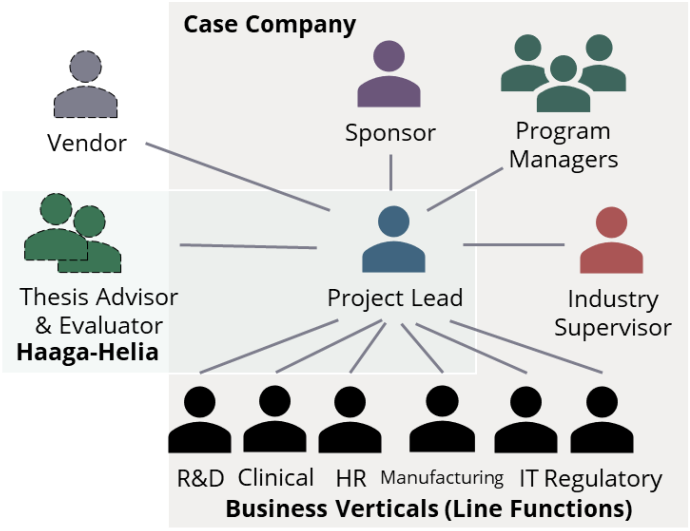


Figure 12: Thesis Project Stakeholder Matrix

The product portfolio in the case company has expanded with many products moving from early development to late-stage, impending first-in-human clinical studies, and submission to health regulatory authorities around the world for marketing authorization. The case company has alliances with leading multinational and regional pharmaceutical companies who will market its products in their respective territories. The case company essentially operates in an industry where innovation and time to market determine success and where the reported capitalized R&D cost to bring a new biopharmaceutical product to market has increased from $1.2Bn in 2007 to $2.8Bn in 2016, with an average clinical phase to approval success rate of 30% (Farid *et al.*, 2020, p. 1). The overall research and development costs and success rates imply the requirement for tight control and oversight of portfolio processes, requiring timely strategic decision making. According to Bode-Greuel and Nickisch, the portfolio management process in the pharma industry entails a stage-gate decision checkpoint, related to major development milestones, when progress is measured and it is decided whether achieved results support continuation or re-prioritization of the project (Bode-Greuel and Nickisch, 2008, p. 309). The enterprise portfolio management tool that is implemented as part of this thesis work is important to achieve this through centralized data collection, analysis, reporting, and dashboarding.

3.1.2 Transformation project timeline

The need to undertake the business transformation project that is the topic of this thesis work was identified during the Annual Operating Planning cycle of 2020. The project was initiated in Q2 2021 with a vendor identification and screening process undertaken. The business case and value mapping were presented to the management followed by defining scope and gathering requirements resulting in the project charter. An initial feasibility study was undertaken resulting in the identification of the desired EPMS vendor. The project team was formed, and stakeholders were mapped out. Vendor contracting, confidentiality and non-disclosure agreements, and vendor setup were completed at this time. The implementation project was formally kicked off in July 2021 in an in-person meeting at the company headquarters in Reykjavik, Iceland. The project schedule, cost, and scope baselines were established along with logistical planning. The project was undertaken in Q3 and Q4 2021 following agile methodology resulting in successive iterations, termed release, of the product. The tool was production-ready in Q1 2022 for an organization-wide rollout. The transformation project timeline is shown in Figure 13:

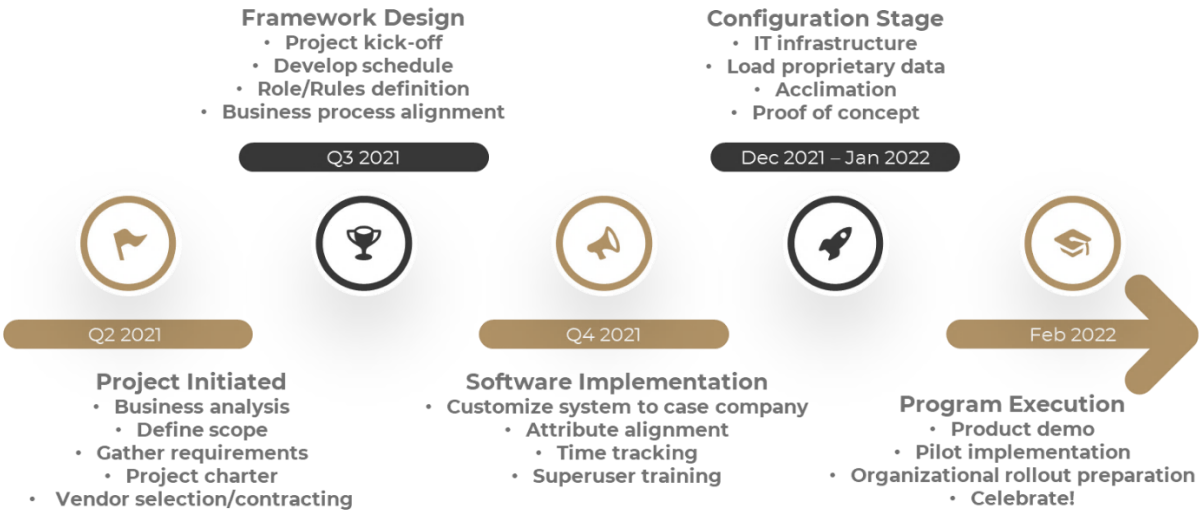


Figure 13: Transformation project timeline

The research study was undertaken in parallel with the transformation project to leverage synergies. The theoretical frameworks were utilized to guide project planning and implementation. This also aided in increasing project success, reducing challenges, and improving the chances of product uptake by the organization. Mistakes were made along the way which was acknowledged by the researcher and project stakeholders. Lessons learned from the experience will be compared to literature for guiding future projects.

3.2 Research approach

Since the thesis comprises of performing a practical business transformation project, the research philosophy is pragmatic with an inductive approach to using a theoretical framework to execute the work. The research uses an action research strategy with a qualitative data collection methodology. Action research is solution oriented to remedy an organizational problem by a thorough analysis of the challenge, formulating an action plan, and implementing the plan, followed by continuing assessment for iteration or course correction (Saunders, Lewis and Thornhill, 2019). Action research also employs a co-creation approach through stakeholder participation thereby ensuring improved alignment during change implementation. A mixed-method qualitative study methodology is employed in the study to explore the challenge from the participant's point of view based on their experience and interaction with others to derive solutions. In other words, the advantage of qualitative research is the ability to describe how the participant perceives the research topic (Silverman, 2010). The time horizon is cross-sectional (current process).

3.2.1 Action research

Action research methodology can be attributed to Lewin who developed it in the mid-twentieth century in the United States to address organizational conflicts, crises and change management through group participation (Oates, 2006, p. 160). Lewin introduced a process comprising of planning, action, and sense-making of the consequences of the action to solve practical social problems. The approach gained momentum in the information systems sector as the topic is well understood when the researcher becomes part of the process and collaborated with participants to solve the problem instead of participating as an observer (Baskerville and Wood-Harper, 1996, p. 238). Action research has the following characteristics (Oates, 2006, pp. 161–162): concentration on practical issues, plan-act-reflect as an iterative cycle, emphasis on change, collaboration of the practitioner, a multitude of data generation methods, and research and/or action outcomes. The action research cycle as originally proposed by Lewin is a cyclical process consisting of a non-linear pattern of planning, acting, observing, and reflecting on the changes in social situations. This was further expanded to a five-step cyclical process as shown in Figure 14 (Baskerville, 1999, p. 14):

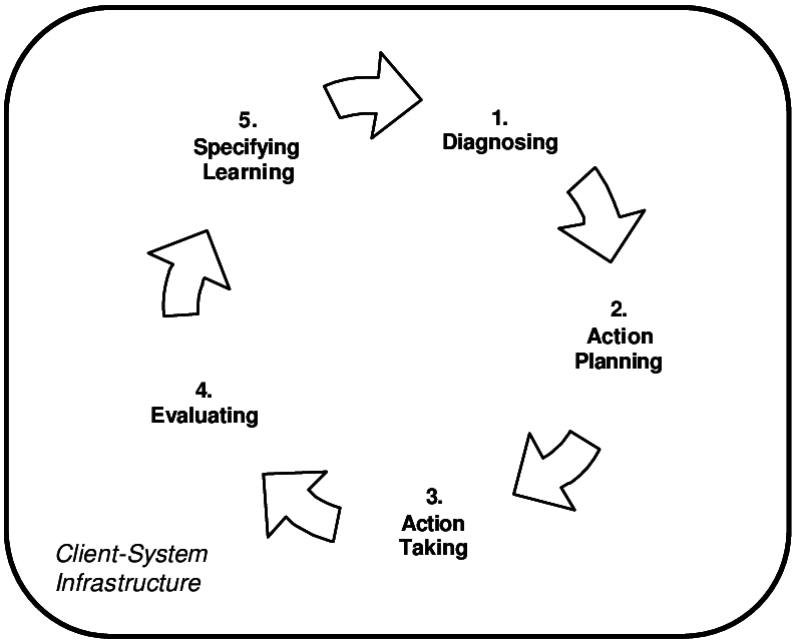


Figure 14: The action research cycle (Baskerville, 1999)

The five phases are comprised of diagnosing, action planning, action taking, evaluating, and specifying learning. During the diagnosing phase, problems underlying the organization's need to change are identified and interpreted in their entirety without simplification. In the action planning phase, researchers and participants collaborate to address the problems using theoretical frameworks as appropriate and develop a plan to implement the solution to resolve the problem. In the next stage of action taking, the plan is implemented through intervention into the organizational processes either directly (e.g., message from CEO) or indirectly (best practices). The evaluation stage follows wherein the outcomes from the implementation are evaluated to estimate success or failure, meeting of success criteria and attribute the effect to the intervention. Depending on the outcome, the need for iterative cycles is established. Lastly, the specifying learning stage is an ongoing process and ensures the knowledge gained is utilized to improve the process in the organization resulting in new knowledge, generating new knowledge for future interventions, and sharing the knowledge with the scientific community for further research on the topic.

3.2.2 Research process

The research process was initiated by setting targets for the transformation project after discussion with the sponsor. The researcher and sponsor pitched the idea to management followed by a business case analysis. The objective of the research work was identified followed by the first round of research questions incorporated into the thesis plan. The thesis plan included the research strategy and approach, a preliminary literature review to identify relevant framework, study plan and timelines, stakeholders, data collection, and data analysis plans. As the project progressed and data were analysed, the research questions and theoretical framework were refined in scope to fit

within the timeframe of the thesis and compare the outcomes of the study with the theory. This is shown in Figure 15 below:

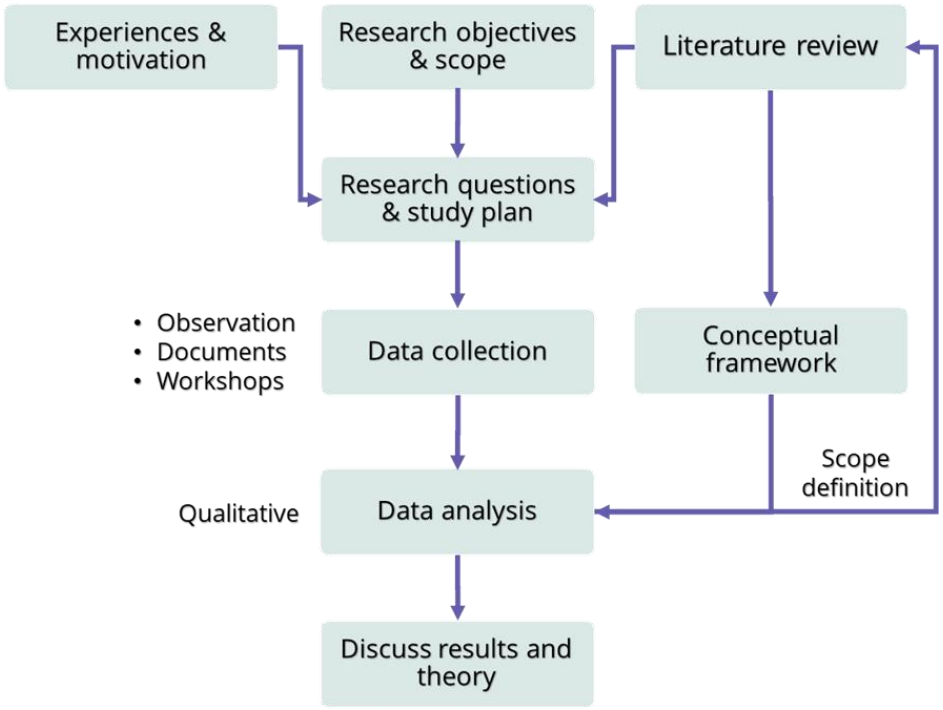


Figure 15: The research process

3.3 Data collection

The action research methodology is empirical with the data collected being qualitative and interpretive. The business transformation project is led by the program management line function with cross-functional participation from other verticals to provide the customer perspective. The participants in the study comprised the business transformation project team from the case company and the vendor as shown in Table 5 below:

Table 5: Participant group

Participant Type	Acronym	Number	Subgroup
Leader	L	1 1	Head of Program Management Chief Portfolio Officer
Team member	T	2 6 6	Program head Program manager Functional manager
Vendor	V	1	Vendor

Data collection was done during participatory observations in group workshops conducted in English, virtually using Microsoft Teams (90%) and through in-person meetings (10%) for collective ideation with stakeholders. There was a total of 14 pivotal meetings of 1-2 hours duration on average. Meeting invites were sent a week or two in advance with the agenda to enable the

participants to prepare for the meeting. The process involved techniques like brainstorming, process mapping and blueprinting that were successfully used in qualitative research as a data collection methodology (Ørngreen and Levinsen, 2017). The sessions were recorded with prior notice to participants for training purposes. Notes taken from these meetings were transcribed, shared with participants post-meeting for alignment, and subsequently used for data extraction.

3.4 Data analysis

The analysis of data was performed using qualitative content analysis. A generalization of the phenomenon of interest was made systematically and objectively. Though the researcher is also the business process owner of the transformation project, he has attempted to have a critical and impartial view of the interpretation of events such that they do not conflict throughout the research process. The analysis was conducted using notes taken from the meeting using Microsoft OneNote, and revisiting recorded meeting sessions as needed for analysis, Microsoft Excel for coding and theme analysis, and Microsoft PowerPoint for visualization. The meeting and workshop proceedings were analysed and the themes emerging based on the researcher's interpretation of the conversation were recorded into categories and where applicable sub-categories. The different levels of categories were colour-coded and visualized to create results as shown in the exhibits in the appendices. The data analysis process was mostly iterative with the researcher shuttling between the levels of depth, abstraction, and generalization, to ensure fidelity of data analysis. The recordings of the meetings were helpful to jog memory without solely relying on meeting notes.

3.5 Ethical considerations and limitations of the study

The Finnish Advisory Boards on Research Integrity (TENK) requires research to be conducted responsibly and following ethical guidelines to be reliable, credible, and acceptable. This section discusses the ethical considerations followed by the limitations of the research.

The research followed the guidelines on ethical research and carried out the work with integrity following acceptable scientific standards. Prior work of other researchers was respected and acknowledged with an appropriate citation in the theoretical section. The workshops were recorded after informing participants voluntarily (a legal requirement in the case company) with anonymization and aggregation of responses for reporting findings. Where required, academic literature has been supplanted with practice-based literature ('consultancy papers' or 'body of knowledge') to ensure a holistic understanding of theory.

The study has limitations in that data collection was primarily through group workshops conducted virtually in a remote setting, possibly resulting in losing visual and non-visual cues like body language which could have led to a richer interpretation of user inputs. It is also possible that not all

participants were wholly engaged leading to input bias. The researcher is not an independent observer but an active participant, and importantly, the leader of the research work, which could also carry a certain amount of bias. The research was conducted over nine months to study the early development phase of a project that spans several years so is a temporal event that deals with forward-looking statements on change management (journey) but does not describe the outcomes of the transformation (destination). The current research work involves the project team with a handful of people from the project management team and select line functions limiting the generalizability of responses to the organization. The responses however are considered to the representative of organizational thinking, as representatives from all line functions were consulted during the research work.

4 Results

This chapter is divided into three sections that correspond to the research questions and presents the results of the study. Section 4.1 answers the first research question: *the value of using EPMS for portfolio management,* based on the project management concepts discussed in the theoretical section. The next section 4.2 answers the second research question: *how EPMS should be customized for the case company to deliver value to stakeholders,* by calling upon the theoretical concepts of design thinking and agile methodology. Lastly, section 4.3 answers the third and final research question: *how EPMS should be implemented to effect business transformation with success,* using the theoretical frameworks of change management, challenges, and success factors.

4.1 Business value of transformation project

This section summarizes the thesis work's contribution to answering the research question of the *value of using EPMS for portfolio management at the case company*. A series of meetings were held with internal stakeholders like line function heads and the executive leadership and the vendor in Q2 2021 to identify the business value by mapping out the line function's processes and to determine the benefit of the tool. The vendor provided a demonstration of the tool to enable the planning and execution of the project as shown in Table 6 below:

Table 6: EPMS tool capability

Project Stage	Stage Goal	Tool	Project domain
Plan	Optimize	Business Intelligence	Collaboration / knowledge
		System Integration	
	Align	Budget	Strategy / portfolio vision
		Roadmap	
		Program plan	
		Strategic buckets	
	Balance	**Capacity**	Resource management
		Conflict	
Execute	Ideate / review demands	Skills	
		Time tracking	
		Risks	Project execution
		Gating	
	Build proposals	Agile	
		Costs	
		Issue management	Collaboration / knowledge
		Social networking	

Of these tools, the roadmap, program plan and capacity (bolded in Table 6) were identified to be of immediate requirement to the case company owing to the following reasons. The case company had initiated the development of a blueprint or roadmap in 2020 to support the clear sequencing and scheduling of program activities, define interdependencies, and enable reliable forecasting of activities to enable project progression. Three challenging areas required additional headcount

planning and process improvements: (i) the status of the program appeared to be bottlenecked at a particular development stage, (ii) the increasing number of clinical studies being planned, and (iii) transition to the marketing stage (application for approval to sell medicines).

The participants were then requested to share the challenges associated with project management processes and possible solutions including using EPMS. These are shown in Table 7 below:

Table 7: Challenges, process group, and solution

Challenge	Process	Solution
Documents are scattered all over the place	Document management	Document management system
Project information is not easy or intuitive to find	Document management	Database management
Need to chase up with program managers to know what's happening with the programs	Reporting (consumer-side)	Real-time program status tracking, dashboarding
Creating reports is cumbersome and takes a lot of my time	Reporting (producer-side)	Automated reporting
Current FTE[1] resource forecasting is theoretical…not based on actual demand…	Resource management	Time tracking to model activity-based resource requirements
Can we improve COGS[2]?	Modelling	Tracking actual spending accurately with manufacturing output
How do we know if we are funded to start new projects	Resource management	Forecasting (people and materials)
How do we know our strategy is working?	Strategy	An executive dashboard that is contemporary and consistent and shows program and line function status
Often our governance forum does not get the right proposals from the program team, or it is difficult to follow	Scenario analysis	Tools with enhanced data visualization capabilities to overlay scenarios clearly for decision making
We don't proactively and consistently capture risks and develop mitigation plans	Risk management	Risk tracker that is well maintained with historical and current information
We don't seem to learn from our mistakes and keep repeating it	Knowledge management	Conduct an after-action review and document it in the tool appropriately

[1] Full-time equivalent (FTE) is a unit that indicates the workload of an employed person in a way that makes workloads comparable across contexts. For example, 40 hours/week would be considered as 1 FTE in Europe, while in India 45 hours/week is 1 FTE. Students working half-time are considered 0.5 FTE

[2] Cost of goods sold (COGS) refers to the direct costs of producing the goods sold by a company. This amount includes the cost of the materials and labour directly used to create the good. It excludes indirect expenses, such as distribution costs and sales force costs

In project management terminology, this is the ‘gather requirements’ activity and the challenges and solutions to address them gathered from the team were used to develop the executive summary with business case analysis. These were classified into a problem statement, value contributions of the EPMS tool, and strategic considerations as shown in Figure 16:

Problem Statement

- Current portfolio planning and analysis limited by collection of Excel, Project and PowerPoint documents scattered throughout SharePoint Site collections.
- PAM Portfolio reports (Weekly, Monthly and Quarterly) are labor intensive and hindered by above.
- An Enterprise Portfolio Management capability brings all program platforms into one integrated solution.

Value contributions

- EPMS drives Alvotech value by connecting strategy to programs and their results.
- EPMS brings together budget, forecast, schedule, resources, and actuals in one integrated solution.
- Allows Alvotech to develop and automate Pan-Portfolio and Cross-Line Function dashboards against established program milestones.
- Allows program attributes (Time, FTE and Cost) to be forecasted, actuals documented and variance analysis against single point of truth program plans and approved Gannt activity matrix.
- COGS modeling transformed with progressive program actuals.

Strategic Considerations

- Pan-Portfolio Workflow automation drives strategic program insights much as the 2021 AOP drove enhanced business insights.
- Starting from the Corporate Strategy, the solution facilitates program selection, with improved visibility and communication, and understanding of how to accelerate approved programs.
- Enables end-to-end program prioritization from a single source of truth driving data-driven, scenario-tested business decisions.
- Enables progression from a collection of programs to a future state of Commercial and Pipeline asset mix.
- Enables business case development with EPMS data matrix actuals to understand forward investment opportunities.

Figure 16: Executive Summary - Enterprise Portfolio Planning

The next step is to use the requirements to define the scope, identify stakeholders, and develop the project charter. Based on the interactions with the stakeholders in the workshop, a high-level list of objectives, scope (inclusions and exclusions), and stakeholders were identified. The heads of line function nominated members from their respective lines to represent them in the implementation project.

The objectives were identified as:

- Establish coordination at portfolio level – Organizational Truth
- Understand and Track Portfolio Operations across stakeholder functions
- Adjust to the speed of the business and enable preparation for governance forums and scheduled updates

The activities in-scope and exclusions were identified as:

Table 8: Scope with inclusions and Exclusions (Outcome from group workshop)

Inclusions	Exclusions
○ Program progression activities/Blueprint and Base Case performance ○ Program Milestone KPIs ○ Portfolio financials (direct spend) ○ Time Tracking: FTE/Capacity analysis Actuals and Forecast variance ○ Manufacturing schedule/Batch Metrics (DS/DP) ○ Commercial Considerations ○ Supply Chain updates ○ Regulatory Updates ○ Clinical Updates ○ Quality Updates ○ Supports IPRB governance	○ In-Direct Spend (Line Functions) ○ Alliance Financials ○ Business development and commercial concerns of parent company ○ Patent/Intellectual Property and Competitive Intelligence

The workshop was followed by a meeting with the executive leadership to formally endorse the project to develop the EPMS tool for the case company. The project was endorsed in April 2021 which was followed by discussions with the vendor to kickstart the project. The team is comprised of members as mentioned in Section 3.1.1. and 3.3.

4.2 Development of product for the case company

This section summarizes the thesis work's contribution to answering the research question of *how EPMS should be customized for the case company to deliver value to stakeholders*, by calling upon the theoretical concepts of design thinking and agile methodology. A series of workshops were held in Q3 and Q4 2021 to plan and execute the agile business transformation.

The kick-off meeting was held at the case company headquarters in Reykjavik, Iceland on 19-July-2021 to align expectations, inform project goals, introduce team members, and plan project execution. The roles and responsibilities were established and accepted by the team as shown in Table 9 below:

Table 9: Define roles and responsibilities

Role	What	Who
Sponsor	Provides project resources, guidance, and oversight of progress Accountable for project results	AR and PM
Business Project Manager	Organize global meetings Track the progress of the project (consolidating internal and external tasks) Coordinate SMEs and ensure their availability Coordinate decision making & prioritization when necessary	KA
IT Project Manager	Responsible for IT aspects of implementation project (interfaces, impacts on existing systems, etc) Coordination of Alvotech IT experts on architecture, security, infrastructure	PG
Enterprise Business Lead	Decide on design with an architect by consolidating SME's requirements Document SME's work and all functional decisions Alvotech internal support & assistance activities	KA
Subject Matter Expert (SME)	Consolidates the users' requirements by department/function/type of usage Help with testing and provide early feedback on the system	PM, KA, GH, DN, RR, SO, SN, NA, SC, SS, MT, SB
Training and Change Management	Define training strategy & plan Define communication strategy & plan Train end-users Responsible for all CM & communication actions & follow-up	Vendor representative (CP) and case company team

The team discussed the project communication strategy, as constant, concise, and clear communication is vital to the success of agile transformation projects (Kalenda, Hyna and Rossi, 2018, p. 17). In the project management world, it is a fact that 90% of a project manager's time is spent in communication! The communication plan consisted of a weekly 'Project status update meeting' between the vendor representative (CP) and the enterprise business lead (KA), a fortnightly 'Management synchronization meeting' between the two above members and the executive sponsor (PM), and lastly a monthly 'Steering committee meeting' with the executive sponsors. These were exclusive of the workshops with the team to develop the tool for the case company. The preferred platform for communication was Microsoft Teams and SharePoint for file sharing. Since the business transformation was carried out as a process, the EPMS tool was selected for planning and executing the project including project attributes such as project plan, risk, and progress tracking. The advantage of this approach is that the information is available at any time to the project team members, is good practice for the project team to use the system during implementation, and it was deemed beneficial to communicate to end-users that the project team is already using the system to manage the project implementation.

The success factors for the transformation project were identified based on the discussion in Section 2.3.2 (Dikert, Paasivaara and Lassenius, 2016, p. 100) and are captured below:

- Strong sponsor support
- Project acknowledged as an important project for Alvotech
- The project team is empowered to make decisions
- The project core team contains a few key business representative people (<5)
- People involved in the project are the right ones
- People involved in the project have the required availability to work on the project
- Keep alignment with vendor EPMS standards and best practices
- Project team members validate the system step by step
- Good project communication
- Do change management all along with the project
- Celebrate successes

A standard agenda template for weekly project meetings was discussed and was identified to comprise of progress status summary, current timeline status, sprint progress and requirements for the next demonstration, new and major risks, actions, and reminder of short term (2 weeks) upcoming tasks, and finally question and answers. This was to make the recurrent meetings structured and consistent.

The transformation project was carried out as an agile implementation (Gandomani *et al.*, 2014, p. 185) with the defined requirements and scope shown in the objectives and scopes mentioned previously as the starting point. Based on participant suggestions, it was decided to stay close to the EPMS standard (the out-of-box specifications of the tool) as much as possible and to focus the workshops on topics requiring a decision on configuration options to customize it for the case company. This saves the time that would be required to build new functionalities in the tool which may delay development. The business processes that need to be transformed to EPMS identified in the previous section were classified into phases to make the business transformation realistic and achievable and to ensure resources and time are adequate to deliver the project (Kalenda, Hyna and Rossi, 2018, p. 9). The phases are shown below:

Phase 1: Project management, risks, issues, presentation, and timecard

Phase 2: Manufacturing capacity, budget forecasting, actuals, and variance analysis. All business processes are required to implement and utilize the EPMS platform. Support for annual operating planning (AOP) cycle

Phase 3: Companion modules like business analytics and intelligence, and dashboards. Interfacing EPMS tool with other platforms like SAP (financial management)

This was planned to ensure team members are properly acclimated to the tool to avoid resistance to change and abandonment due to lack of familiarity and training (Kalenda, Hyna and Rossi, 2018, p. 11). The shift of business processes to the EPMS tool in Phase 2 ensures adherence to the new way of working. Owing to the timeframe of the transformation project of around 2 years, the thesis will focus on Phase 1 development only which comprises of project management core module, risks, issues, presentation, and timecard modules. These were divided into 3 sprints as they are called in agile methodology to see the solution early and often, collect feedback, and get more value from the discussions as shown in Figure 17 below:

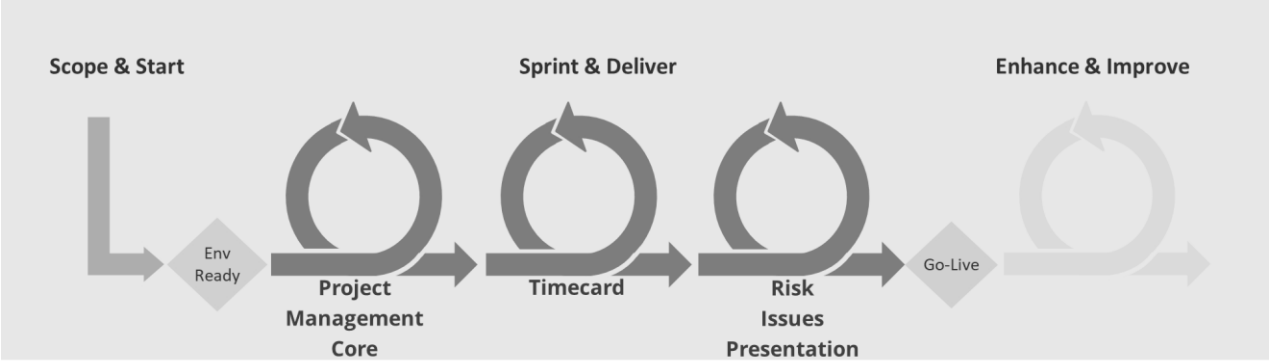


Figure 17: Agile implementation of the project

The three workshops for Phase 1 development topics of PM core, timecard, and risk-issue-presentation were conducted in Q3-2021. The project uses the agile methodology described in Section 2.2 and executed in the case company as shown in Figure 18 below:

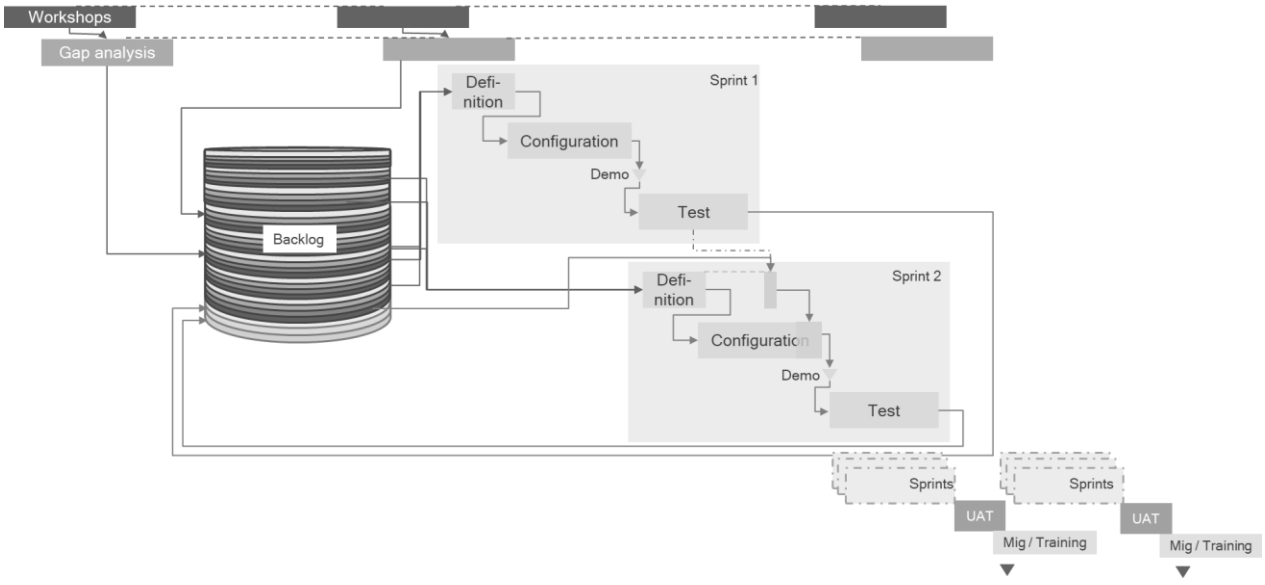


Figure 18: Workshop / Backlog / Sprint / Release cycle

The workshops were conducted to understand current gaps from a user perspective using an adaptation of the design thinking approach discussed in Section 2.2.1. Briefly, during the ‘empathize’ stage, the participants were guided through the workshop framework topics and encouraged to share their experiences and pain points to develop user stories. There were occasional conflicts between the team wherein pain points identified by a participant were a preferred option for another. These conflicts were smoothened out during the workshop during the next ‘define’ stage, to define the requirements. It was beneficial to have representatives from the program management line function which is typically the producer and the functional lines like research and development and manufacturing who are the consumers/internal clients. The expectations from the line functions were captured at this stage. During the ‘Ideate’ phase, the team worked together to generate a range of ideas to manage the expectations using the EPMS tool. The steps mentioned so far are part of the ‘problem definition’ cycle which starts with the identification of problems and culminates in defining the required specification and actions required, which are committed to the ‘backlog’ for solution development. These were deployed in organizing the workshops as shown in Figure 19:

Figure 19: Workshop organization - design thinking approach for identifying problems and solutions

The following stages overlap between design thinking and agile methodology and comprise the ‘prototype’ or ‘configuration’ stage to incorporate the specifications in the tool to develop a prototype which is then formally tested during the ’test’ stage. The final step is ‘implementation’, where the final product is rolled out. These three steps together constitute the ‘solution development’ cycle. The design thinking canvas that employs the double diamond framework (Tschimmel, 2012, p. 9) was utilized during the gap analysis stage to empathize, define, and ideate as part of the ‘problem definition’ cycle.

4.2.1 Project Management workshop

The project management workshop was conducted to understand the problems in the current processes, collectively brainstorm solutions, and adapt them to the EPMS tool for customization.

The processes were divided into six categories of the project concept, project creation, project scheduling, project stage gates, project access rights, and project versions. The discussion was restricted to the above topics which together cover the project management processes. The design thinking approach as mentioned in Section 2.2.1 was followed and the current process, problems, and solution using the EPMS tool were gathered from the design thinking canvas (see Appendix A) and are tabulated below:

Table 10: Project management: Current process, problems, and solution using EPMS (see Appendix A)

Current process	Problems	Solution (EPMS)
Stage 1: Project concept		
Program and functional plans are built by a discussion with a cross-functional team	Lack of consistency across programs, no standardization	Build a blueprint for the program and functional plans based on standard offer
Linking activities to programs	Plans are managed by different people in silos, difficult to find a plan, and with no version control	All activities and plans are maintained in a centralized database (cloud)
Program planning process: information (schedule/costs) sharing between functions and program team	Maintained in different plans with no interlinking, budget maintained in spreadsheets	Centralized database with program activities, associated direct and indirect costs
Identification of critical paths	Manual and distributed across functional and program plan	Possible to centralize program level and function level plans for analysis
Scenario analysis	Not archived consistently, the visual appeal could be improved	Scenario mapping tool available with archival and visualization capabilities
Risk management	Different tools/platforms are used (Workbook, presentations) without consistency across programs	Risk management module available across program and functional plans with aggregated reporting possible
Stage 2: Project creation		
Creation of program and naming convention	Created from scratch and built as the program progresses, naming as per existing convention (AVTXXX)	Blueprint (standard offer) can be used as a template to build a program plan 80% ready
Define the development status the of project	Defined manually where applicable	Program plan status can be set to predefined values and will be reported globally
Roles and responsibilities for project creation	Defined: Program managers and Program heads	Carryover same convention

Key attributes of the project	Not defined	Identified as name, program manager, program head, calendar, start and finish dates, status
Stage 3: Project template and library		
Program plan template	Not used and hence standardization issues	Make template mandatory to conform minimally to the development paradigm
Stage 4: Project stage gates		
The validation process to pass the gate and approver	Program manager records outcomes of governance forum to evaluate passing of gate requirements; process not linked to list of deliverables; no defined program status outcomes	Well defined stage/gate module to define gate, link to deliverables in the plan, and record governance forum outcomes and dates
Rules and responsible persons to process gates and deliverables	The program manager and program head are responsible, but the process is not well defined	
Stage 5: Project access rights		
Management of access rights and restrictions	Access control is not defined and is controlled by Microsoft Teams defaults	Possible to define access rights based on the type of user for functional and program plans
Stage 6: Project baseline and versions		
Baseline creation and rules	Created manually and with no rules and inconsistency between projects	Baselines can be created manually (after the budgeting cycle, replan, etc.) or automatically (monthly, quarterly, etc.)
Version creation and rules	Currently, scenario planning is done in Microsoft Project by recreating a set of tasks within the same program plan; no archival possible	Dedicated scenario planning module with timestamp, archival and overlay features possible

The solution envisioned by the team was added to the product backlog to customize the rules and settings in the EPMS tool. The customized tool was then rolled into a test environment and introduced to the team in a demonstration session. The team were given a month to practice with the system and identify errors (commonly called in programming parlance as ‘bugs’) or concerns for rectification. This was followed by a meeting to resolve issues following which the identified concerns were addressed and the updates rolled out. This concluded the first sprint to customize the project management module of the EPMS tool and was followed by the timecard module. An important problem identified during this stage was that the team had not practised in the system due to change resistance and lack of time due to work overload. The teams were not properly incentivized to ensure compliance and test the tool completely. Another important learning for the author was that the development of a test script or checklist would have made it easy for the team to know what to look for specifically. While the team were told to practice in the system, a few colleagues built dummy plans to test the system but did not ensure the tool had parameters customized for the case company. A few others had not tested at all and came unprepared for the issue resolution meetings. Dropout and team member replacement were also observed in 2 and 1 case

respectively due to members citing non-availability of time. Lack of management support at this stage was identified as the reason for this churn and was noted as a problem to be corrected in the implementation stage.

4.2.2 Timecard workshop

EPMS tool provides an integrated platform to track personnel time and utilization across line functions and programs and enable effective resource management by modelling resource requirements across the portfolio. The time management workshop was conducted to understand the current time tracking tools used by the organization, compare between tools and their advantages or disadvantages and the nuances concerning the transition to the EPMS time tracking tool.

The processes were divided into six categories of overall time tracking, resource breakdown structure (RBS), users and profile, timecard input and validation, and timecard integration. The discussion was restricted to the above topics which together cover the timecard module. The design thinking approach as mentioned in Section 2.2.1 was followed and the current process, problems, and solution using the EPMS tool were gathered from the design thinking canvas (see Appendix B) and are tabulated below:

Table 11: Time tracking: Process, problems, and solution (See Appendix B)

Process	Problems	Solution
Overall time tracking	The complexity of the time tracking process	The process should be simple (not more than 5 mins per week) for employees
	Doesn't time tracking signal a lack of trust by management	Time tracking is to understand the time spent on various phases/activities of programs, training activities, and development projects and is not meant to monitor employees
	Managing messaging around time tracking introduction	Make objectives clear and process simple
	Multiple time tracking tools	Evaluate replacing other time tracking tools based on functionalities available in EPMS (not in scope for phase 1 implementation)
Resource Breakdown Structure (RBS)	Availability of RBS	Organization structure available with HR with 4 levels of depth
	Calendars to be managed according to line function, shift, geography	These are irrelevant if % of time spent on activities is captured. Transformation of % time can be converted to hours at the backend
Users and profile	Who is responsible for time tracking?	Employees track time through their user login/account. No delegation of work.
	Frequency and granularity of tracking	Track time weekly at high-level activity level in % Examples of categories are Program facing time and program, holidays, training, development projects, etc.
	What calendar will be used for tracking?	The calendar is irrelevant to the information captured

	Threshold of input	The nearest 5% approximation is sufficient
	Tracking in % or decimals	Time spent in % per week to be captured
Timecard input and validation	How do you remind users to fill TC?	Reminders should be weekly based on status (filled or not filled) in an automated manner
	Who owns TC compliance?	TC compliance will be owned by the line function based on TC timecard status every month
Timecard integration	Should actuals be visible at the program level?	Not required for Phase 1 implementation (data will be collected, not used)
	Do actuals impact the initial forecast?	Human effort tracking is not in scope for phase 1 implementation but at maturity, actuals from the past program will inform future program estimates
	How should TC input be integrated into the database?	This should be done in an automated manner with pre-defined parameters (make assumptions initially and iterate as desired)

The solution envisioned by the team was added to the product backlog to customize the rules and settings in the EPMS tool. The customized tool was then rolled into a test environment and introduced to the team in a demonstration session. The team were given a month to practice with the system to verify if it is performing as intended, identify concerns, and make changes as appropriate.

The objective of the time tracking module in EPMS was identified as understanding the effort (human hours) required to execute activities, milestones, and programs. This would enable the organization to model human resource requirements per line function, per program, throughout the program and together with multiple programs, for the entire portfolio. This will in turn help make the right hiring decisions according to skillset (for example, recruiting scientists if R&D is understaffed). Secondary objectives include understanding program facing vs non-program facing time (e.g., training, business excellence projects) for a rebalancing of organizational priorities.

The biggest problem was the sensitivity around introducing a time tracking system which may trigger resentment among employees about trust. It was identified that the messaging to employees needs to be handled suavely to manage change effectively and in a positive manner. The suggested way was to be transparent in communicating the objective behind the exercise which is to capture the effort required to execute programs. Secondly, it is helpful to point out the benefits behind the implementation which is to identify and manage resourcing needs appropriately to ensure fair and equitable distribution of work and prevent burnout. The second biggest problem was that there are two other time tracking tools in use though in different line functions. For example, the manufacturing line function utilizes a time tracking tool for overtime tracking and payment. Thus, the introduction of yet another tool will require appropriate justification. It may be beneficial to make the time tracking process simple and identify opportunities to eliminate redundancy by consolidating time tracking to one tool, i.e., EPMS, after proper feasibility studies.

The following success factors were identified for an effective time tracking system:

- Keep it short and simple
    - Users log in, add a missing activity, enter time, and then send the timesheet
        - Searching for activity: good naming conventions to ensure user finds the right activity
    - The more options, the more training
    - The more details, the more time consuming
- Change management
    - No one likes to report time
    - Find the good carrot and scary stick that works for the organization
    - Keep the end goal in mind throughout design & communications
- Know your local rules
    - Some countries have specific regulations that may call for different system profiles

4.2.3 Risks, Issues, and Presentation workshop

After customizing the core project management module and the timecard, the final topic for phase 1 EPMS implementation was the risks, actions, and presentation module. These are part of the project management module but were handled independently of the core PM module of program timeline planning to have the base layer built-in before building successive components. Future development phases will include modules such as budget, dashboards, business analysis, etc. Risk management (RM) is an important part of project management (PM) as outlined in Section 2.1.2 and serves to manage risks, opportunities, and assumptions collectively called an RAO tracker. Risks are identified as a group exercise in cross-functional team meetings followed by their ranking in terms of the probability of occurrence and severity of impact. A suitable mitigation plan is then developed that involves either accepting the risk with reduced impact, avoiding the risk, or transferring (e.g., insurance) as appropriate. Action lists are actionable outcomes from meetings assigned to team members that need to be closed out within a defined timeframe. Presentation is the visualization of the project schedule in an easy to read/understand/interpret manner and consistently across programs. The risk-issues-presentation workshop was conducted to understand the current process, problems faced, and the transition of these processes to EPMS.

The design thinking approach as mentioned in Section 2.2.1 was followed and the current process, problems, and solution using the EPMS tool were gathered from the design thinking canvas (see Appendix C) and are tabulated below:

Table 12: Risks, Issues, and Presentation: Current process, problems, and solution (See Appendix C)

Process	Problems	Solution
Risk management	Risk tracking is all over the place: weekly/monthly trackers, RAO tracker, eWorkbook, line function documents	EPMS integrates risk management in one place
	Impossible to view all risks: portfolio and line function, consolidated in one place	EPMS provides complete visibility with automated reminder capability and enables actionable insights/strategic decision making e.g., pause programs
	Risk capture and mitigation template and workflow not standardized across programs and functions	Standardized templates are available OOB (out-of-box) from EPMS and can be further customized to the case company
	Who creates and owns risks and mitigation plans?	Rules could be defined for creating and owning risks. Minimally, Program Managers, Program Heads, Sub team Leads, and Functional Managers should be able to create risks. Ownership and responsibility to develop mitigation can be assigned to team members
	What are the categories of risks and the risk matrix?	The categories as per current standard in case company shall be negative (risk), positive (opportunity) risks, and assumptions
	What risk attributes should be captured to add value to the process?	Risk attributes captured should include Description, Program, Activity, Deadline, Category, Owner, Line function, Status, Impact, Probability, Resolution (free text) and Comments (free text)
Action (Issue) management	Action items are currently captured in different places e.g., meeting minutes email, eWorkbook, OneNote, etc.	EPMS integrates action/issue management in one place
	Action follow up and compliance is not standardized across the portfolio with no follow-up in some cases	EPMS provides complete visibility with automated reminder capability and enables complete accountability and follow-up
	Lack of visibility and accountability in who owns what and by when	
	What should action management workflow look like?	PM, STL, FM capture action items from meetings and assign actions to owners and use EPMS to follow up
	What action management attributes should be captured to add value to the process?	Actions attributes: Description, Program, Meeting name, Meeting date, Activity, Deadline, Category, Owner, Line function, Status, and Comments (free text)
Presentation	Presentations are typically generated from Microsoft Project for Alliance partner reports, Swimlane view for a monthly report to internal stakeholders, and Microsoft Visio or Microsoft PowerPoint for weekly trackers: these could be consolidated	Standardize view for the portfolio and preserve format across the board using EPMS

	The current operation is labour intensive	Develop report specific templates and use one-touch report generation

The solution envisioned by the team was added to the product backlog to customize the rules and settings in the EPMS tool as done in the project management and time tracking workshops. The customized tool was then rolled into a test environment and introduced to the team in a demonstration session. The team were given a month to practice with the system to verify if it is performing as intended, identify concerns, and make changes as appropriate.

Together the three workshops were instrumental in customizing the EPMS system to the case company's requirements. The workshops were followed by a testing phase for the project team to test the system in a development sandbox environment. Meanwhile, the vendor representative programmed the tool to specifications and resolved the issues identified by the team. These activities were completed by Q4 2021 and were followed by the next stage: Go-live in Q1 2022.

4.3 Implementation of product at the case company

This section summarizes the thesis work's contribution to answering the research question of how EPMS should be implemented to effect business transformation with success, by using the theoretical frameworks of agile transformation, challenges, success factors, and change management.

Organizational change is part of its strategy as no strategy can be implemented without introducing some form of change. There are three kinds of people in organizations who can enable or block an initiative: endorsers, or those positive about the change; resisters, who take an opposing view; and fence-sitters, who see both potential benefits and drawbacks (Battilana and Casciaro, 2013, p. 819). Typical reasons for the failure of change projects are the resistance from stakeholders (resistors) and failure in engaging people (fence-sitters) to the change. The common reasons why most people resist change (Dikert, Paasivaara and Lassenius, 2016, pp. 92–94) are:

1. Fear of losing something of value like power or autonomy
2. Lack of an understanding of the necessity to change
3. Resistance due to misinformation that change does not solve the problem
4. Fear of reskilling and acquiring behaviour to cope with the change

Thus, it is important to be proactive and understand the reason for change resistance and prepare for it from a stakeholder perspective rather than being reactive and blaming the resistance. A series of meetings and workshops were held in Q1 2022 for implementation and pilot rollout planning. The rollout at this stage will involve the deliverables from phase 1 development which includes project management including risk and action management with presentation features and timecard modules. As mentioned previously, phase 2 development will involve budget estimation, actuals, variance analysis and dashboarding features which will be developed in 2022 after phase 1.

Implementation was planned by using an adapted version of Kotter's eight-step model for transforming the organization into the case company as shown in Table 13 below:

Table 13: EPMS implementation change management using Kotter model (Kotter, 1995, p. 61)

Kotter Stage	Case Company Context	Actions
Establish a sense of urgency	• The company operates in the fast-paced pharma generics industry where time is of essence • Rapid growth from start-up mode with public listing (IPO) ongoing • People and processes have swelled creating silos and communication gap	• Communicate the context and the consequent need to change and the perils of not doing so

	• Access to a single source of truth on-demand is vital for strategic decision making	
Form a powerful guiding coalition	• Organizational structure is mildly hierarchical • Leadership strongly influences line function decision making • Program management team is a cohesive unit with team players	• Demonstrate capabilities of EPMS to management and obtain 'buy-in' • Ensure management is vested with successful implementation in their best interest
Create a vision	Clear organizational vision and mission statements drive strategy and action plans	• Develop EPMS implementation project charter with clear vision and mission statements, objectives, and timelines • Align EPMS project charter to overall organizational strategy and goals
Communicate the vision	Alvocado, the internal company portal and email newsletters are established communication platforms	• Plan communication of project vision, mission, strategy, objectives, and status to colleagues in a transparent manner • Marketing campaign should be 'shock and awe' to ensure 100% attention and interest • Plan demonstration session with management and line function leads to show capabilities and applications
Empower others to act on the vision	Start-up origin of case company means more colleagues are change-agile and work as a team	• Evaluate project team and colleagues for 'mindset' and classify into resisters, endorsers, and fence-sitters • Pay special attention to resisters and fence-sitters by open communication and understanding pain points – do not assume a lack of dissent for alignment! • Ensure committed team members are available from other line functions • Strive to remove obstacles faced by the team promptly • Make it acceptable to make mistakes during the learning phase and ensure proper training and coaching are available • Find the right 'carrot' and 'stick' to incentivize adoption
Plan for and create short term wins	Established rewards and recognition opportunities and other incentive processes/platforms are not available or to be identified	• Establish short-, medium-, and long-term success criteria to celebrate and reward colleagues • Identify ways (metrics or KPIs) to measure the success of change

		• Grandly recognize wins and winners to make embracing change aspirational
Consolidate improvements and produce more change	Established processes are often lacking making it relatively easy to drive adoption	• After gaining traction, set cut-off and eliminate legacy processes not aligned to project vision to avoid reversion • Establish new processes as a status-quo and initiate a workstream using them • Recruit change agents to the cause from within line function and gather followers
Institutionalize new approaches	As a growing company, employee turnover and new hiring enables institutionalizing recruits	• Use communication platforms to claim credit for new processes and behaviour driving company success • Ensure succession plan is in place throughout project implementation and transition phase to avoid a 'leadership vacuum' • Ensure new management leaders are onboarded and appraised of the project to ensure continued support

During the development stage, the project team was largely motivated and engaged, but the project team size would increase during the implementation stage. Therefore, significant effort must be made to get colleagues engaged with a frequent reminder of the mission and objectives. As mentioned earlier, resistance is due to perceived uncertainty and resisters could be won over by involving them as perpetrators of the change process instead of the recipient.

Communication ('marketing') plays an important role during the change transition process and needs to be managed carefully and purposefully. This can be accomplished using tools such as Alvocado (company intranet), email newsletters, town halls, and info sessions. Initial communication involved a demonstration of EPMS to key management team members between February to April-2022. An organizational broadcast is planned in May-2022 through an email newsletter and intranet burst introducing the project vision, mission, goals, timeline, and people. This will be followed by town hall by the CEO and info sessions with interested colleagues to expand adoption and access. A monthly email newsletter communication is planned to include user stories with the system and share positive feedback and criticism. A steering committee comprising of project team lead, sponsor, and executive management team would be formed to review project progress every quarter.

Training is another area of importance as the tool requires some learning curve and technological acuity. A series of quarterly training sessions are planned with the vendor to train new members appropriately and adequately. Though expensive, this has the advantages of ensuring having the

right trainers and frees up valuable colleague time to focus on advanced topics like adapting the tool for specific line function requirements. The trained colleagues will now act as ‘user champions’ to train respective line function users.

It is important to celebrate successes and therefore small wins will be created during the implementation to keep the team motivated. The following wins are envisioned for the project:

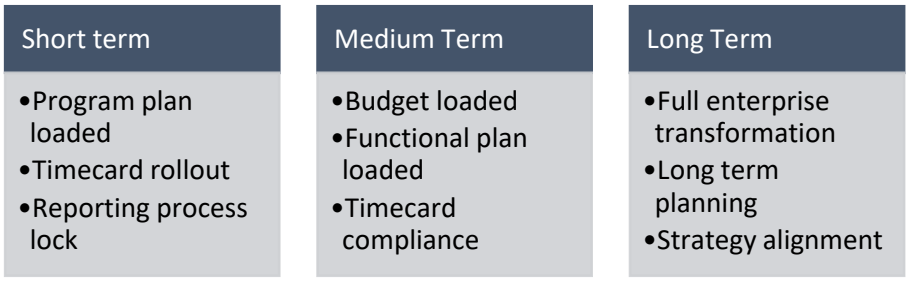


Figure 20: Short-, medium-, and long-term wins for EPMS implementation project

The identification and celebration of these wins have the following advantages:

1. Validates project vision and strategy
2. Provides motivation
3. Boosts morale and increases adherence/adherents
4. Weakens resistance and resisters

In aggregate, this section presents the outcomes of discussions with management and the project team in Q1 2022 to plan the implementation of EPMS in the organization. The implementation will begin with a small-scale pilot within the R&D organization as the head of the department has shown a keen interest in the tool and serves as its strongest management champion.

5 Discussion

This chapter includes the discussion of the results and their comparison with the theoretical framework, limitations of the research, and suggestions to continue the work in the future for research and practice. The chapter is accordingly divided into four sub-chapters where the first section discusses the summary of results for which this journey was undertaken. The second section discusses the theoretical, empirical, and managerial contributions. The third section talks about the future continuation of this work, and the fourth and final section presents the conclusion.

5.1 Summary of results

This section summarizes the thesis work's contribution to answering the research questions of *the value of using EPMS for portfolio management*, *how EPMS should be customized for the case company to deliver value to stakeholders*, and *how EPMS should be implemented to effect business transformation with success*.

The first research question addresses the 'why?' part of the research with an analysis of the current project management processes in the case company and the problems or challenges. This was followed by brainstorming solutions to address these problems, using EPMS tools. The comments gleaned from this stage were used to gather requirements which were then used to develop the business case to be presented to the management to get buy-in. The objectives of the project were delineated along with the inclusions and exclusions. Overall, the conclusion was that the tool provides a single source of truth and a command-and-control centre to manage the portfolio strategically compared to the current fragmentation of information. The outcome of this stage was a strong 'Go' from the management team to proceed with the project. Vendors were approached to get quotes and evaluated, followed by the selection of a vendor who is an industry-standard portfolio management ICT solution for the case company.

The second research question addresses the 'what?' part of the research on what are the items that need to be customized. This stage involved the formation of a cross-functional development team to work closely with the vendor representative to develop the platform for the case company. The work involved the constitution of the team, the definition of roles and responsibilities, and developing the schedule for successful implementation. It was decided to execute the project in phases to provide sufficient time for the testing, assessment, and uptake of the new system. The first phase of development would involve building out the project management, risk and action management, presentation, and timecard modules. The development project followed the agile methodology with sprint workshops with the vendor and development team to understand the case company process and customization of the platform to suit its needs using a plan-build-test-fix cycle. At the end of this stage, the platform was customized to meet the needs of the case company.

The third research question addresses the ‘how?’ part of the research on how the developed product should be implemented in the case company. The developed product was demonstrated to the CEO and other management executives which were well received and appreciated with a strong recommendation to advance to rollout. A high-level change management plan was developed using the Kotter model (Kotter, 1995, p. 4) to ensure successful business transformation.

5.2 Theoretical, empirical, and managerial contributions

This section deals with the contribution of this thesis work to the body of literature in section 2. Section 2.1 talks about the theoretical background of the project, program, and portfolio management. The thesis work contributes to how the program management business unit in an organization should structure their PM processes and workstreams to ensure conformity with the theoretical aspects (Gemünden, Lehner and Kock, 2018, p. 151) but remove the challenges around practical aspects or operationalization of the theory. A case in point is risk and action management where several challenges were noted in identifying, documenting, and more importantly acting on these to drive corporate strategy. Section 2.2 delves into design thinking and agile methodology. The results from the thesis take a clear position that though the theoretical frameworks of design thinking and agile methodology come from different domains (industrial design and software development respectively), they share many similarities and are compatible and complementary to each other. While design thinking is useful to explore the problem, agile methodology is useful to build the right thing (Schneider, 2017, p. 17) as shown in Figure 21:

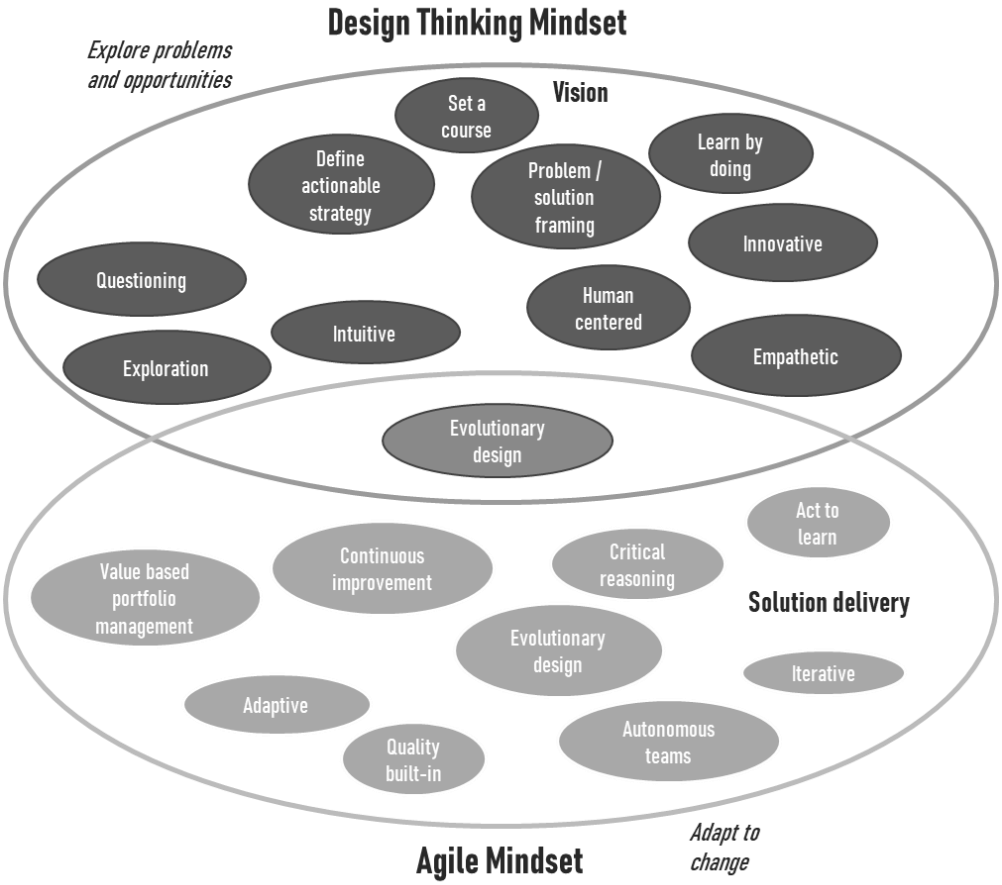


Figure 21: Integration of design thinking and agile methodology

The double diamond framework of design thinking (Tschimmel, 2012, p. 9) and the associated tool design thinking canvas were utilized to drive the discussion to explore the problems and the solution. The agile methodology was used to execute the project with the key takeaway to work in short cycles, perform incremental innovation, and evaluate user feedback with each iteration. If it works, the process is repeated until the product is ready. Holding regular retrospectives to review what went well and seeking to improve marginally that which didn't go well by adding these to an improvement list (backlog) was helpful to ensure the tool was built right. By including the line function representatives in the project team, the customer was at the centre of everything, actively involved and providing feedback, helping the team align quickly and unambiguously to build a product fit for purpose. The conversation with the team helped me understand challenges to remedy and best practices to amplify. The thesis work also contributes to the theoretical aspects of leading business transformation in terms of the challenges faced (Dikert, Paasivaara and Lassenius, 2016, p. 95) which were as described in theory.

The thesis contributes to the body of work around the development and implementation of a business transformation system in a company transitioning from the start-up stage to maturity, the challenges that can be expected in that setting, and ways to manage them. The key takeaway from a

managerial perspective was to ensure management ‘buy-in’ and strong support, rallying people to the cause, and delivering the tool in thoughtfully designed increments to ensure maximal uptake.

5.3 Future research and practice

The business transformation project and change management would occur over many months and would impact hundreds of colleagues. Thus, there lies an opportunity in the future to study the impact of the transformation, especially the change management aspects in detail.

5.4 Conclusions

The thesis work studies the planning and development aspects of a large-scale organizational transformation project to implement an enterprise portfolio management system in a growth stage biopharmaceutical company. The deliverable from the research work is the product, the current iteration of which was demonstrated to the CEO and line function managers and was well received. The research unequivocally proves that selecting the right theoretical concepts such as design thinking and agile methodology could be very useful in undertaking a product development effort and ensures success by eliminating actions that can cause failure. The project met its objectives although challenges were encountered in co-ordinating globally dispersed team members, from different line functions used to the traditional way of working (Kalenda, Hyna and Rossi, 2018, pp. 8–9) in an environment where the workload was simply too high to let team members devote time to the project (Dikert, Paasivaara and Lassenius, 2016, p. 95). These were managed through shared values and vision to change the status-quo, provision of tools and training through external experts, team support, and strong management support for the project (Kalenda, Hyna and Rossi, 2018, pp. 10–11). A significant learning opportunity from the challenges faced during the project was to take action to keep the team motivated and incentivized to stay the course. The learnings from the project will be applied in future product development during Phases 2 and 3.

References

Abrantes, R. and Figueiredo, J. (2015) 'Resource management process framework for dynamic NPD portfolios', *International Journal of Project Management*, 33(6), pp. 1274–1288. doi:10.1016/j.ijproman.2015.03.012.

Ahmadi-Javid, A., Fateminia, S.H. and Gemünden, H.G. (2020) 'A Method for Risk Response Planning in Project Portfolio Management', *Project Management Journal*, 51(1), pp. 77–95. doi:10.1177/8756972819866577.

Alvotech - Setting a new standard in biosimilars (2021). Available at: https://www.alvotech.com/ (Accessed: 1 November 2021).

Archer, N. and Ghasemzadeh, F. (2007) 'Project Portfolio Selection and Management', in Morris, P.W.G. and Pinto, J.K. (eds) *The Wiley Guide to Managing Projects*. Hoboken, NJ, USA: John Wiley & Sons, Inc., pp. 237–255. doi:10.1002/9780470172391.ch11.

Basics and Benefits of Agile Method | Planview LeanKit (2021) *Planview*. Available at: https://www.planview.com/resources/guide/agile-methodologies-a-beginners-guide/basics-benefits-agile-method/ (Accessed: 31 October 2021).

Baskerville, R.L. (1999) 'Investigating Information Systems with Action Research', *Communications of the Association for Information Systems*, 2. doi:10.17705/1CAIS.00219.

Baskerville, R.L. and Wood-Harper, A.T. (1996) 'A critical perspective on action research as a method for information systems research', *Journal of Information Technology*, 11(3), pp. 235–246. doi:10.1080/026839696345289.

Battilana, J. and Casciaro, T. (2013) 'Overcoming Resistance to Organizational Change: Strong Ties and Affective Cooptation', *Management Science*, 59(4), pp. 819–836. doi:10.1287/mnsc.1120.1583.

Beck, K. *et al.* (2001) 'Manifesto for agile software development'.

Beringer, C., Jonas, D. and Kock, A. (2013) 'Behavior of internal stakeholders in project portfolio management and its impact on success', *International Journal of Project Management*, 31(6), pp. 830–846. doi:10.1016/j.ijproman.2012.11.006.

Bode-Greuel, K.M. and Nickisch, K.J. (2008) 'Value-driven project and portfolio management in the pharmaceutical industry: Drug discovery versus drug development – Commonalities and differences in portfolio management practice', *Journal of Commercial Biotechnology*, 14(4), pp. 307–325. doi:10.1057/jcb.2008.6.

Boehm, B. and Turner, R. (2005) 'Management Challenges to Implementing Agile Processes in Traditional Development Organizations', *IEEE Software*, 22(5), pp. 30–39. doi:10.1109/MS.2005.129.

Brown, T. and Katz, B. (2009) *Change by design: how design thinking transforms organizations and inspires innovation*. 1st ed. New York: Harper Business.

Clegg, S. *et al.* (2018) 'Practices, projects and portfolios: Current research trends and new directions', *International Journal of Project Management*, 36(5), pp. 762–772. doi:10.1016/J.IJPROMAN.2018.03.008.

Conboy, K. and Carroll, N. (2019) 'Implementing Large-Scale Agile Frameworks: Challenges and Recommendations', *IEEE Software*, 36(2), pp. 44–50. doi:10.1109/MS.2018.2884865.

Cooper, R., Edgett, S. and Kleinschmidt, E. (2001) 'Portfolio management for new product development: results of an industry practices study', *R&D Management*, 31(4), pp. 361–380. doi:10.1111/1467-9310.00225.

Costantino, F., Di Gravio, G. and Nonino, F. (2015) 'Project selection in project portfolio management: An artificial neural network model based on critical success factors', *International Journal of Project Management*, 33(8), pp. 1744–1754. doi:10.1016/j.ijproman.2015.07.003.

Cummings, T.G. and Worley, C.G. (2009) *Organization development & change*. 9th ed. Australia ; Mason, OH: South-Western/Cengage Learning.

Dikert, K., Paasivaara, M. and Lassenius, C. (2016) 'Challenges and success factors for large-scale agile transformations: A systematic literature review', *Journal of Systems and Software*, 119, pp. 87–108. doi:10.1016/j.jss.2016.06.013.

Duffield, S.M. and Whitty, S.J. (2016) 'Application of the Systemic Lessons Learned Knowledge model for Organisational Learning through Projects', *International Journal of Project Management*, 34(7), pp. 1280–1293. doi:10.1016/j.ijproman.2016.07.001.

Faisal Abrar, M. *et al.* (2020) 'De-motivators for the adoption of agile methodologies for large-scale software development teams: An SLR from management perspective', *Journal of Software: Evolution and Process*, 32(12). doi:10.1002/smr.2268.

Farid, S.S. *et al.* (2020) 'Benchmarking biopharmaceutical process development and manufacturing cost contributions to R&D', *mAbs*, 12(1), p. 1754999. doi:10.1080/19420862.2020.1754999.

Gandomani, T.J. *et al.* (2014) 'An Exploratory Study on Managing Agile Transition and Adoption', in Boonkrong, S., Unger, H., and Meesad, P. (eds) *Recent Advances in Information and Communication Technology*. Cham: Springer International Publishing (Advances in Intelligent Systems and Computing), pp. 177–188. doi:10.1007/978-3-319-06538-0_18.

Gemünden, H.G., Lehner, P. and Kock, A. (2018) 'The project-oriented organization and its contribution to innovation', *International Journal of Project Management*, 36(1), pp. 147–160. doi:10.1016/J.IJPROMAN.2017.07.009.

Hajjdiab, H. and Al Shaima Taleb (2011) 'Adopting Agile Software Development: Issues and Challenges', *International Journal of Managing Value and Supply Chains*, 2(3), pp. 1–10. doi:10.5121/ijmvsc.2011.2301.

Hussain, S.T. *et al.* (2018) 'Kurt Lewin's change model: A critical review of the role of leadership and employee involvement in organizational change', *Journal of Innovation & Knowledge*, 3(3), pp. 123–127. doi:10.1016/j.jik.2016.07.002.

Jarzabkowski, P. and Seidl, D. (2008) 'The Role of Meetings in the Social Practice of Strategy', *Organization Studies*, 29(11), pp. 1391–1426. doi:10.1177/0170840608096388.

Johnson, L.K. (2004) 'Execute your strategy without killing it', *Harvard Management Update*, 9(12), p. 3.

Jonas, D., Kock, A. and Gemünden, H.G. (2013) 'Predicting Project Portfolio Success by Measuring Management Quality—A Longitudinal Study', *IEEE Transactions on Engineering Management*, 60(2), pp. 215–226. doi:10.1109/TEM.2012.2200041.

Kalenda, M., Hyna, P. and Rossi, B. (2018) 'Scaling agile in large organizations: Practices, challenges, and success factors', *Journal of Software: Evolution and Process*, 30(10), p. e1954. doi:10.1002/smr.1954.

Killen, C.P., Geraldi, J. and Kock, A. (2020) 'The role of decision makers' use of visualizations in project portfolio decision making', *International Journal of Project Management*, 38(5), pp. 267–277. doi:10.1016/j.ijproman.2020.04.002.

Kock, A. *et al.* (2020) 'Project portfolio management information systems' positive influence on performance – the importance of process maturity', *International Journal of Project Management*, 38(4), pp. 229–241. doi:10.1016/j.ijproman.2020.05.001.

Kotter, J.P. (1995) 'Leading change, Why transformation efforts fail', *Harvard Business Review*, 73, pp. 59–67.

Lewin, K. (1951) *Field theory in social science: selected theoretical papers (Edited by Dorwin Cartwright.).* Oxford, England: Harpers (Field theory in social science: selected theoretical papers (Edited by Dorwin Cartwright.).), pp. xx, 346.

Mahanti, A. (2006) 'Challenges in Enterprise Adoption of Agile Methods - A Survey', *Journal of Computing and Information Technology*, 14(3), p. 197. doi:10.2498/cit.2006.03.03.

Mankins, M.C. and Steele, R. (2005) 'Turning great strategy into great performance', *Harvard business review*, 2607, p. 4.

Martin, R.L. (2009) *The design of business: why design thinking is the next competitive advantage*. Boston, Mass: Harvard Business Press.

Martinsuo, M. and Lehtonen, P. (2007) 'Role of single-project management in achieving portfolio management efficiency', *International Journal of Project Management*, 25(1). doi:10.1016/j.ijproman.2006.04.002.

Meinel, C. and Leifer, L.J. (2011) *Design thinking: understand - improve - apply*. Berlin London: Springer (Understanding Innovation).

Melchiors, P. *et al.* (2018) 'Dynamic order acceptance and capacity planning in a stochastic multi-project environment with a bottleneck resource', *International Journal of Production Research*, 56(1–2), pp. 459–475. doi:10.1080/00207543.2018.1431417.

Mellstedt, H., Niederwieser, D. and Ludwig, H. (2008) 'The challenge of biosimilars', *Annals of Oncology*, 19(3), pp. 411–419. doi:10.1093/annonc/mdm345.

Oates, B.J. (2006) *Researching information systems and computing*. London ; Thousand Oaks, Calif: SAGE Publications.

Ørngreen, R. and Levinsen, K. (2017) 'Workshops as a research methodology', *Electronic Journal of e-Learning*, 15, pp. 70–81.

Piney, C. (2007) 'Integrated portfolio and program management: discovering organizational project management', in. *PMI® Global Congress 2007 - EMEA*, Budapest, Hungary. Newtown Square, PA: Project Management Institute. Available at: https://www.pmi.org/learning/library/integrated-portfolio-program-management-7409.

PMI PMBOK® (2017) *A guide to the project management body of knowledge (PMBOK® guide)*. 6th edn. Philadelphia: Project Management Institute.

Poppendieck, M. and Cusumano, M.A. (2012) ‘Lean software development: A tutorial’, *IEEE software*, 29(5), pp. 26–32.

Porter, M.E. (1996) ‘Competitive Advantage, Agglomeration Economies, and Regional Policy’, *International Regional Science Review*, 19(1–2), pp. 85–90. doi:10.1177/016001769601900208.

Saunders, M.N.K., Lewis, P. and Thornhill, A. (2019) *Research methods for business students*. Eighth Edition. New York: Pearson.

Schneider, J. (2017) *Understanding design thinking, lean, and agile*. 1st edn. O’Reilly Media, Inc.

Shenhar, A.J. *et al.* (2001) ‘Project Success: A Multidimensional Strategic Concept’, *Long Range Planning*, 34(6), p. 5. doi:10.1016/S0024-6301(01)00097-8.

Silverman, D. (2010) *Doing qualitative research: a practical handbook*. 3rd ed. London ; Thousand Oaks, Calif: SAGE.

Stuckenbruck, L.C. (1979) ‘The Matrix Organization’, *Project Management Quarterly*, 10(3), pp. 21–33. Available at: https://www.pmi.org/learning/library/matrix-organization-structure-reason-evolution-1837.

Teller, J., Kock, A. and Gemünden, H.G. (2014) ‘Risk Management in Project Portfolios is More than Managing Project Risks: A Contingency Perspective on Risk Management’, *Project Management Journal*, 45(4), pp. 67–80. doi:10.1002/pmj.21431.

Tschimmel, K. (2012) ‘Design Thinking as an effective Toolkit for Innovation’, in *ISPIM Conference Proceedings*. The International Society for Professional Innovation Management (ISPIM).

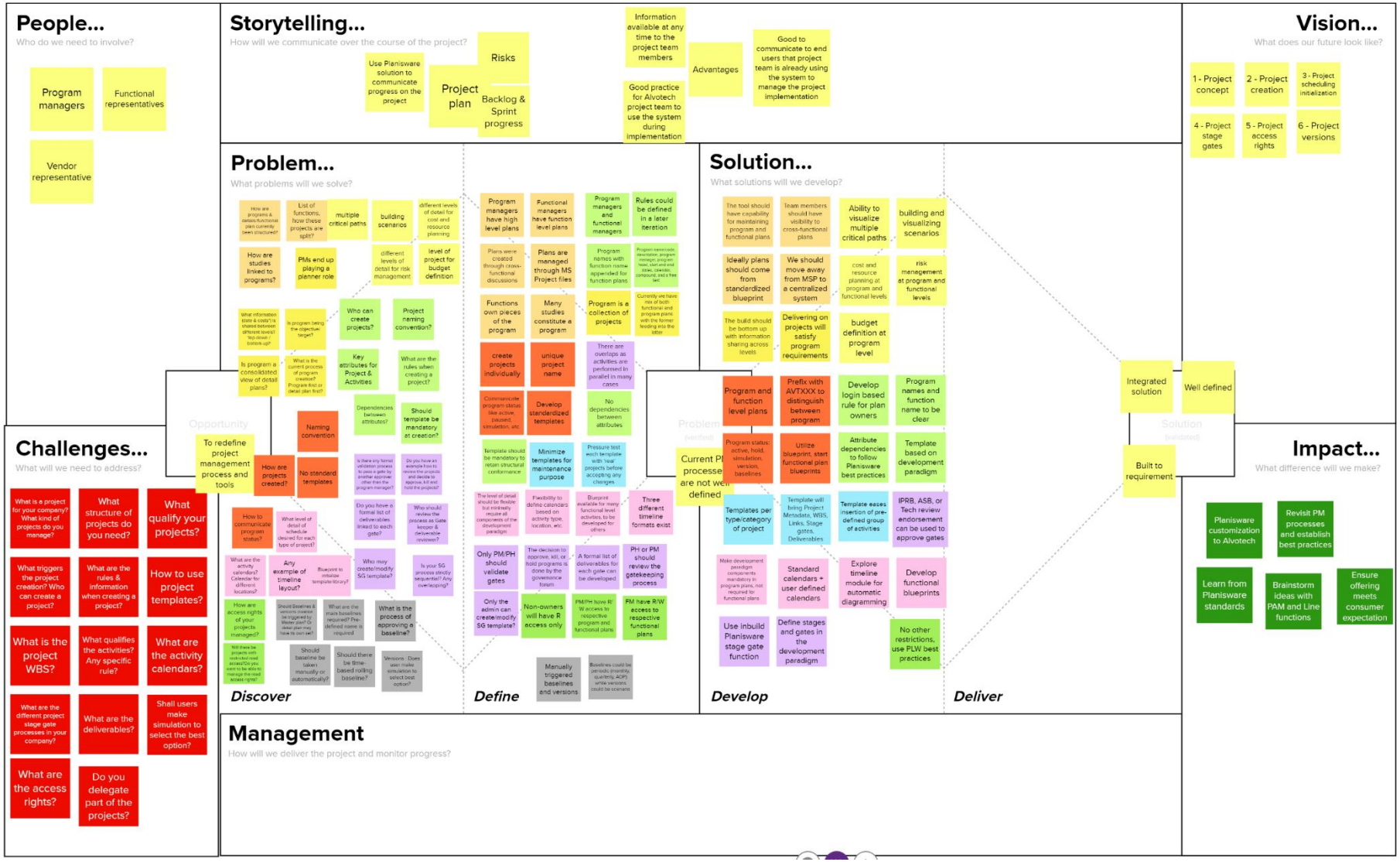
APPENDIX A. PROJECT MANAGEMENT WORKSHOP - DESIGN THINKING CANVAS

Design Thinking Canvas

For: Workshop: Project Management

Created: 21-July-2021

Develop an innovative design-led strategy with a structured vision

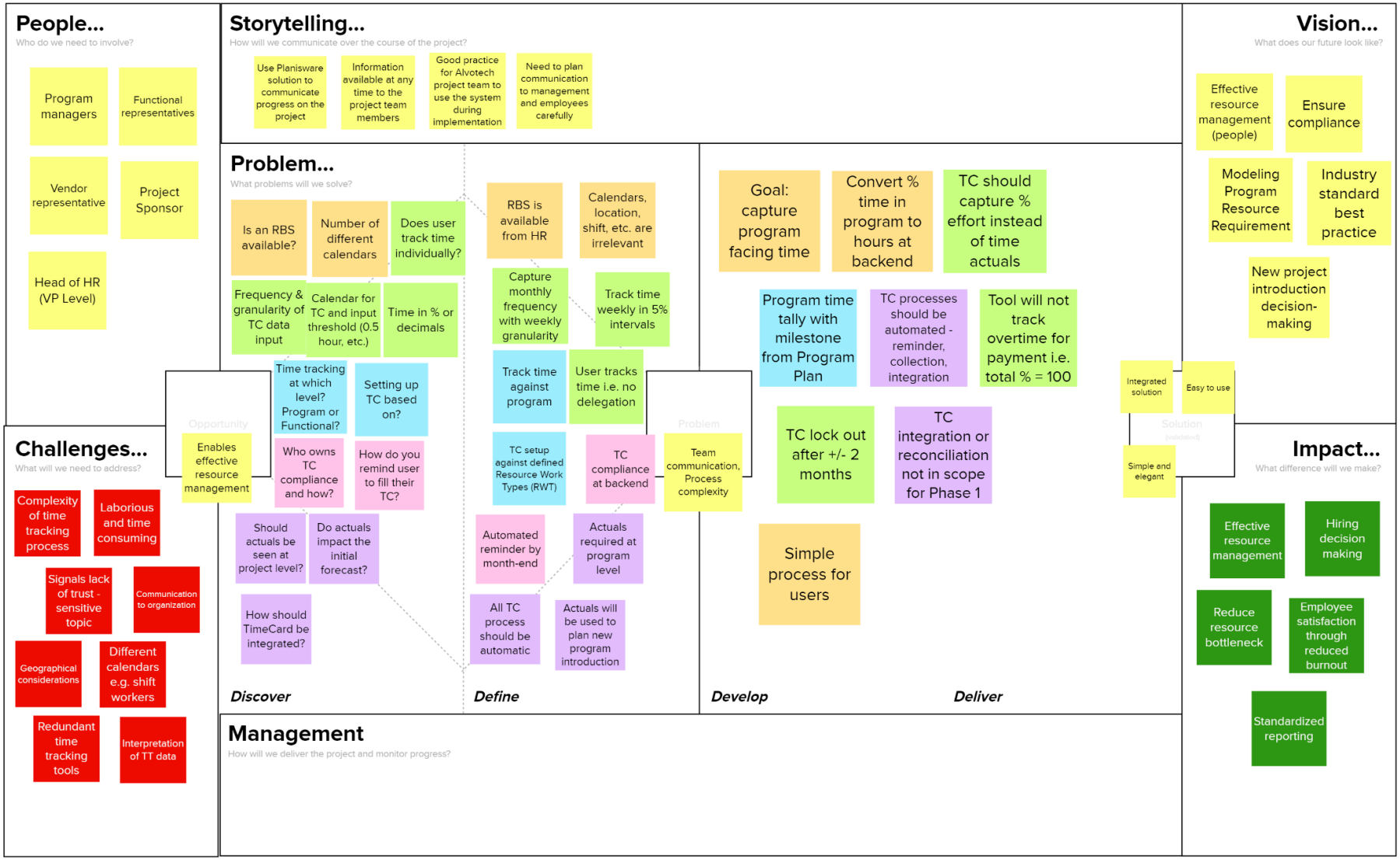


APPENDIX B. TIMECARD WORKSHOP - DESIGN THINKING CANVAS

Design Thinking Canvas

For: *Workshop: Timecard* Created: *25-August-2021*

Develop an innovative design-led strategy with a structured vision



APPENDIX C. RISKS/ISSUES/PRESENTATION WORKSHOP - DESIGN THINKING CANVAS

Design Thinking Canvas

For: Workshop: Risk, Issues, Presentation Created: 22-September-2021

Develop an innovative design-led strategy with a structured vision