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Product Maturity to improve Time to Money processes.



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Abstract

The thesis is focused on the improvement of Time To Money (TTM) projects. The TTM process represents the innovation system employed at Hilti. The improvement aims to reduce the innovation cycle time, and hence speed up the launch of outstanding new products.

In line with the Champion 2020 Hilti's business strategy, the objective is to increase the number of new offerings in the markets while reducing the time needed for the development process. In order to do so, it was analyzed the execution of the current development system and the results were translated into an opportunity to innovate the process.

The development process has been organized into value streams and a product maturity concept has been developed to revise and update the TTM process. The introduction of the new concept aims to provide a framework to check the activities and the tasks required for a successful innovation system. It intends to foster discussion on important matters and boost the efficiency of the whole process.

Key words: Product maturity, Development process, Agile, Checklist, Concept evolution, Innovation cycle time.

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List of abbreviations

MO: Market Organization.

BU: Business unit.

TTM: Time to Money.

TTM PL: TTM Project Leader.

BU PM: BU Product manager.

REQ: Stakeholders Requirements.

SPEC: System Specification.

DES: System Design.

IMP: Implementation.

RT: Requirements Testing.

ST: System Test.

DT: Design Specification Testing.

G: Gate.

TP: Technology Process.

1 INTRODUCTION

In a global industry, such as construction, the fight for market share is always very fierce. “Windows of opportunity and life cycles have been shortening in recent years, placing pressure on firms to stay competitive” (Calantone & Di Benedetto, 2000). Companies need to constantly improve themselves and thus reach the market quicker and reduce lead-time to get ahead of the competition. Therefore, the product development phase is a constant target for lead-time improvements.

Rendering product development more efficient means rationalizing the decision-making process and making decision in a shorter time frame. Nevertheless, speeding up cycle time must not result in compromised product quality and extensive post launch product debugging. The product development lifecycle is a learning process where team continuously improve the knowledge about a product and develop outstanding offerings.

By developing new products faster than competitors and increasing the number of new products introductions, a company could increase its market share. Hence, it is evident the importance of improving and shortening the new product development process.

A product development process can be evaluated by assessing its performance in terms of effectiveness and efficiency. Product development effectiveness is represented by the level to which the new product address and meet customer requirements while at the same time create value for the manufacturer. Product development efficiency reflects the level to which the resources and time required to launch the new product are minimized. A good effectiveness and efficiency of the process execution provide a company with a competitive advantage. Execution is enhanced when a complete and consistent process and framework are followed.

Successful companies improve their innovation cycle by using effective product development frameworks and having a robust product development process. An effective product development process requires a clear definition of process stages with no-go/go decision gates, dedicated gates review, clearly defined deliverables and efficient methods to manage each stage.

Hilti’s development process framework is a structured phase-gate process that involves several deliverables.

1.1 Objectives and scope of the project

The objective of this project is to improve the innovation cycle at Hilti, while keeping superior product quality.

To continuously improve and innovate, Hilti is always looking for inefficiencies to address and for redundancy to reduce. In a complex systems development, such as the hardware development process in place at Hilti, it is easy to get off track by focusing on irrelevant details. This is especially the case, in a development process that involves several different deliverables.

The main duty of a project manager is to check the readiness and completeness of the deliverables and present the project's risk and updates to a steering committee. The deliverables involved in the development process are more than one hundred. In order to help the project leaders to successfully manage projects, Hilti has developed an excel based tool that follows a checklist mindset. However, the tool is considered restrictive and not flexible, as it does not foster discussion and it often results in just a mere check in a box.

Therefore, the aim of this thesis is to develop a new concept, by defining a new tailored framework, able to assist the project managers in efficiently handling the list of deliverables and presenting the projects status to the steering committee, so that it will be possible to render more valuable the decision-making process and speed up the innovation cycle.

2 PROJECT CONTEXT

In this chapter, the company where the project was conducted, Hilti AG is introduced. The reader is provided with some insights into the structure and the business of the company. Furthermore, a brief introduction to the PPM team will clarify the project implementation and details.

2.1 Company description

Hilti is a privately-owned company, founded in 1941 by the engineer Martin Hilti and his brother Eugen, in Schaan, Liechtenstein. All company shares are held by the Martin Hilti Family Trust, a fact that ensures long-term continuity and ongoing development of the company. Hilti is a multinational company, based in over 120 countries with more than 25,000 employees, that designs leading-edge technology, software, and services, which power the professional construction industry.



Figure 1
Hilti Headquarters, Schaan, Liechtenstein

The company offers a 360 degrees' service for the build – from software design, products, and tools for work onsite to training, repairs, testing, and consultancy. Hilti is defined as a one-stop shop for building, worldwide. Tools, technologies, and software for the construction industry fit seamlessly together so the customer can use them throughout the design, installation and building management. They are designed for a wide range of applications, from everyday jobs to solutions for the harshest of environments and toughest of job sites.

Hilti's main purpose is to passionately create enthusiastic customers and build a better future. The company does not believe in just sitting in the office. The sales teams and field engineers work closely with customers onsite, finding solutions to make builds faster, easier and safer. This drives to its innovation, because the company knows and understand what its customers really need.

Hilti's success is measured by customers, employees, partners and suppliers' satisfaction and an overall positive influence on society and environment.

Hilti stands for innovation, quality, and direct customer relationships. The company opened a new modern innovation center in 2015 and completely renovated its headquarters and the company premises in 2016, signaling its commitment to the location of Liechtenstein.

The focus of the new "Champion 2020" corporate strategy is sustainable value creation through leadership and differentiation.

Hilti launches on average 45 new products per year. Every day at its research, development and testing centers in Europe, North America, and Asia, Hilti engineers and experts are testing and imagining new ways to make work easier, safer and more productive.

Hilti works with various universities and independent research laboratories to tackle the most challenging technical problems. It invests more than 5 percent of turnover in research and development on annual basis.

From a functional perspective, Hilti is divided in BUs, Corporate Research & Technology Unit, Supply Chain, Corporate Functions and Market Organizations (MO). Besides the latter, all functions are located at the corporate headquarter in Liechtenstein. The MOs are legal entities located all over the world, which have a marketing and sales functions.

The company is structured in two main business areas: Electric Tools and Accessories (ET&A) and Fastening and Protection Systems. Specifically, Hilti's portfolio contains seven



Figure 2
Hilti's Champion 2020, Hilti

business units: anchor systems, electric tools and accessories, installation systems, measuring systems, diamond systems, firestop systems, direct fastening and screw fastening.

The company's electric tools, accessories, software and services cover a broad spectrum of applications. Diamond service providers and customers in the energy industry can all find specific products suiting their needs. This is supplemented with comprehensive services such as fleet management and software-based solutions as well as a worldwide logistics network.



Figure 3
Hilti System Solutions, Hilti



Figure 4
Hilti's Business Model, Hilti

Hilti strives for excellence. The Hilti corporate culture is founded on four key ideas: teamwork, integrity, courage, and commitment, along with self-responsibility, respect, and tolerance. The company boasts an environment of open communication, idea sharing, and best practices, it fosters an atmosphere of openness and cooperation and applies truth and honesty in dealing ethically with all people. Positive and negative experiences are considered sources of learning and innovation and it is highly recommended to break out the circle of habits by taking risks. Moreover, Hilti celebrates success and recognize achievement.

The company is based on four strategic pillars: People, Strategy, Processes, and Results. To guarantee successful results and continuous improvement of the diverse portfolio of products and system solutions, there is a specific team responsible for the processes required to implement the company's strategy.

2.2 PPM Team description

The team in charge of the management and improvement of the processes used in the company is called PPM (Product Portfolio Management). The expertise of the members of the PPM team drives excellence in Process, Data and System Support to improve productivity and customer satisfaction.

The PPM team is divided into the following sub-teams:

- **Global Process Management**

Global ownership for innovation, INP (Introduction of new products), Product Complaint Handling and Phase out Processes.

- **Product Data Management**

Global Ownership for Material Master and Publishing processes, first level support for SAP and PDP, Global governance role for all product data topics.

- **Development Support**

Global ownership for Development Business Scenarios, first level support for ECtr (Engineering Control Center).

The Global Process Management Team focuses on constant improvement and aims to develop a culture of innovation. The team's purpose is to implement various methods to discover, model, analyze, measure, improve, optimize and automate business processes. The focus is on improving corporate performance by managing, in the most efficient and effective way, business processes.

The team pays specific attention to the process in place to support the introduction of new products in the market, as it is considered to be fundamental to the company's success. Effective timing is critical to attracting customers and optimizing revenue and profit on a new product. Therefore, the Global Process Management Team has recently focused on updating the TTM (Time to Money) process.

The TTM, the current company's innovation process, has been launched in 2002 and updated for the last time in 2006. Since then, all Business Units have adapted the TTM according to their needs and have tried to develop initiatives to define ways to speed up the execution of the process. The objective of TTM projects is to provide new hardware, services, and

software of outstanding customer value, to the market, in the shortest possible time with an excellent level of quality.

The Global Process Management Team is driving corporate-wide initiatives to improve the process by operating with different tools:

- Customer-centric Design Toolkit.
- Requirement engineering methodology
- Scrum project management (Agile framework).

A company tailored combination of methods can lead the company to achieve measurable results with process optimization and increase efficiency through proven methods and tools in the industry.

The requirements, tasks, teams, and knowledge needed to implement TTM projects successfully are different for hardware, software, and services. For this reason, the team is further divided into different sub-teams responsible for the three different categories.

3 PROJECT ANALYSIS

This chapter focuses on analyzing the project context, providing all the relevant information to understand the concept that will be developed to improve the TTM process. Specifically, this chapter highlights the academic theories that support the product development process used at Hilti.

3.1 The project business tools

The process of product development has evolved over the years, from being managed sequentially through strategic planning and concept generation to being managed through the acknowledgment of the overlapping nature of the different phases. Over the past decades, highly structured approaches on how to handle product development have emerged. For example, the seven-stage new product development process, the product and cycle time excellence process, the quality function deployment process or the value proposition process have been employed in order to improve development outcome.

New products development speed is becoming increasingly important for companies to maintain a competitive advantage in the marketplace and hence sustain high levels of profits and long-term competitiveness. This leads to a change of perspective, more specifically to a shift in management focus from a more traditional cost or quality orientation to a time orientation suitable for a fast-changing business environment.

The term “time to market” refers to the length of time needed for a product to be conceived until it’s available for sale. Short time to market is an important driver for sustainable competitive advantage. It allows firms to gain competitive advantage.

Time to market is a crucial element in being successful in the global marketplace. Increased speed to market gives the competition the disadvantage when it comes to innovation, allowing the company to reach consumers with new products, services or offers before the competitors do. It gives the opportunity to dominate the market, developing the reputation of being an industry leader.

Several methodologies and approaches have been identified and studied in the last years that could improve the introduction of new products in the market, such as the following described ones.

3.1.1 Stage-Gate

The Stage-Gate system has become, over the last year, a popular system for driving new products to market. “It is a conceptual and an operational map for moving new product projects from idea to launch and beyond, improving effectiveness and efficiency in managing the new product development process” (Cooper, 2008). It was developed by Robert G. Cooper in 1980 and it is based on phased review project. The stage gate system seeks to manage risk and increase efficiency by using a highly structured development process.

The system divides the innovation process into a predetermined set of stages, each composed of a group of prescribed, related and often parallel tasks. A stage is composed of information gathering activities and integrated analysis. The stages are designed to gather information to reduce uncertainties and risks. Each stage costs more than the preceding one, hence the stage gate system can be defined as an incremental commitment process.

Each stage is followed by a gate, where decisions are made to continue to invest in the project. The decision is usually between “go” or “kill” the project. The gates function as quality control checkpoints, which essentially require that certain criteria are met before the project can proceed further.



Figure 5

Example of a Stage Gate system

A gate consists of deliverables, criteria and outputs. A deliverable is the results of a set of completed activities, it represents what the project leader and team bring to the decision point. The criteria are used to judge and prioritize projects, and the output represents a decision along with an approved action plan for the next stages.

According to Cooper, the play is rapid, with activities occurring in parallel rather than in series and by a cross functional team. The stages are not dominated by a single functional area.

The governance process is clear, with defined gates and criteria for efficient, timely decision making (Cooper, 2008). Many companies tailor the model to their own circumstances and build lots of flexibilities into the process. For instance, certain activities and deliverables can

be omitted or bypassed. Similarly, activities can be moved from one stage to another – for example, moving an activity ahead one stage in the event of a long lead time (Cooper, 2008).

As Cooper stated, due to the visual graphics associated with stage-gate some people see it as a linear model, but while the stages are laid out in a sequential stepwise fashion, within each stage, activities and tasks are anything but linear. Instead, inside each stage some activities are undertaken sequentially, others in parallel, and others overlapping. Therefore, the process is anything but linear, even though the traditional graphics depict a neat, linear and logical process.

Agile vs Stage Gate

“Leading firms are now beginning to integrate elements of the Agile IT product development method into their traditional gating processes to develop physical products” (Cooper, 2016).

Agile is an iterative method, focused on the collaboration of the team members to develop high quality products. It is considered a team based approach to development.

The term Agile emerged in the late 1990s, early 2000s and replaced the traditional waterfall process, which is mainly focused on a long-term goal, on the final product and its major features. The waterfall model is a linear and sequential life cycle model; it is identified as one of the less flexible approach. The development flows in one direction, downwards like a waterfall.

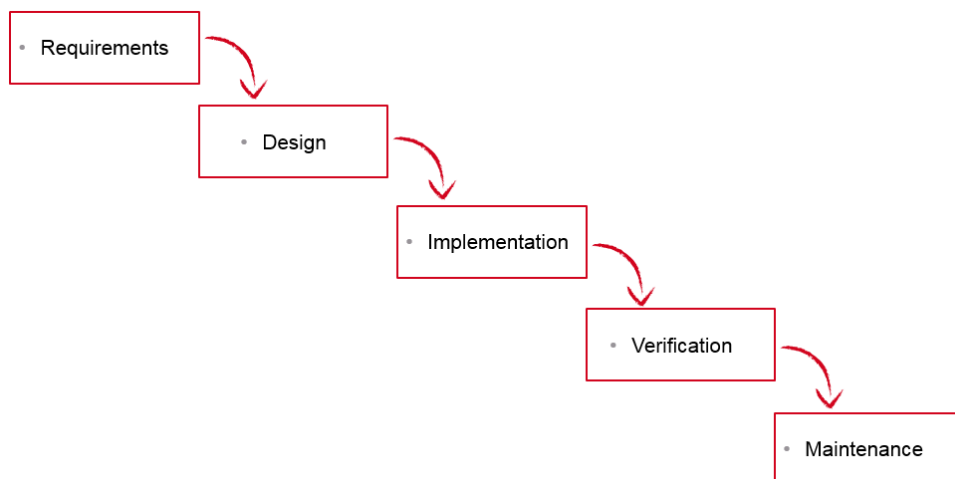


Figure 6
Waterfall approach

As shown in figure 6, the waterfall approach consists of five different phases:

- Requirements
- Design
- Implementation
- Verification
- Maintenance.

It assumes that all the requirements can be defined upfront during the first stage. However, requirements tend to change rapidly in projects, thus committing early to features and schedule means that compromises will be needed late in the process. Agile was introduced to deal with these issues through adaptive planning, evolutionary delivery, a time-boxed iterative approach, and flexible response to change (Cooper, 2016).

The Agile approach consists of different loops of four stages:

- Discover
- Design
- Develop
- Test.

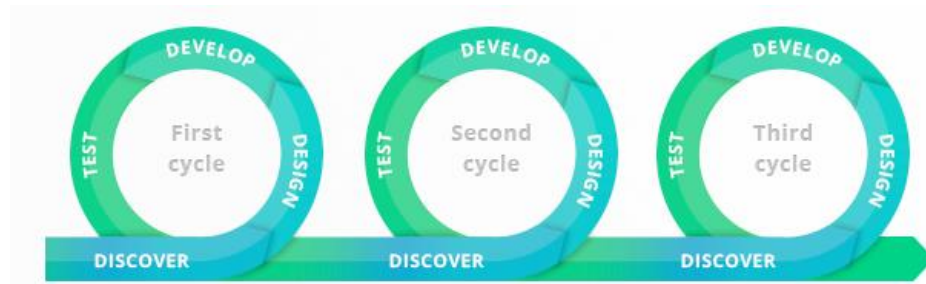


Figure 7
Agile methodology

According to Boehm and Turner, the main difference between plan-driven product development and Agile approaches is that the Agile methodology is based on planning and building on the fly. The Agile development is designed to help product developers create working products with continual validation from the customer.

In agreement with Eastern Peak, figure 8 shows the main characteristics of the traditional waterfall approach and the Agile methodology.

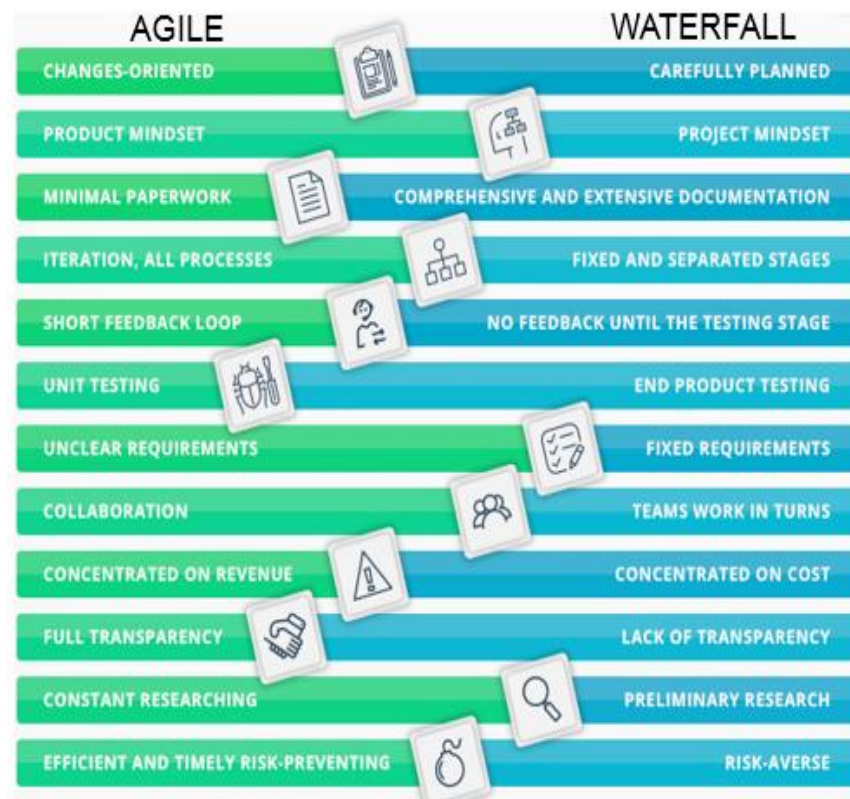


Figure 8
Agile vs Waterfall, Eastern Peak

The Stage-Gate system uses a waterfall development approach. In accordance with Cooper, while the Agile system is a microplanning management methodology, the Stage-Gate system is a macroplanning process that includes a comprehensive idea-to-launch system. The Stage-Gate process defines what to do within the projects in the different stages.

“The decisions in the Stage-Gate system follow an investment decision model, a go decision at a gate commits the resources for the next one, so that resources are funneled to the best projects as their potential emerges” (Cooper, 2016).

Agile, instead, is a project management tool developed to connect the development team with the customers and improve the communication within the team, with the purpose of speeding up the development process.

The Agile and Stage-Gate expert Peter Fürst perception of the differences between the two systems is: “In project management, there are three variables: scope of work, budget, and

time. In traditional methods, scope of work is fixed (the product requirements), and budget and time are flexible. But in a time-boxed system, for each sprint, time and budgets are fixed, and scope of work flexible”.

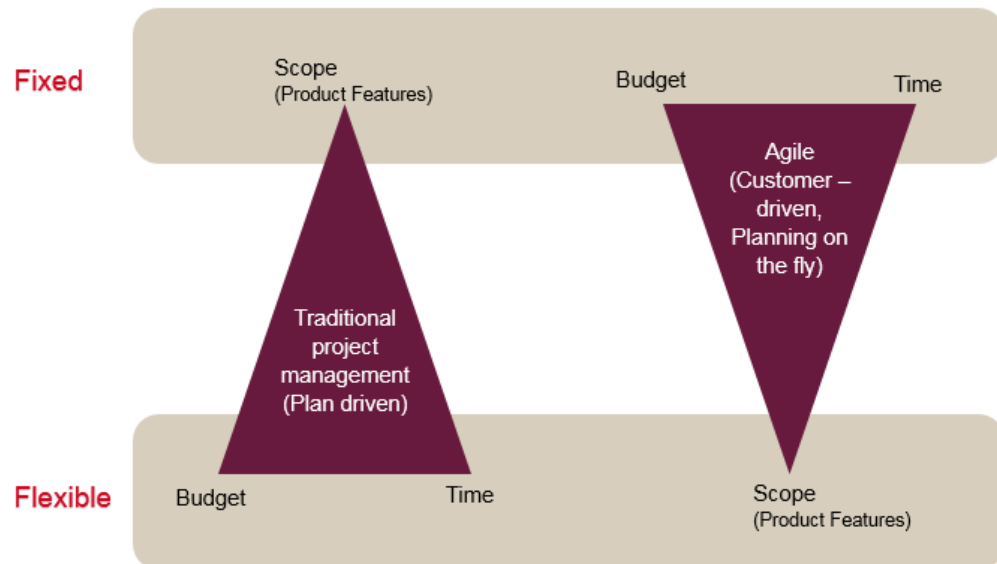


Figure 9
Fixed vs. Flexible elements in Stage-Gate and Agile, P. Fürst

The three primary benefits of the Agile methodology are: improved communication and coordination, quicker product releases, and faster responses to changed customer requirements or technical challenges. Although there are reported to be at least 26 different versions of Agile, the Scrum method seems to be the most popular Agile variant among the handful of firms employing Agile for physical product development.

Scrum

Scrum is a framework used to address complex problems, while efficiently and innovatively delivering products of the highest possible value. Scrum is a framework that allows effective team collaboration. It is not a methodology, it is the implementation of the scientific method of empiricism. It implements the principles of Agile as a concrete set of artifacts, practices and roles.

The Scrum lifecycle is iterative. The entire lifecycle is completed in fixed time-period called a Sprint.

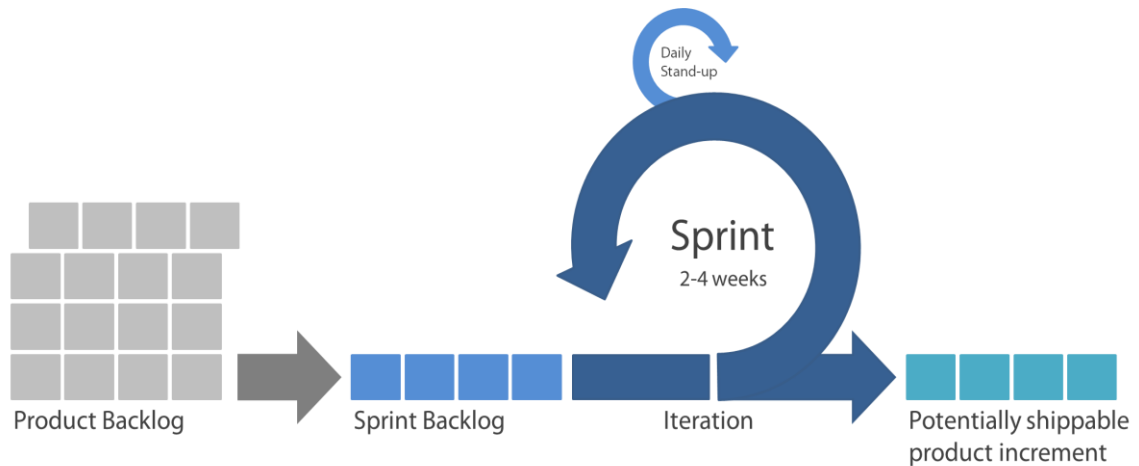


Figure 10
Scrum framework

Scrum involves three specific roles:

- *Product owner*, responsible for managing the team’s activities and for keeping the product backlog in priority order.
- *Scrum master*, responsible that team follows properly the process while resolving any obstacles might arise during the sprint. The scrum master continuously seeks for ways to improve.
- *Scrum team*, it is made up by individuals that actually build the product.

The product backlog represents a prioritized list of requirements that the team should consider while working on the product during the sprint. The sprint backlog represents a list of activities and tasks that the team needs to do to deliver the expected outcome in the sprint. The team chooses the activities and task that will be performed during the upcoming sprint.

At the end of every sprint, the team will attend two meetings:

- *Sprint review*, the team displays the results of the sprint to the relevant stakeholders.
- *Sprint retrospective*, the team reflects on the failures and on the successes of the sprint with the purpose of continuously improve the team’s performance.

The output of a sprint is called “Potentially Shippable Increment”, this means that the outcome should meet the criteria set by the product owner and should be a high-quality output that can be presented to the stakeholders.

The cycle is repeated for every sprint. The iterative cycle offers the team the possibility to learn and improve and represents the essence of Agile.

Scrum provides a framework for the team to follow, but it also gives flexibility to the team in the execution.

Hybrid: Agile-Stage-Gate

Companies, such as Ericsson, ABB and Vodafone, had a Stage-Gate system in place and they built Agile methods into their existing process creating what it is now called the hybrid Agile Stage Gate system. According to Cooper, the two models are, in fact, compatible and the hybrid approach yields several major payoffs:

- *Improved team communication.*

The structure of the hybrid model provides the mean for a better communication between the team members. The team has the control of the activities.

- *Better planning.*

The team is focused on customer requirements and in meeting them. The continuous customer feedback helps the team to deliver efficiently what requested.

- *Improved customer feedback.*

The customer is strongly involved in the development process. This helps to have a clear understanding of the customers' needs and develop a high-quality useful new product.

- *Higher motivation.*

Every member of the team plays an important role in the process.

There are also some challenges, for instance the risk that the long-term planning tends to be ignored in favor of a focus on the current sprint. Overall, Agile offers greater efficiency and focus while Stage Gate provides a means to frame the activities needed and to coordinate the different teams.

Agile-Stage-Gate is based on a series of sprints planned within the gates. At the end of each sprint, the team has to deliver something that can be demonstrated to stakeholders. The sprint are scheduled in real time, on the fly. For this reason, the system is highly adaptive and

responsive. Thanks to fast and timely feedback on concept, requirements and design the probability for market success is improved.

The process is visual. There are lots of different tools to display plans, progresses and results in real time. The gates represent the Go/ No Go decision, they help to distinguish weak projects from strong projects by providing focus in the projects pipeline.

The gates provide high level overviews of the project, insights into the activities required within each gate and the expected deliverables.

The Agile-Stage-Gate has been mainly applied in technical phases of the projects so far. However, nowadays companies are starting to gain confidence and they are using it also in other stages of the development process. In fact, the method can be applied successfully in the early phases as in the later phases.

Agile methods are employed by the project team within each stage in Stage-Gate, as they plan, manage and execute their work.

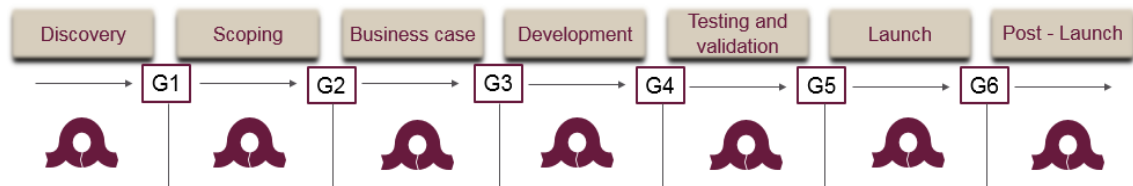


Figure 11
Hybrid: Agile-Stage-Gate

There are nine distinct elements essential for Agile execution: three artefacts, three roles and three tools.

The three artefacts

The artefacts generate the framework for fast, incremental product releases. The three artefacts of the Agile methodology are the sprint, the daily scrum and the retrospect meeting.

The sprint is a previously agreed period of time, usually between two and four weeks, during which the team works to complete a part of the project. The objective is to have a completed part of the project at end of each sprint, in order to present the customers or to relevant stakeholders the progress of the project at a sprint review. The sprint review aims to present the result of the sprint to customers and management, while a gate review consists of reviewing multiple sprints.

The daily scrum is also called daily stand-up. It is a short meeting to review project updates, it usually takes place at the beginning of the day and it lasts for about 10-15 minutes. The team members discuss what they've done yesterday, what they plan to do today and what problems they may have. The meeting is useful to highlight crucial problems that need to be dealt with. In fact, at the end of the meeting the team deals with the problems thanks to the collaboration of every team member. One of the advantages of the daily scrum is the instant knowledge-sharing.

The retrospect meeting is the final artefact at the end of every sprint. The retrospect meeting aims to improve how the team works. In fact, it is not focused on reviewing the sprint results, but of the team performances. During the meeting, each team member challenges his own performance and highlights his failures and successes by focusing on improving his way of working in the team. The objective of the meeting is to continuously improve the way in which the team works to achieve the expected outcome.

Siemens (Motors Division) uses a starfish chart to help structure the retrospect meeting. Each team member notes their concerns and suggestion on the chart using post-its.

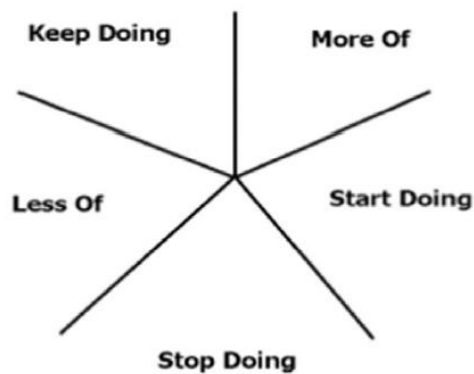


Figure 12
Starfish chart used at Siemens' retrospect meeting

The retrospect meeting is facilitated by the scrum master who ensures adherence to the starfish model and sees that all team members participate equally.

Three distinct roles

In Agile, all the team members are important at the same level, there is not a most important role, but each individual member is valuable. The team is responsible for the project's execution and it is empowered to take decisions. The team manages the project, and not management, by defining and allocating activities and different tasks among the team members. Based on the agreed outcome of the sprint, the team decides which activities are crucial and need to be undertaken during the sprint to achieve the expected goals, by deciding who does what and when.

The project manager is called “scrum master”. He or she undertakes every sprint supporting and facilitating the project team. He is responsible to ensure that the team is adhering to the Agile methods and is using the artefacts and tools properly. In fact, the scrum master facilitated also the daily scrums, the sprint planning and the post-sprint meetings.

In order to ensure that the team is able to execute quickly and without impediments, the scrum master is in charge of removing any obstacles.

Another distinct role is the “product owner”, who is responsible for product backlog. The product owner is not part of the project team. He or she works closely with the team to make sure that the right product requirements are built into the sprints. The product owner manages the customer involvement and focuses on stakeholders' management.

The Agile-Stage-Gate companies adopt the three roles, but sometimes they remain with the familiar roles and responsibilities of the following roles: team members, project manager and project leader.

The three tools

Agile-Stage-Gate features three important visual tools to help manage and monitor projects.

The “product backlog” is the equivalent of the traditional product definition or requirement specifications, but it does not contain detailed specifications. The product backlog is mainly focused on customer requirements, needs and preferences. The project team is free to experiment the product’s design by considering the product backlog guidelines. The items in the backlog have a logical sequence, they are prioritized. The first ones, the most important, should be tackled first. The document is continuously updated and re-prioritize as new information and learnings are available.

At the beginning of every sprint, the product backlog items are translated into defined tasks to create the “sprint backlog”. Some firms don’t include the product requirements into the product backlog, but rather the user stories that describe how the product fulfils the users’ needs and how the customers will engage with the product.

The second tool is the “sprint board”, which is also called Kanban board. The board consists of Post-It or activity cards on virtual boards, which list all the activities or tasks that need to be done during the current sprint. There are different way to set up the board, but the most used one is the use of three different columns: “to-do”, “doing”, and “done”. The board helps to keep track of the activities and to create a continuous flow. The activities and tasks cards are moved from “to do” to “doing” to “done” across the board during the sprint.

A “burn-down chart” is used to displays the work left to do versus time. This helps the team to value its performance. In other words, the burn- down chart shows how the team is burning through the customer’s user stories. It shows the total effort against the amount of work the team delivers each iteration.

The more the team uses the tools, the more accurate the results will be. Over time the ability of the team to plan the activities improves and so does the performance.

While Agile-Stage-Gate system consists of a number of elements – the nine artefacts, roles and tools – the whole is much greater than sum of its parts. The key to making it work is the change in mindset required by both management and project teams, and the application of the entire system in an integrated fashion. While the elements of the system are useful, experience suggests that they do not bring significant performance improvement unless they are employed together and with the appropriate change in the “way of working”.

3.1.2 Customer-centric Design Toolkit

Customer satisfaction is a factor that contributes to the success (or failure) of a business, it's important to track and improve it in order to understand current customer needs and wants. Customer centricity is about providing solutions based on a deep understanding of customer needs, preferences and behaviors.

The Customer-Centric Design Toolkit (CCDT) is a tool that helps design and test value propositions by systematically applying a set of human – centered methods/tools. The CCDT offers a list of methods and tools for value proposition design, to support innovation in product portfolio management processes and strategical marketing projects as well as research initiatives.

Methods and tools in the CCDT at Hilti are organized around their prevalent purpose. The main purposes are:

- *Empathize.*
Immerse in customer reality, define the research approach and means for collecting data.
- *Derive insights.*
Organize information and derive insights to identify opportunities.
- *Generate ideas.*
Ideate potential solutions as a response to one or more insights.
- *Validate solutions.*
Validate potential solutions by testing and getting customer feedback.

Customer-centric Design Toolkit is a set of initiatives to better manage the non-linear nature of research and value proposition design by systematically applying adequate tools and methods.

CCDT methods and tools can be used at an early innovation stage to derive (future) product needs/insights from a customer perspective as well as in the usage stage to figure out potential improvements for the next product generation.

CCDT provides a set of various methods and tools that can be applied to understand the customer behavior, to derive insights, generate potential ideas and proof them.

3.1.3 Requirement engineering V-model

Requirements engineering (RE) is a multifaceted discipline which “aims at providing a set of system requirements which, as far as possible, is complete, consistent, relevant and reflect what the customer actually wants” (Sommerville & Sawyer, 1997). It helps to better elicit and formulate stakeholder, especially customer requirements and to transform them into successful products. RE fosters an integrative development approach and support transparency between requirements and their fulfillment throughout the development process.

It refers to the process of defining, documenting and maintaining requirements in the engineering design process. It should be used in the markets to elaborate on customer requirements and how to test them.

RE at Hilti comprises several sub-processes, these include: elicitation, analysis, review and release, change and versioning processes. They are all strong connected to a proper documentation process, which is a continuous process accompanying the entire development cycle.

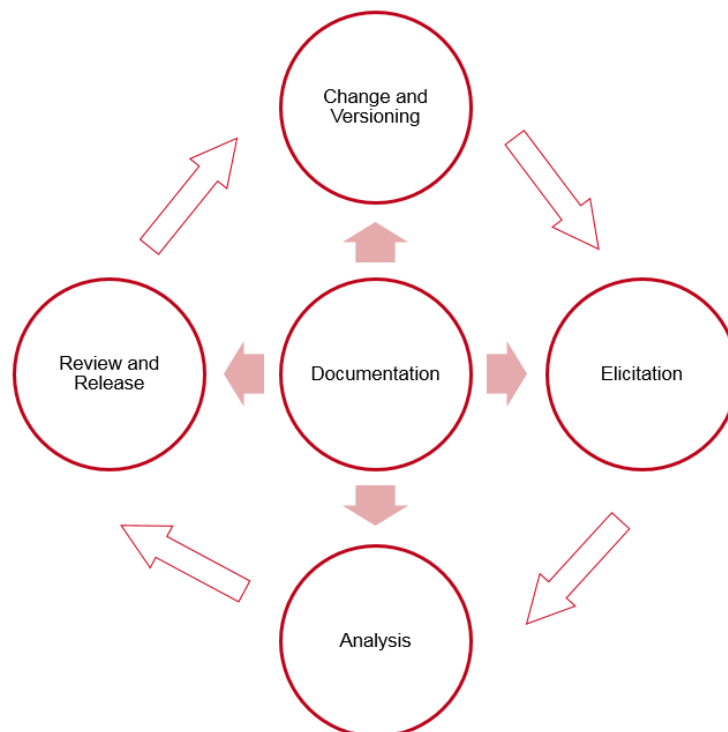


Figure 13
Simplified RE at Hilti, Hilti

Hilti adapted the V model as a generic framework of Requirements Engineering activities. The V model is a lifecycle model useful in the product development process that shows the link between the test specifications at each phase of development. The name comes from the basic shape of the model. This model twists the traditional waterfall model by linking the test plans with the respective development phase.

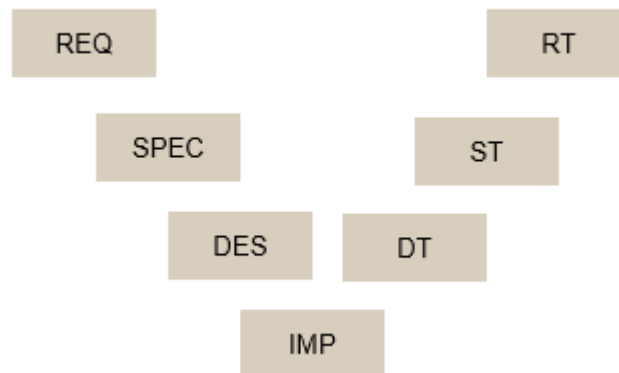


Figure 15
V Model at HILTI

Located at the highest level are the stakeholder requirements (REQ). The purpose of creating the REQ is the establishment of a consistent and agreed system description from the stakeholders' perspective. The REQ is the basis of SPEC (System specification). Located at the opposite of REQ is the Stakeholder Requirements test (RT), which mainly refers to the customer confirmation of the product to be developed. Located opposite to SPEC is the System Test (ST). It resembles the system specification; it is the proof of the error-free implementation of system requirements. The most concrete level of the Hilti V system includes the System Design (DES) and the Design Test (DT). The DES is established on the basis of the SPEC and it is the result of the system architecture design process which fulfills the purpose of identifying which system requirements are allocated to which elements of the system. The implementation (IMP) depicts the physical and logical combination of the various system components which, when integrated, build up the complete system one level above.

The Hilti V-Model is employed in order to structure and visualize development activities and highlight certain required products in connection to RE. The V model is used to frame RE activities and work products on system and subsystem level. It, therefore, emphasizes the requirements that belong to different hierarchical levels.

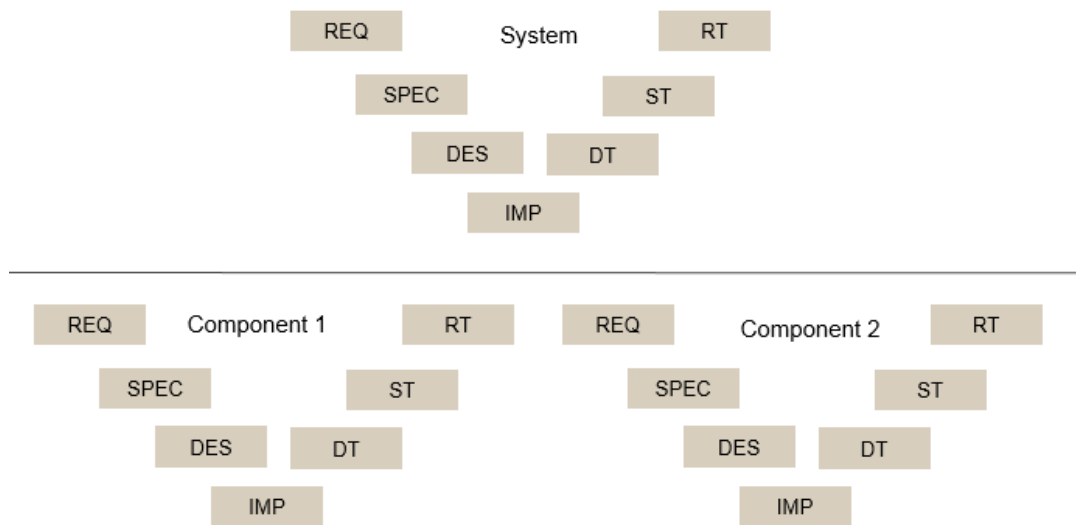


Figure 16
Hilti adapted V model and RE

3.2 Problem analysis

There is a great variety of systems and frameworks that companies can use to improve and speed up their business' processes.

Many companies succeed by finding a unique niche or competitive advantage that differentiate them from their competitors. The competitive advantage often translates into businesses processes that are different and company tailored. Effective business processes support the unique traits of the business operation.

One challenge, today, for companies lies in finding the right approach to measuring and continuously improving the current state of a company's product development process. The need for shorter lead time requires increased knowledge and advanced skills in the design of complex product development processes. The ability to manage such complexities is seen as a competitive advantage for technology advanced industry.

In accordance with Eriksson, Johnsson and Olsson (Eriksson, Johnsson, & Olsson, 2008), to be able to manage a complex product development system in an appropriate way three aspects have to be considered: uncertainty, performance and decision making. In a development process various decisions have to be made in order for the process to go forward. The development system may be considered as a group of decisions that influence each other in a complex way.

The decision-making process currently used in the company is based on a checklist mindset that is considered restrictive and not flexible.

3.3 Objectives

This project aims at developing a new company tailored concept able to improve the decision-making process used in the product development system. The real leverage in most management situation is to understand the dynamic of the process rather than detail the complexity of it.

One of the objective of developing a concept to improve the decision making is to increase the ability to focus on the right aspect of the product development process and to support it in order to increase the decision-making performance over time. If no decision is made, the process remains at halt.

4 AS IS – Current execution of TTM processes

This chapter aims to give a deeper understanding of the company's development process. The chapter describes the implementation of the stage gate process at Hilti.

4.1 Hilti's development process

Hilti uses the expression "Time to Money" to refer to "Time to Market". The objective of Time To Money (TTM) projects is to provide new offerings of outstanding customer value to the market, in the shortest possible time and at an excellent level of quality.

Hilti's TTM process is implemented and performed using the stage gate system. The company is currently implementing into its existing development approval gate process the Agile method. Embedding agility into project execution aims at high transparency and fast delivery.

For high-technology companies, it is important to link technology development process with product development process, in order to achieve a competitive advantage and organizational growth. Developing products which require technologies that are not ready to be integrated in them could lead to failures, in fact technologies need to be available and mature enough to be integrated into products. New technologies may offer improved performance and greater efficiency and effectiveness. Therefore, a process is required to develop and measure the maturity level of technologies.

Innovation in technology might come from many different sources such as: individual engineers, universities, competitors, suppliers, market researches. Creating a separate technology unit that performs basic and applied research for new technology development is a common approach.

4.1.1 Technology process

The technology process (TP) at Hilti describes all activities, which are necessary to develop a technology to a "TTM ready" maturity. The general objective of the TP process is to define a common process and communication frame in order to:

- Have an efficient and effective communication between and within teams.
- Balance customer requirements with technology offerings.
- Balance project risk and technology cost.
- Master a new technology before starting a TTM project.

Users of the technology process are Business Units and central functions such as Corporate Research & Technology who contribute towards launching new products.

The structure of the technology process is gate oriented. The process is defined through four gates and phases: ideation, definition, concept and development. The details of the process are defined through the so called key deliverables at each gate. The deliverables are results which must be presented at the gate in order to move on into the next phase. The process is concluded with TP4, followed by the implementation in a TTM project.

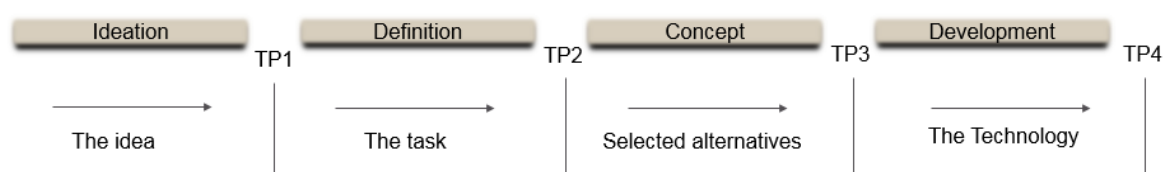


Figure 17

Technology Process, Hilti

The basic structure is therefore extremely simple: define the process, develop a concept of variations, select a preferred variation and develop it until effectiveness can be proven. This helps ensure that the probability the TTM project must go through technology cycles is limited to an acceptable level.

In general, a technology is deemed to be ready for implementation if there are functional prototypes or a pilot system that ensure the probable product implementation with limited risk.

The assessment of readiness not only refers to product and manufacturing technologies developed internally, but also to technologies developed by key suppliers that must be assessed to an equal degree.

The specific objective of the TP process is to minimize risk before launching a TTM project and to provide all users of the process with a guideline and tools so that they are able to work as efficient teams in their effort to mature and continuously improve/develop new technologies at an excellent level of quality.

4.2 TTM process overview

Hilti products serve many different types of customers for different job to be done, such as: building construction, electrical installation, civil engineering, diamond service providers, steel and metal construction, interior finishing etc. The company has a global presence in more than 120 markets, each with own characteristics and different products portfolio.

Hilti releases an average of 45 new products families each year, products and solutions vary a lot in terms of their attribute and complexity. To enable product portfolio management, it's necessary to have processes, data and systems in place. The PPM (Product Portfolio Management) team manages the development system called TTM (Time to Money) process and the product life cycle process portfolio around it.

Before the TTM process, the development systems were strongly regimented and checklist-driven. In 1988, Hilti used the PISA process. It was a generic, high-level description of an ideation/innovation and a project evaluation, prioritization and preparation process. In 1990, the company adopted the PUMA system. It was a detailed, low-level checklist for all activities from the release for development work on the intended product to the confirmation of market acceptance. These old procedures were either too generic, or too detailed and product-specific, leaving little freedom to the projects teams.

Hilti adopted the TTM process in 2002 and it has been adapted to changing business and market needs during the years. It supports documents and deliverables; it is less checklist driven and generalized for an expansive and complex product portfolio; the process is driven by marketing and it is a mix between a generic and a specific process.

Hilti has different systems in place, all of them related to the TTM process, for the following different categories of offerings: hardware, software and services. For each category, specific deliverables and documents are identified and defined. The objective of this thesis is to focus on the hardware products and develop a new concept to replace the still strong influence of the checklist mindset.

4.2.1 Hilti's hardware development framework

The TTM process is not considered as a simple product development process, but instead it is a phase gate process framework that helps defining a structure for the development of new products. A framework is an approach to solve a problem that provides a rough outline of the process, providing the general principles to implement correctly the process. When implemented properly, the phase gate process reduces risks and accelerates the speed of the time to money.

The process is not specific to any single business unit or product; it is deliberately generic to cover all Hilti different products. It is considered as a supporting and enabling guideline, which supplies a list of relevant deliverables that need to be released and finished at a specific time to move on with the process efficiently and effectively.

The TTM process is not the ultimate, precise process, instead it is a process that needs to be periodically adapted to the changing business context. It has a flexible structure that has to be adapted to different products depending on the expected challenges.

It is a powerful tool which focuses the attention of the project team on the customer input while:

- *Defining the project target.*
- *Delivering the new solution in the shortest possible time.*
- *Introducing the new solution to the customers according to a professional marketing introductory plan.*

The focus on new products demonstrates excellence in product quality and attention to customer needs. The process involves different teams and different areas and it goes from the idea of a new product to the launch on the market and gaining money.

The TTM project team is not a hierarchical organizational chart, but a communication and coordination network between different roles, coordinated by the TTM PL (Project leader), the BU PM (Product manager) and the development team. The process runs more smoothly when the information flows across the network, including the voice of the customer from MOs to BUs.

The TTM process defines the activities, tasks and responsibilities that are necessary to bring new products and services to the market, from the beginning with a business opportunity until completion of the launch into the markets.

During each phase of a TTM project, the teams constantly need to share product information, but if there is not a controlled process behind, things can easily go haywire. Having a strong process helps manage product development and reduces possibilities for mistakes that can blow the time to market target. Moreover, having controlled processes in place facilitates access and communication of the latest product information, in fact, the purpose of a well-defined process is to identify a strategic approach for effectively communicating among different teams.

The benefits of a common framework and a well-defined process fall into the following main categories:

- *Structured workflows*: having a well-defined workflow enables to minimize down times and waste of time during the process. Moreover, it helps to have defined responsibilities and a clear structure of the whole process.
- *Process automation*: a product development process needs to have an operational system in place to approve deliverables and reports needed for effective management. Automating the development process will allow the company to focus on what matters the most.
- *Process transparency*: by sharing information on the project status and checking the progress with team, the company will be able to continuously improve the process and achieve objectives with more transparency and agility. Furthermore, visual information facilitate the teams' access to critical information.
- *Clustered information management*: accessible and visual data allow to review much more easily and rapidly.

- *Real-time and flexibility*: in an evolving society and business contexts, it is important to be quickly responsive and focused on market changes. Sharing information in real-time allows the team to be agile and improve in an effective way the decision-making process.

When Hilti launches new product on time, it can beat the competition to the market and have more time to collect product revenue. When the product development process is controlled the time to market is more predictable and the team has the flexibility to handle the unexpected hitches that will always happen, hence the ability to hit the time to market date, depends on having controlled product development process in place that helps the company stays on track and minimize chances that something significant impact the schedule.

4.2.2 TTM into Value Streams

The TTM process at Hilti consists of the following gates:

- *Gate 0: Kick off*

The kick off represents the discovery phase; it consists on activities that helps generate new ideas and identifies opportunities.

- *Gate 1: Business Opportunity*

The preparation phase foreruns the business opportunity gate. It consists of an assessment of the market context and its prospects. It is a preliminary scoping and investigation of the project and leads to a Business Case.

- *Gate 2: The task*

The definition phase anticipates the task gate; it refers to the definition of project in its details, of a detailed action plan and of the requirements that should be met.

- *Gate 3: The project target*

The concept phase foreruns the project target gate and consists of a detailed design and actual development of the new product.

- *Gate 4: The tested system*

The design phase anticipates the tested system gate and involves the verification and validation of the proposed new product, including the definition of a marketing plan, production plan and operations.

- *Gate 5: The series product*

The launch preparation precedes the series product gate and represents a test of serial production and the efficiency of doing it.

- *Gate 6: Money.*

The last phase is the market introduction; it represents the launch of the product in the relevant markets and the commercialization of the product.

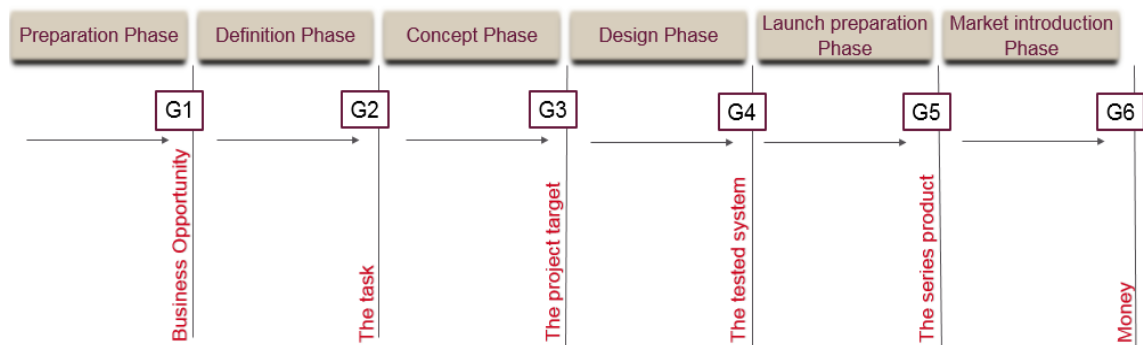


Figure 18
TTM process at HILTI

A TTM project involves different areas within a BU. It is coordinated and managed mainly by a project manager. The project manager is the one in charge to lead an interdisciplinary team and manage the project from the market evaluation to the introduction of the new products to the relevant markets. He is responsible for time and budget planning. Furthermore, he defines targets and secure the achievement regarding product value proposition and quality.

The project manager aligns customer requirements targeting to drive differentiation versus competition. He steers the technical team to deliver outstanding solutions and partner with sourcing to achieve product cost targets. The product manager is responsible that the product, as well as the project, is a success from the very beginning to the end in all dimensions.

The TTM has been restructured into value streams to help visualize what is needed to proceed with the next deliverables or gate and speed up the decision-making process.

A value stream represents a sequence of linked activities, or a flow of deliverables as well as the flow of information and documents, which are necessary to produce and deliver a product or a service. Thanks to a value stream analysis, it is possible to separate from activities that brings value to the process and tasks that could be improved.

According to Kennedy, Harmon & Minnock, product development can be divided into two general value streams; a product value stream and a knowledge value stream. The product value stream is related to the tasks, resources and activities needed to develop the product, therefore it is project specific. The knowledge value stream represents the knowledge gained during the whole project across the different teams. For each product development project, knowledge is documented and re used to improve the next projects.

Value stream mapping is a lean methodology for tailoring and improving processes. As indicated by the name, it consists of a map of value streams. It allows to easily understand the flows of activities and information required to make the final product and how the whole process can be improved. By looking at an entire value streams, instead of isolated tasks, it will be easier to focus on improving the whole system rather than just a part of it. Value stream mapping was recently applied by a lot of different companies as a visual method that helps simplify the complex product development environment.

In the Hilti TTM process, five different value streams were identified:

- Project management
- Go to market
- Development
- Supply chain
- Knowledge management.



Figure 19
TTM Value streams

While “Project management” and “Knowledge management” serve as a support for the feasibility of the whole process, “Go to market”, “Development” and “Supply chain” are product related and are core streams that serve the progresses of the project.

For each gate, several deliverables relative to each value stream are required to successfully pass to the next one. The gates represent the latest possible time when the key deliverables must be presented. It is not specified the timing or the starting date for specific activities leading to the key deliverables. The project team is free to plan and carry out these activities whenever they find these activities necessary for the success of the project.

At end of every phase, the project manager schedules a meeting with management to show the project’s progress. It is called “Gate review meeting” or “Steering meeting”. The gate review represents a decision-making point and a prioritization decision point. Decisions are attempt to create value, and this can only be done by committing resources to actions. It is important to foresee factors and uncertainties impacting the decisions.

4.2.3 Gates review

According to the Product Development Institute Inc., gates deals with quality issues such as quality of execution, business rationale and action plan quality. A gate review is an evaluation process which authorizes the project to progress to the next phase. It represents quality-control check points and prioritization decision-making meeting.

The stage gate system is designed to improve the speed of the development process and provides a structure to help the teams prepare the right information at the gates to support the project. The TTM framework empowers the project team by providing a clear roadmap, with priorities and deliverables at each gate. High quality deliverables submitted for review to management enables timely decisions. Therefore, the TTM project team plays an important role in assessing the project health and quality before it is submitted to the management review.

Prior to attending a gate review, the project manager should review the pertinent documentation and have a good understanding of the project and its performance. Each phase is characterized by activities within it, these activities are completed in parallel and

are cross functional. The gates are designed to monitor the progress of the project and reduce risks and uncertainties.

The gates of the TTM track the readiness to address a business opportunity successfully. The gate review meeting is based on a check of the deliverables needed at each gate to move the project forward. In particular, it is examined the project risks and the issues arisen during the phases. The content of each deliverables is not examined or checked in details during the meeting, because, given the numerous deliverables required per gate, it would be time consuming to go through all of them with a management committee. During the gate review meeting, based on the progress and status of the project, the management committee re-prioritize activities, re-allocate resources and define an action plan for the next phase.

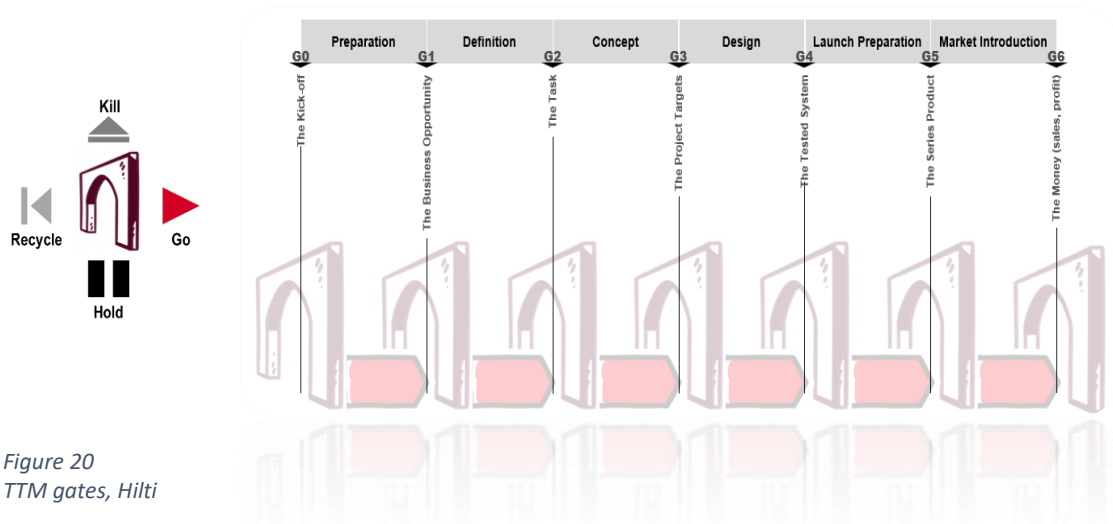


Figure 20
TTM gates, Hilti

The project manager makes sure to have the required documents needed for the gate review. He checks the status of the deliverables needed at every gate by constantly communicating with the TTM project team. The project manager checks with the team the risks and the difficulties and present them to the management committee that will assess the business attractiveness, the feasibility and the risks of the proposed new product and will decide to move forward with the development.

In order to be prepared for the gate review, the project manager adopts a checklist mentality by checking the status of the deliverables relative to each value streams. In addition, the checklist mentality is fostered by an excel based tool designed to help project managers handling and making sure that the relevant gate deliverables are completed. This tool is

basically a list of deliverables clustered by gates and value streams, where the project leader can keep track of the status of the project, by ticking the box of the completed deliverables.



Figure 21
Excel tool to keep track of the deliverables, Hilti

4.2.4 Checklist mindset

The checklist is a useful tool to present all the tasks that need to be accomplished, so nothing is forgotten. In a long and complex process, as the TTM process, it helps to follow a path of deliverables that will enable the company to achieve competitive advantage. However, it is a restrictive methodology that does not foster discussion between team members. Moreover, it can result in a “Pencil Whipped” action, meaning that a deliverable can be checked as done without actually knowing or reviewing what is that is being approved.

In general, a checklist mindset is quite common, as it is considered an easy to use tool and a well-known approach. Nevertheless, it does not allow to have any flexibility or freedom in the execution of the entire process and do not let people think but just help them execute.

The checklist mindset results in the tendency of not having rational thoughts but instead just following a list of things to do or check. As long as the checklist items are checked, everything is ok, no matter how far one had to stretch to check off the items on the list.

It's important not to reduce understanding and knowledge to a set of checkmarks on a list. A checklist mentality can also be seen as a form of intellectual laziness that avoids real understanding of the issues and real accountability for a decision. It represents the decision, and the checker needs think no further.

Many times, the checklist mindset results in a race through activities and targets. The goal is to complete the project, a check in the box to show that the deliverable has been finished and the targets accomplished, so it is possible to move on to the next phase.

Specifically, during the TTM process there are a lot of deliverables needed to pass the gate and it is not easy to focus on the overall picture of the project when there are a lot of specific tasks and activities to do.

Checklist can serve as a support to remind the project manager of all the things that he needs to think about and makes sure that all the relevant key tasks and activities have been met. Nevertheless, most of the time checklists become substitute for thought and understanding and people reduce professional duties to a set of activities and tasks losing the vision of the big picture. The danger is the possibility to get lost on the details of the single actions without considering the connection with the whole process. It's important to stay focus on activities that mean something, avoiding do things just for the sake of getting them done.

From an operational point of view it could be easier to reduce and simplify a process to a list of tasks, but from a strategic perspective it is important to be informed on the context and the purpose of the overall project.

To remain focused on the big picture and don't get lost among the several deliverables the following ideas were proposed to be evaluated and considered:

- Turn activities into outcome. Instead of listing the activities or deliverables that need to be done at each gate, list out the content that is necessary to move on to the next gate.
- Challenge the TTM team to turn in evidence of foundational knowledge and responsibility for the task that they are in charge of doing.

5 TO BE – Vision of future TTM processes

This chapter highlights a solution to replace the checklist mindset and help achieve higher quality gates review meeting. The focus is on developing a concept based on the product maturity to actively check the content behind the phases of the development process.

5.1 Challenge to address

The objective of the thesis is to create a framework that would be used to improve the TTM process and in particular the decision making during the gate review by showing the progress and the content behind the deliverables.

The first step to develop the framework is to understand in details the process, its weaknesses and its strengths. In fact, the TTM process represents the most difficult and critical process in place in the company. The process aims to develop outstanding and differentiated products.

A TTM project can last years and involve several resources, knowledges and costs. A product development framework provides guidance for creating new products or improving the performance, cost or quality of predecessor products. The framework helps company achieve business goals and if it is successfully used can increase profitability and minimize the risk of mistakes.

The development of new products is a high-risk process. In order to minimize the risk and ensure the delivery of the planned new products is essential to measure goals and review progress at each stage of the development process to generate new ideas and assess the overall project. The structure of the TTM process helps the company to perform in the most efficient and effective way possible and to lower its costs, which enable the company to increase its profit margin.

Hilti is a customer oriented company focused on meeting customers' needs. A well-structured process centred on meeting the needs of consumers creates a higher value proposition than just developing exciting technical features that customers do not need. The TTM process guides the TTM project to follow a path and accomplish all the activities and tasks that need to be done to release new products that consistently meet costumers' value expectation.

The TTM process structure provides discipline and control in a process that is viewed as complex. It also ensures that the tasks are conducted at the right stage of the development

process. Nevertheless, the complexity of such process inevitably arises from the interactions of simple components. Managing a cross functional team and a phase-gate review process with several connected deliverables is not an easy task. In a new product development process, this means being able to handle the interactions between teams that work on different parts of a component in the developed product, different teams working together, several resources and technologies that are relevant to develop the new product. While elements located within the company can mostly be influenced by the project manager, the elements located in the project environment are beyond the influence of project management, this makes the process even more difficult to manage.

The job of the project manager is challenged by the numerous deliverables that has to check with the different team members to present the progress of the process at the different gates. In fact, the project manager is responsible to keep track of the project's progresses and to lead a cross functional engineering, marketing, quality, supply and research team that delivers benefits by improving operational performance and efficiency of Hilti's tools.

The project leader is responsible to deliver the projects within the quality, costs and schedule targets, while growing and developing the project team. He is in charge of establishing clear project structure, activities prioritization and timely execution by all the parties involved in the project. The project manager should foster a common understanding and alignment.

Given the difficulties in managing such a process, the gates reviews are considered as critical meetings to show the process progress, risks, weaknesses and strengths. During the gate review, the project manager updates the management on the status of the project.

The presentation at the gate required the collaboration of the team members in delivering the deliverables on time. The theoretical and standard approach to the gate review was to fill an excel spreadsheet, which lists the deliverables needed to pass the gate. Therefore, the preparation of the gate review results into a mere checklist to present the development of the process.

5.2 Maturity models

Maturity represents an assessment of the ability of a company to continuously improve in different areas. Maturity models are now commonly used to assess processes and procedures and find better solutions to change and improve. Over the last few years, several models have been developed to support different applications in a company. For instance, the Capability Maturity Model (CMM). It is used by companies in different domains as a tool to continuously improve company's competitiveness.

Maturity models define the evolution and change of company's capabilities in a stage by stage process by continuously comparing the as-is situation to the desired and planned situation, based on the assumptions of predictable paths.

Hilti has recently implemented a maturity model for the development of new services. It is a prescriptive model that defines the evolution of tasks and deliverables along the development process. This is possible because the development process for new service involves not as many tasks, as the TTM process for hardware does, and the same deliverables, with different degree of detail, are needed to pass every gate. Therefore, the model results in an evolution of every deliverable through the gates.

5.3 Product maturity concept

In Hilti, the TTM process implementation for hardware is a very extensive process, which cannot be carried out in a single step, but should be divided and manage in a series of smaller stages. The process involves the completion of several deliverables at each stage. The concept of maturity implies an evolutionary progress in the accomplishment of a target from an initial to end stage and it is referred to a number of growth stages that depict the development of a product during several sequential periods of time.

Maturity reflects the “distance” between the actual level of completeness relative to what should be the level of completeness. The distance between the targeted and actual product readiness decreases across the project while maturity increases.

A maturity model helps formulate language and discussion of what needs to be improved and how such improvement might be achieved. It provides a common framework and leverages years of experience. A model helps users to keep the big picture in mind while

focusing specifically on improvement. The long-term goal is increased profitability, sustainable growth, customer satisfaction and noteworthy performance benefits.

A maturity model can be used to make the implementation of better-approachable and carefully planned TTM process. This is done, by evaluating the current status of the product progress relative to the different value streams mentioned above. It'll help the company to establish its own goals and strategies and choose the next steps in improving its TTM process infrastructure and practices.

Maturity models are commonly applied to assess the as-is situation, to derive and prioritize improvement measures and control progress (Iversen et al., 1999). These models describe an anticipated evolutionary path following a pattern. The idea of maturity is presented by defining a number of growth stages that characterize the potential upward development or performance of organizations during several sequential periods of time. Based on predictable patterns of evolution and change, maturity models are characterized by a sequence of levels that depicts the process progresses and includes improvement measures.

As stated by Pöppelbuß and Röglinger, it is possible to distinguish three different types of maturity model based on their purposes:

- *Descriptive*

A maturity model is classified as descriptive if it is applied for as-is assessment. The current capabilities of the evolving entity are assessed with respect to the chosen criteria.

- *Prescriptive*

A maturity model is classified as a prescriptive model if it defines future maturity levels and provides guidance and improvement measures.

- *Comparative*

A maturity model is classified as comparative if allows for internal or external benchmarking. For instance, comparing the maturity levels of different business units.

The evaluation of artifacts is an essential part of defining a maturity concept. They are evaluated “with respect to the utility provided for the class of problems addressed” (Hevner et al., 2004).

Maturity models have also been subject of criticism, for instance, King and Kraemer criticize that by adopting maturity models, the company will focus on the final state or end-product and not on the factors and actions that actually influence evolution and change.

5.4 Global and standard process

Hilti develops global company's tailored processes to leverage knowledge, create stability and common understanding within the different BUs. Having the BUs pulling the carriage in the same directions creates opportunity for high quality performance. Business processes are an asset that should be actively managed and improved. It is important to have a system that provides visibility, control and consistency to the whole process, to continuously improve and challenge the current performances.

Hilti supplies several hardware products. The BUs involved in the development of such products follow the TTM framework to deliver high quality offerings to the markets.

Every BU deals with products that have different complexity and distinct features. Therefore, it's difficult to find a common efficient process that can be easily adapted to every case.

Using standard process and procedures creates a structure in the business and provides a way to communicate efficiently within the company. The use of a common framework, defined activities and responsibilities helps save time and offers transparency in the process. Furthermore, it gives clarity to the work that needs to be done and ensures consistency in results.

A global and structured process helps the company keep on track and carry out tasks so it would be possible to focus on more interesting or risky part of the process. Furthermore, Hilti is a multinational company, it is present in different locations all over the world. It is important to have processes that are valid from a company perspective, so that everybody talks and aligns on the same thing.

For these reasons, the maturity concept should be developed in such a way that could be easily implemented and used efficiently in every BUs.

6 ACTION PLAN

This chapter aims to develop the concept of product maturity within the TTM process.

6.1 Idea definition

In order to understand the process and have insights from experienced people that work every day with the process, several interviews were conducted.

In particular, it was used the GUEST methodology, which was developed to provide companies with an innovative framework for business management. But, in this case it was used to structure a process and to develop a new concept that will be implemented in the Hilti's development process.

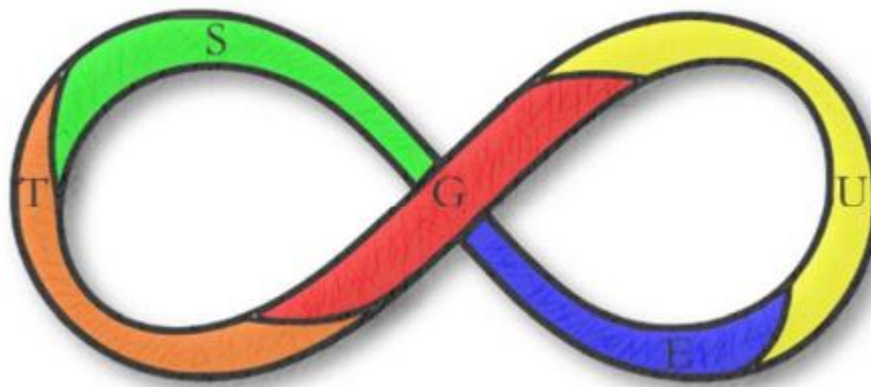


Figure 22
GUEST

GUEST stands for: Go, Uniform, Evaluate, Solve, and Test. These five steps are helpful to facilitate the development of an efficient and effective process structure.

6.1.1 Go

The word Go emphasizes the collection of basic information in order to be able to fully understand the system, who is involved and the interactions within it. In fact, a structured set of meetings were scheduled with different roles in the different BUs. Specifically, a project manager, a development engineer, a product manager and a lean manager from different BUs were interviewed.

The following questions were asked to gather the right information, in a meeting of about one hour long:

- How are you involved in the process?
- How are you involved in a gate review meeting?
- How do you prepare a gate review presentation? What is the essential information that needs to be presented to management?
- What challenges do you face during the process?
- What, in your opinion, are the strengths and the weaknesses of the process?

The following question was asked to product managers only, because they are in charge of checking the readiness of the deliverable before the gates.

- Do you use the checklist tool available in the excel document to check that all the deliverables have been accomplished before the gate? If not, how do you check the readiness of the required deliverables?

Furthermore, to get a clearer understanding of how a global standard process should be developed, interviews with two process managers were conducted to clarify the structure and the final purpose of introducing a new concept within the development process.

6.1.2 Uniform

The word Uniform indicates the standardization of the data collected during the Go phase. In particular, the information received from all the interviewed stakeholders was organized and elaborated to have a uniform structure of the process knowledge and needs. The interviewees are involved in different phases of the TTM process and work in different areas. Therefore, their points of view were distinct. Hence, to have a common understanding it was necessary to create a homogeneous and reliable general structure of the process in order to be able to improve it in the most efficient and effective way possible.

6.1.3 Evaluate

The word Evaluate points out the assessment of the current situation by analyzing the results of the Uniform phase. After having uniformed the information collected and structured it, a detailed assessment of the current situation was done by analyzing the as-is situation and trying to evaluate challenges and opportunities. Thanks to the different points of view

collected during the Go phase, it was very interesting to analyze, sometimes divergent, points of view and opinions.

The interest of a BU is to be profitable and improve continuously. Nevertheless, during a process like the TTM, long and demanding, sometimes there is the tendency to get lost in the details of each team member tasks and not giving the required attention to the big picture and the link that there is among the different deliverables and value streams. For these reasons, diverse opinions were analyzed considering the scope of the whole process by not focusing on one team member point view.

The following three different ideas of a maturity model were presented to management:

- *Model of a product maturity degree map.*

This model consists of two maturity degrees. The first one is referred to a deliverable (or group of deliverables) maturity level, consisting of a maturity degree which shows the suitability to start the next deliverables or group of deliverables without having fully completed the previous ones.

In order to apply this first maturity degree, it's important to identify the connection between the deliverables and then create a maturity-risk matrix to define the risk to start a new deliverable (or group of deliverables). In other words, this means defining whether it is possible, content wise, to start to work on the next deliverables, even if the previous ones are not fully completed, in order to speed up the process.

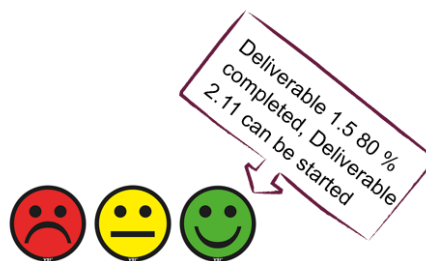


Figure 23
Deliverable completeness

The second degree refers to the product maturity degree, based on the completeness of the product throughout the gates. In particular, a tool will be used to visualize the completeness of the product and it is strictly related to the value streams that make up the TTM process.

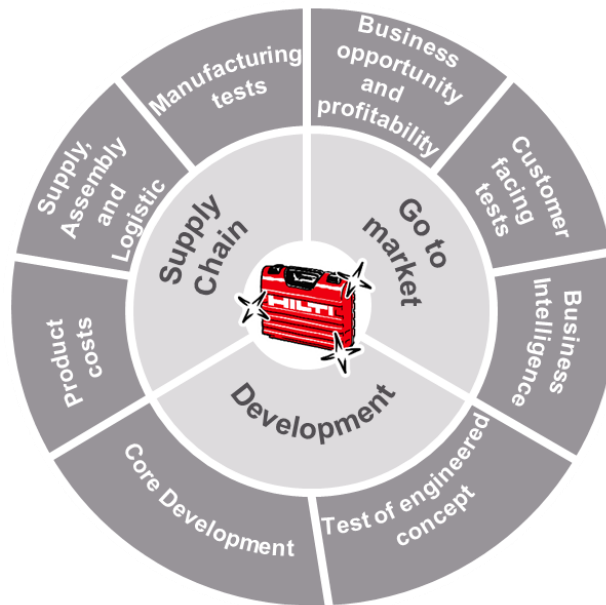


Figure 24
Maturity tool

Each value stream is made up of different deliverables. The deliverables will be clustered in further value streams, as shown in the picture above, and will define the overall product maturity by showing the value stream completeness. The completeness of the deliverables defines the completeness of the value stream; this represents the link between the two maturity degrees.

The maturity tool allows the stakeholders to visually quickly understand the status of the whole project. To complete the concept, it will be necessary to study and define the required maturity of the product to pass the gates. Therefore, it won't be used a checklist but it will be discussed the content of the deliverables that represent what really matters to pass the gate.

- *Maturity levels to describe the evolution of tasks and deliverables along the TTM process.*

The idea behind this model is to identify what are the deliverables that evolve during the process and define whether the level of detail of accomplishment is preliminary, improved or complete. Specifically, this is a purely descriptive model, the application of the model can be seen as an assessment of the as-is situation. Nevertheless, this model could also be seen as a single point encounters with no provision for improving maturity or providing measures of performance.

The description of the maturity should be conducted for every deliverable, once it is clear the evolutionary link between the deliverable thorough the gates.

- *Model for iteration and product maturity management.*

This model describes in steps a guided procedure, beginning with the definition of functional product deliverables and ending with an evaluation of the overall product's behavior.

The idea is to identify the key deliverables needed during the process and consider them since the beginning of it, by discussing them at every gate with a different level of detail. Therefore, this means studying the key deliverables evolution during the TTM process, respecting the readiness of each deliverable at the established gate. Then, apply a product maturity concept, based on the evolution of the main deliverables, for each value streams with the objective to converge them to the overall product maturity concept.

The three ideas were considered applicable and helpful with their own strengths and weaknesses. To increase the efficiency and add value to the model, after a meeting with the PPM team, it was considered that a mix of the three ideas would be a good starting point to develop the concept. The purpose was to use the strengths of every model to create a strong concept with fewer weaknesses.

6.1.4 Solve

The word Solve indicates the analysis of the solutions identified during the previous phases. In particular, in this case, three different solutions were presented to management. A meeting with the PPM team was organized to assess and analyze the possible solutions and decide the next steps to further develop the idea and then implement it.

From the previous ideas, a mix of the three was defined to move the development forward and increase the efficiency of the model.

6.1.5 Test

The word Test highlights a follow up on the action plan. This phase represents the actual implementation of the concept and the evaluation of its outcomes.

In this case, the idea is to implement the concept in a small project and study its effectiveness and efficiency. A pilot study is an important stage to identify potential problem areas and deficiencies in the concept prior the implementation in the whole company. It also allows to become familiar with the procedures and the tools.

Then, if successfully implemented, the positive effects and the benefits of using it will be challenged by introducing the concept to a BU with a pilot project. Once the pilot project in the BU responds positively to the advantages of the concept, the idea can be presented to the Head of Project Leaders. If the Head of Project Leaders approves the concept, it will be introduced to all the BUs.

Every stage of the GUEST methodology supports the decision-making system in the definition and implementation of projects, ideas, and concepts. It a useful tool able to back up the development of new strategies.

6.2 Product maturity model

The idea behind the product maturity concept in the TTM process is to check the content behind the deliverables, by defining what really matters to pass the gate and move on with the project.

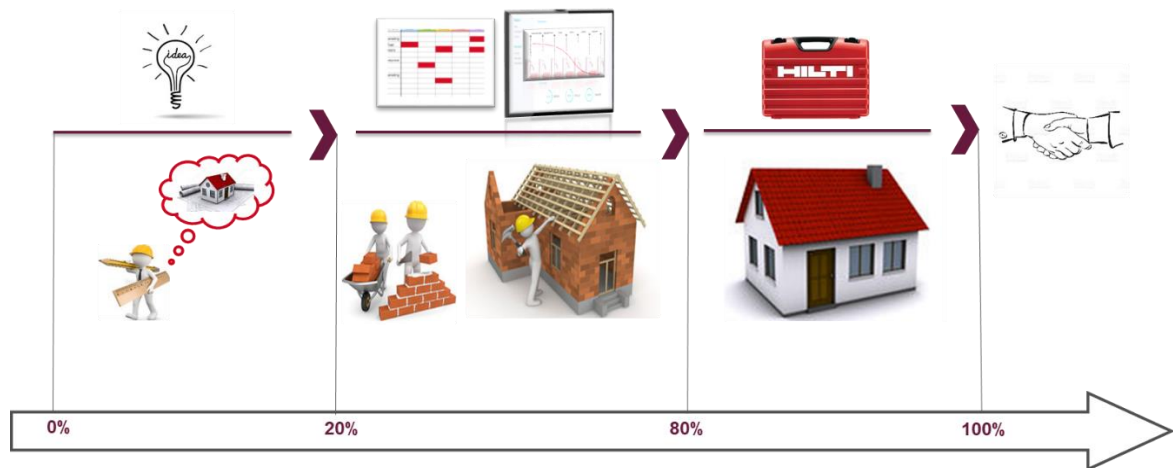


Figure 25
What's product maturity?

The figure above represents an example of the product maturity during the development process.

The product development process starts with the idea generation and continues with the concept development. Once decided upon a product concept, management can evaluate the business attractiveness, the feasibility and the risks of the proposed new product and decide to move forward with the development.

If the product concept passes the business test, it can be developed into a physical product. In order to do so, the following activities are fundamental:

- Definition of an action plan for the next steps.
- Allocation of resources and definition of responsibilities
- Prioritization of activities and timing definition.

The ultimate step is the introduction of the product into the market. In all the steps of the process, the most important focus is on creating superior customer value with outstanding and differentiated product.

All the activities and tasks required to develop the product form the maturity of the product along the TTM process. The maturity increases within the gates; the gates represent a funnel and not a tunnel. The level of detail and precision grows in the different phases.

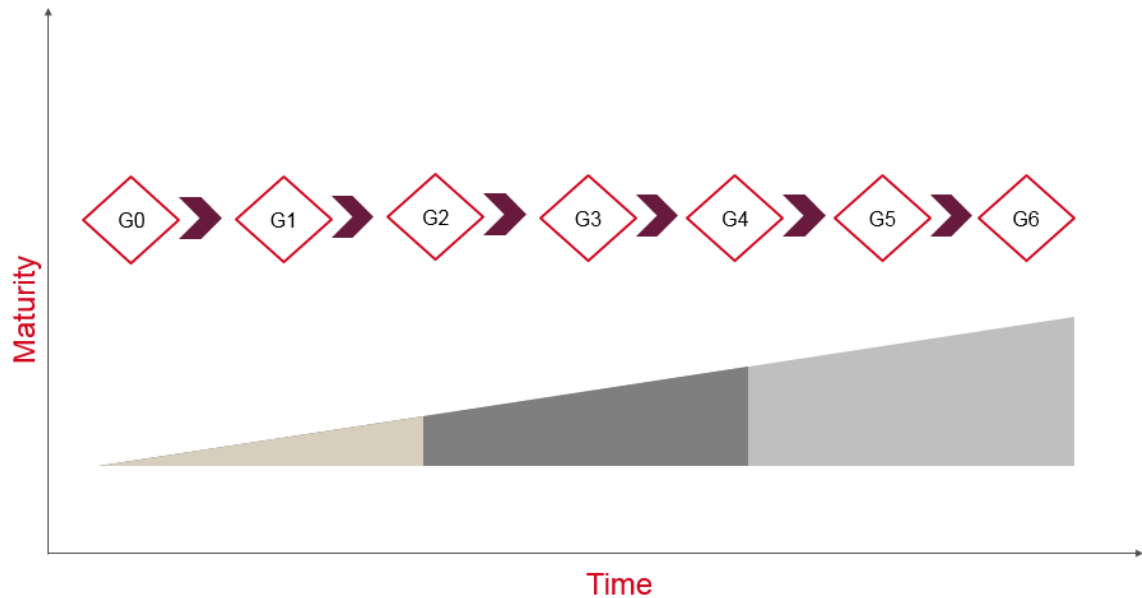


Figure 26
Product Maturity evolution

The objective of this change is to foster a system thinking methodology in the employees' mentality, in order to develop a new way of dealing with the gates. The employees' mindset should move from a simple check in a box, to really thinking about what it has been doing, by considering the importance and the relations between the deliverables.

Foster people to think and not being passive, by broadening the thinking, will help articulate problems in new ways.

System thinking refers to a management approach that analyses decisions based on the systematic consequence they have. A system is a set of connected activities, deliverables or tasks that form a complex process. System thinking foster to look at the big picture, and allow to see how distinct elements interact with. It provides a framework to see the whole picture and understand the complex dynamics and interdependencies. Stepping back to look at the whole picture enables to determine strategic interventions that were not easy to define just looking at the specific task. This saves money and time and addresses root causes instead of simple put on a Band-Aid.

Instead, traditional thinking refers to a management approach that helps handle the complexity of a system by focusing on the single tasks and activities.

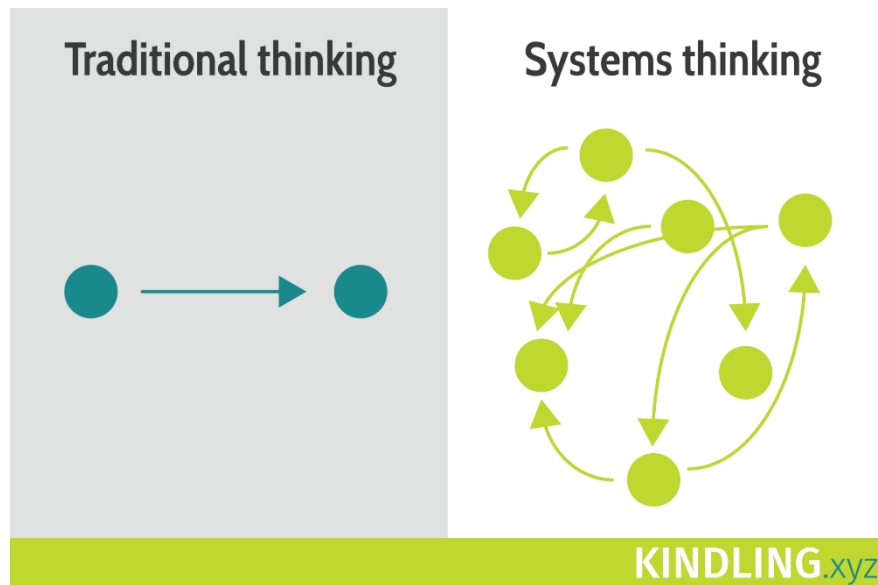


Figure 27
Traditional thinking vs System thinking, Kindling.xyz

The shift to a thinking driven mindset is not easy, but by applying the new concept the TTM team will be able to respond faster to business requirements and deliver more value in a quicker way.

6.2.1 Core idea

The product maturity concept consists of defining per each value stream, a further level of value streams. The purpose is to identify the key contents that evolve through the gates, from G0 to G6, and cluster the deliverables per content, replacing the checklist methodology.



Figure 28
Value streams, Hilti.

In order to identify the key contents and study their evolution, an intense study of the deliverables and their links, along with a set of interviews with experts were conducted.

Following the SIPOC methodology, it was clearly defined the scope of every deliverable and their impact on the whole process.

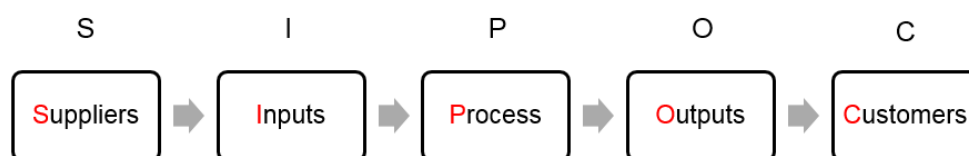


Figure 29
SIPOC

SIPOC, in process improvement, stands for Suppliers, Inputs, Process, Outputs and Customers. While “Process” describes the deliverable and what needs to be done to accomplish it, “Suppliers” and “Customers” represent who supply the relevant information

and material and who need it. “Inputs” defines what the relevant data to complete the deliverable are and “Outputs” represents the results of the completed deliverable and its impact on the rest of deliverables.

SIPOC is an efficient methodology that helps to get a high-level understanding of the scope of the process and of the deliverables. It provides a structured way to discuss the whole process and highlights what it involves.

By using this structure, it was possible to define and analyse not just the content of the deliverables and their dependencies, but also clear roles and responsibilities.

For instance, in the development value stream, three different sub value streams were identified to gather deliverables with a connected content.

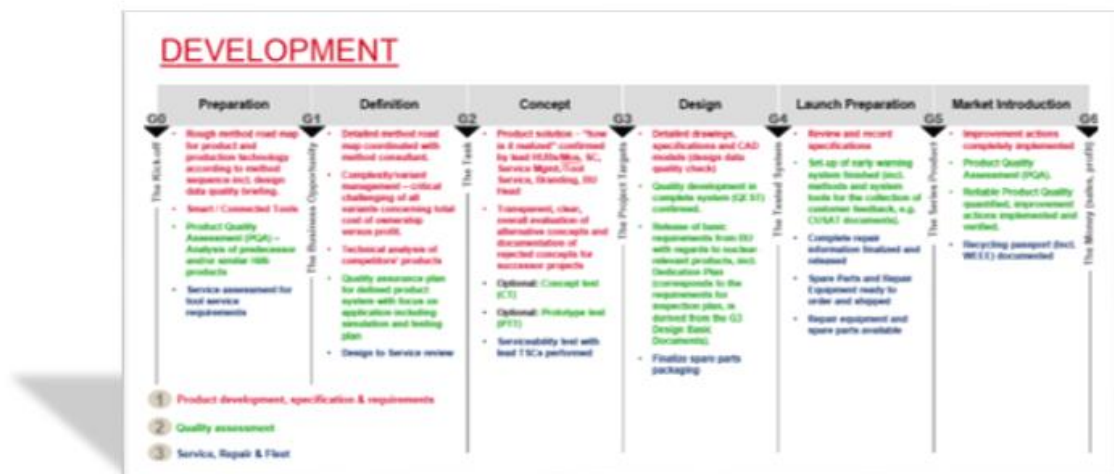


Figure 30
Deliverables Development, Hilti

For a matter of confidentiality, it is not possible to show the deliverables and the contents behind them. Nevertheless, the idea behind the product maturity concept is to highlight the sequencing and the relationship between the distinct deliverables along the TTM process by identifying core concepts that evolve throughout the process, as for example in the testing value stream. The testing phases of product development ensure that the process and the product operate as expected. Different tests are conducted before every gate to validate the process and product requirements and the level of detail, the reliability and specificity of such tests increase progressively.

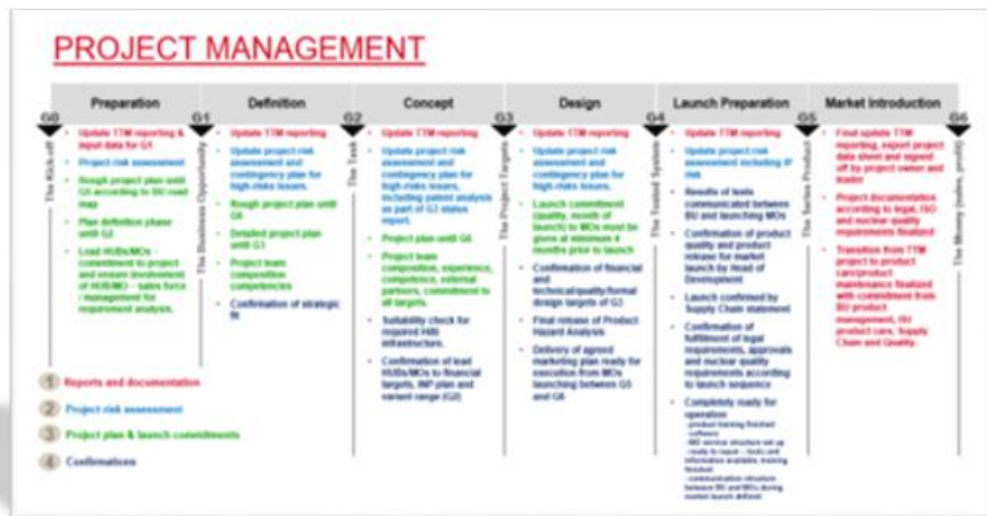


Figure 31
Deliverables Project management, Hilti

In project management, the project risk assessment should be gradually more accurate and scrupulous. There are several factors that can impact the process, such as the nature of the business, the current state of the market, the economy, the availability of technology, etc. There is a continuous evolution of risk management.

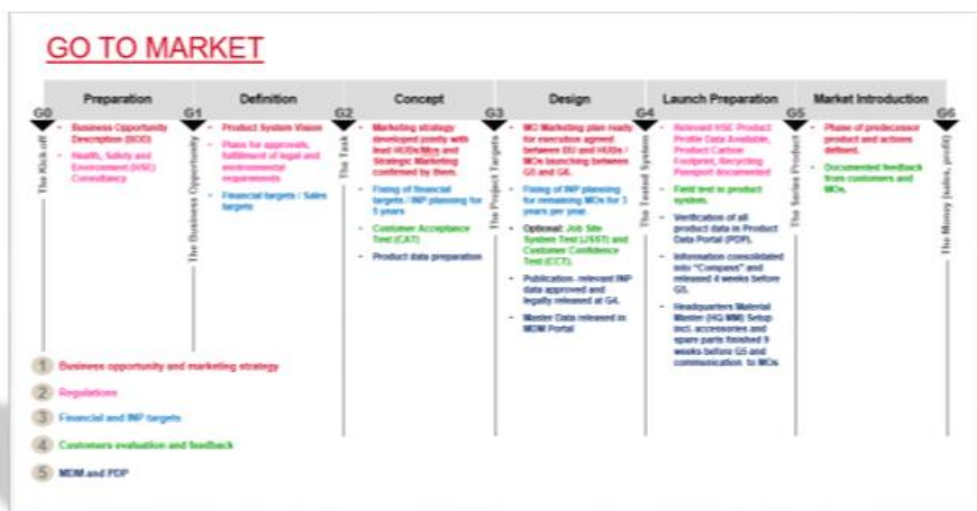


Figure 32
Deliverables Go to market, Hilti

Another example of concept evolution is the specificity of the business opportunity description and of the related deliverables. Market research is critical to business success. The definition of the business opportunity starts with the understanding and evaluation of the markets and of the customers' needs. The definition of the business opportunity

becomes more detailed and specific through the gates and it evolves into a marketing strategy and a marketing plan.

In supply chain, the integration of the product and assembly processes is essential to the

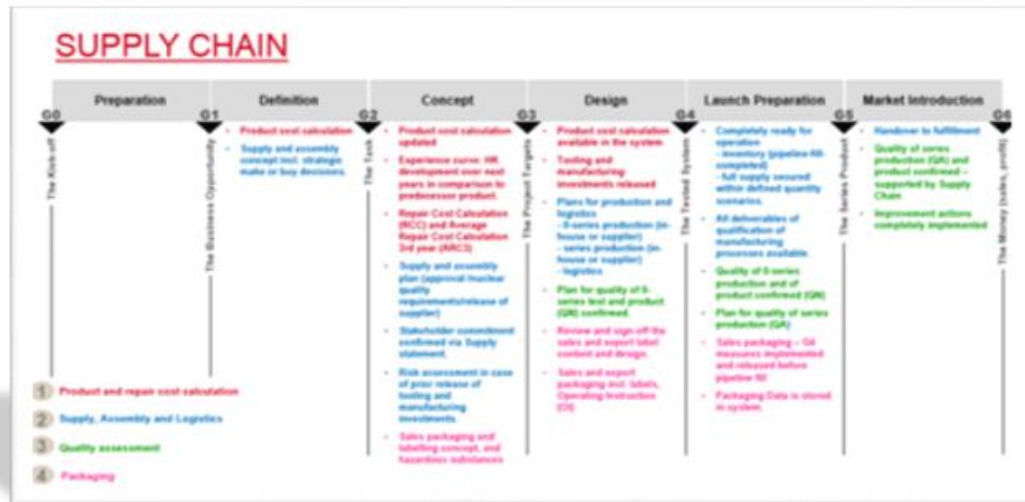


Figure 33
Deliverables Supply Chain, Hilti

logistic process plan. The evolution of the supply concept starts with the definition of the manufacturing requirements, it evolves with the consideration of different suppliers and the definition of a production plan. It also includes packaging processes, warehouse planning, picking, etc.

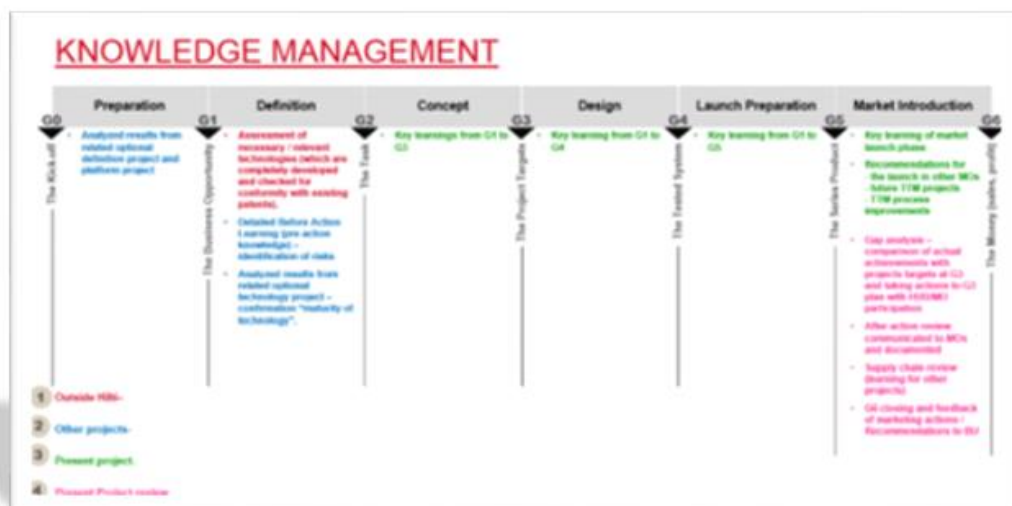


Figure 34
Deliverables Knowledge Management, Hilti

After having defined the core project driven concepts, it is important to identify key questions, which will correctly and exhaustively summarize the content behind the related deliverables. The key questions will function as a framework to check the status of the project, reflected on the product maturity, in the gate review.

The purpose is to shift from the checklist mentality to a product maturity mentality. The maturity of the product is represented by the distance between the actual level of completeness of the value streams compared to what should be the level of completeness.

In fact, by defining the key questions, the gate review will be focused on the answers to the key relevant contents and on ensuring to meet the required product maturity to pass the gate.

For instance, the project manager won't need a list of deliverables to check the status of all of them, but he will use the key questions that will foster discussion and an analysis of the project status.

Furtherly, to help the presentation of the project progress and risks, a tool to visually check the status of the product has been developed. Product maturity is mostly related to the following value streams: Go to market, Development and Supply Chain, while the value streams Project Management and Knowledge Management serve as a support during the whole process.

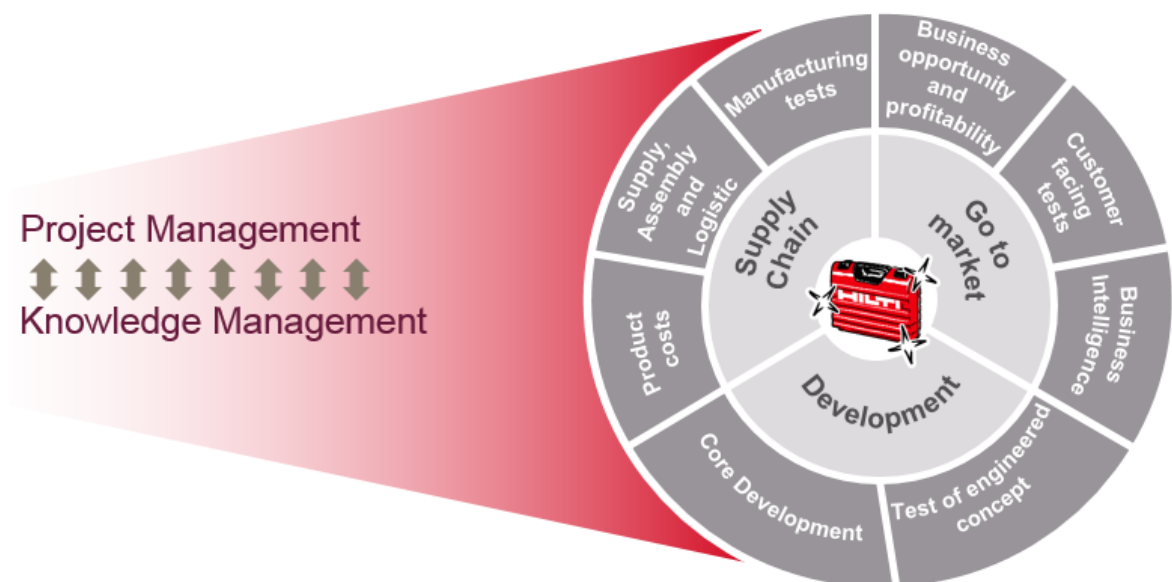


Figure 35
Product maturity radar, Hilti

The radar represents a general example of value streams that can be identified in a product development process. In the radar is possible to distinguish two different levels. The first degree refers to the macro value stream, while the second degree shows an example of sub value streams that can be considered to value the product maturity.

In this case, for instance, development consists of two main macro contents:

- *Core development*

It represents all the tasks and activities that are related to the engineering development of a new product. Design and engineering are fundamental for product development success. This value stream is strictly related to turning the prototype or concept into a workable market offering.

- *Test of engineered concept*

It integrates the results of the feasibility analyses and feedback from various tests. The goal is to validate the entire concept by testing the product before launch. The testing and validation tasks help to ensure that the design concept works as intended.

Go to Market is made up of the following main contents:

- *Business Opportunity and Profitability*

It involves activities and tasks that define and follow up on the evolution of the business opportunity and its expected profitability.

- *Customer facing tests*

It includes the aggregation of the results focused on customer experience. An effective customer experience testing strategy can bring the best of design by increasing the emphasis on customer experience and product performance.

- *Business intelligence*

Business intelligence refers to a system of models, methods, processes, people and tools that make it possible to gather, analyse and organize data of business information. Therefore, it refers to all the deliverables related to gathering product related data.

Supply Chain is composed of the following main contents:

- *Product cost*

It integrates all the financial driven deliverables. It is considered helpful to work on product costs calculations since early stages of a product development project, in order to apply a suitable financial model that is applicable to sustain highest possible profitability since the beginning of the process.

- *Supply, assembly and logistic*

New product implies the configuration of its corresponding supply chain. A better performance is achieved if the supply chain functions are optimized. Moreover, there is a close connection between product design and supply chains performance. Therefore, this value stream includes all the supply, assembly and logistic related deliverables.

- *Manufacturing tests*

It represents the manufacturing work plan, the manufacturing readiness test plan and manufacturing test verification. Manufacturing tests include also the overall manufacturing strategy, a detailed manufacturing work planning and a detailed list of manufacturing requirements.

By assessing the maturity of each value stream, the management will be able to make informed decisions based on progress and on the status of the project to re-prioritize activities, re-allocate resources and consolidate an action plan for the next phase.

Moreover, by presenting results and the status of the project with the help of visual artefacts, the management will be able to see the values and the issues of the project and it will be easier to allocate resource and plan the next project phases accordingly.

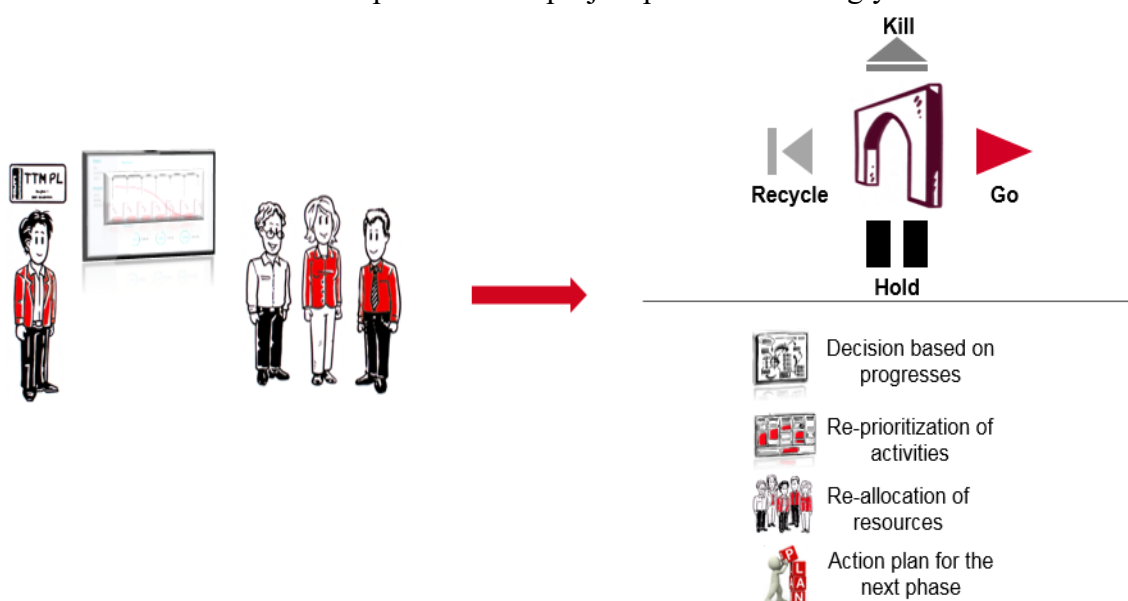


Figure 36
Gates review meeting

The criteria to set the maturity change depending on the product and on the complexity of the requirements. The project manager will clearly present per each value streams:



Figure 37
Value stream presentation methodology

- *What is the purpose?*

The objective of presenting the purpose of the value stream is to state the reason for which the tasks related to the specific content are accomplished, by defining their importance and their sequence. This is important to define the work that has been done and it enables to focus on what is important to bring the project to completion. The project manager should describe the activities in a comprehensive, logical and clear way.

- *Who is involved?*

To clearly identify the aspects of the project, it is important to establish the objectives and goals of the value streams in the process but also define the resources needed to accomplish successfully the required tasks. Although, different team members contribute to the accomplishment of the required tasks, it is important that one team member is in charge. The project manager should state clearly which team member is responsible for the activities in each value stream. Furthermore, it should be defined what was carried out by whom and with whom.

- *What is the outcome?*

The outcome represents the products, services, analysis or activities resulting from the accomplishment of the deliverables linked to the content. It is important to clearly state the outputs in order for the steering committee to assess and compare them with the expected results.

- *Relationship to other value streams.*

Breaking down a project into different concepts is a way to manage the steps that are necessary for the completion of the project. It is, hence, important to ensure the integration of the contents within the broader project framework. The relationship of a content to other contents should be made explicit by stating how the outputs of a value stream will be used by others.

6.3 Required product maturity to pass the gate

Defining the maturity to pass the gate is a challenging task, as it heavily depends on the complexity and on the type of product. Therefore, while the maturity concept, and therefore the key relevant questions that identify the evolution of the main contents need to be clearly defined and standardized to be used from the different BUs, the criteria used to assess the product maturity are defined differently for each BU.

With a focus on each gate and on the key contents, using the key questions, it is evaluated the level of details needed for the answers to be punctual and exhaustive to pass the gate. A matrix will define for each value streams and for each gate the specific content needed to pass successfully the gate review. The product maturity degree indicates the number of fulfilled requirements on the basis of the released parts compared to the total number of requirements.

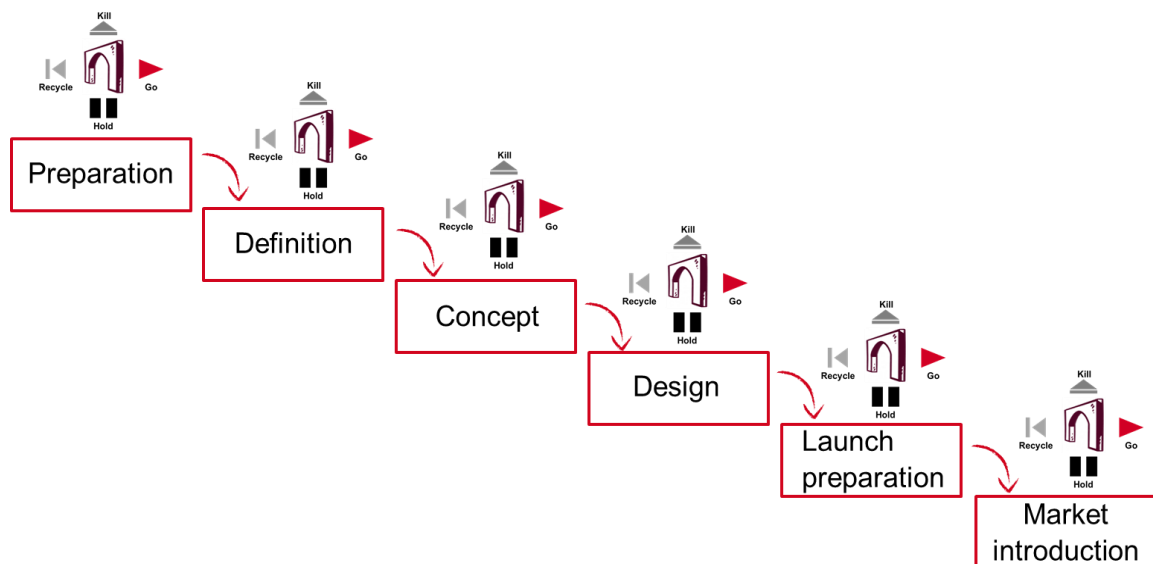


Figure 38
Evolution through the gates

The basis of the product maturity concept is the continuous evaluation and assessment of the requirements related to the main contents during the whole development process. It's the risk of proceeding with working on the new deliverables that represent the maturity of the product. The lower is the risk the higher is the maturity.

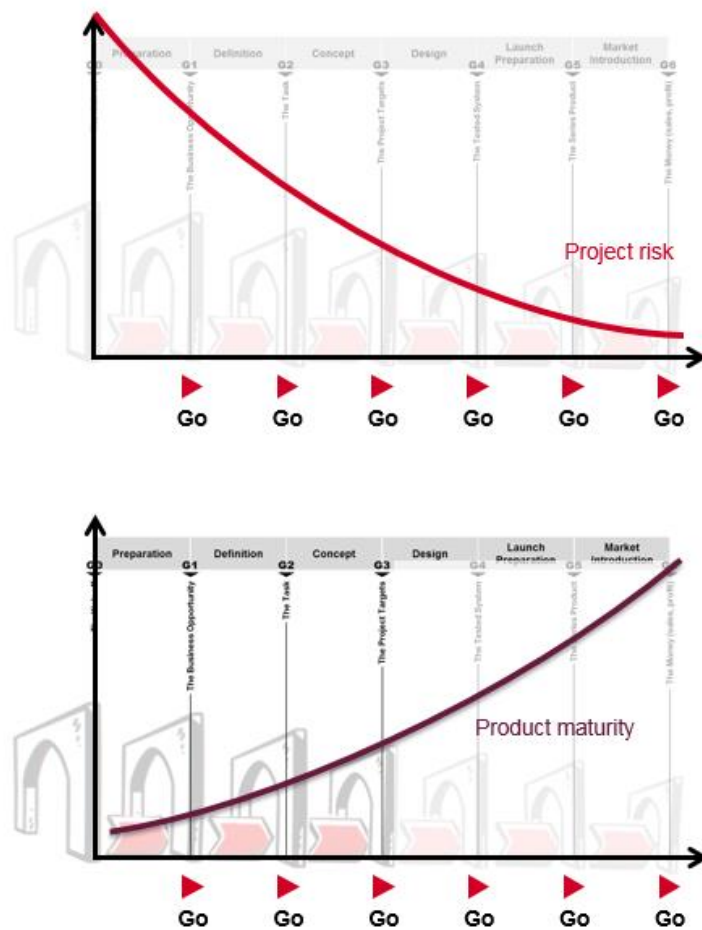


Figure 39
Project Risk and Product Maturity graphs, Hilti

In fact, the overall product maturity increases throughout the gates because information increases and uncertainty decreases. The project risk decreases throughout the gates for the same reason.

The product maturity is reflected by the completeness of the deliverables. Once all the deliverables are completed successfully the maturity will be at its maximum. By using the key questions to frame the main concepts, needed at each gate, will be possible to track the readiness of the concepts to assess the overall product maturity.

This means that at every gate the overall product maturity grows of a percentage, the percentage is reflected by the evolution of the main driven concepts of the development process, referred to each value streams.

The project manager will use the radar tool to show the progress of the project so far and will fill the tool with the required information that will define the product maturity achieved.

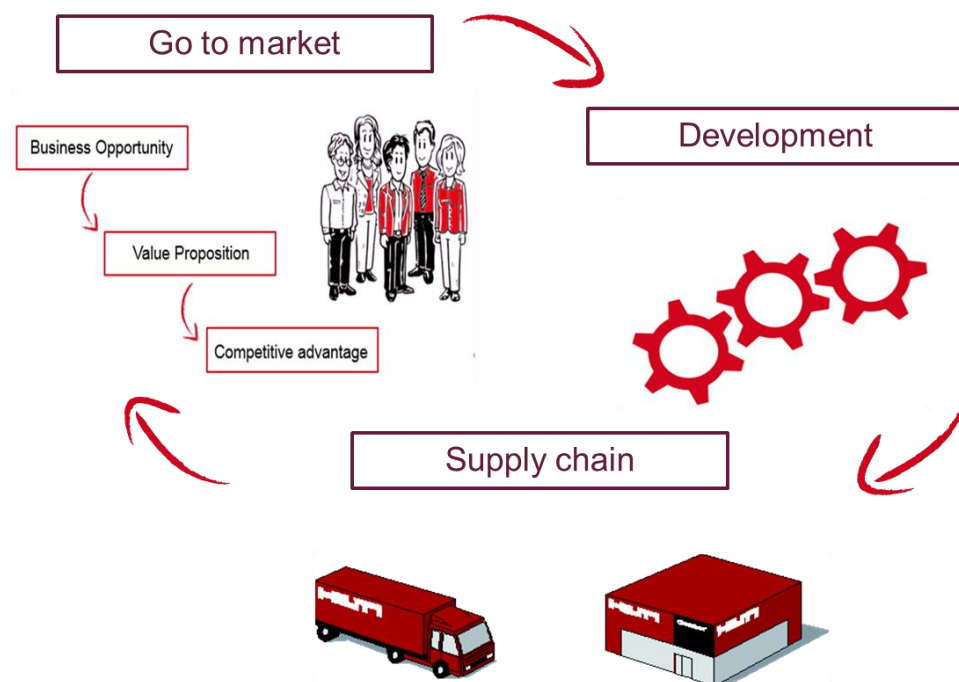


Figure 40
Main value streams, Hilti

The management committee, in charge to assess the project during the gate review, should understand the difficulties encountered during the phase and decide on the next steps, by assessing the gate and validating it.

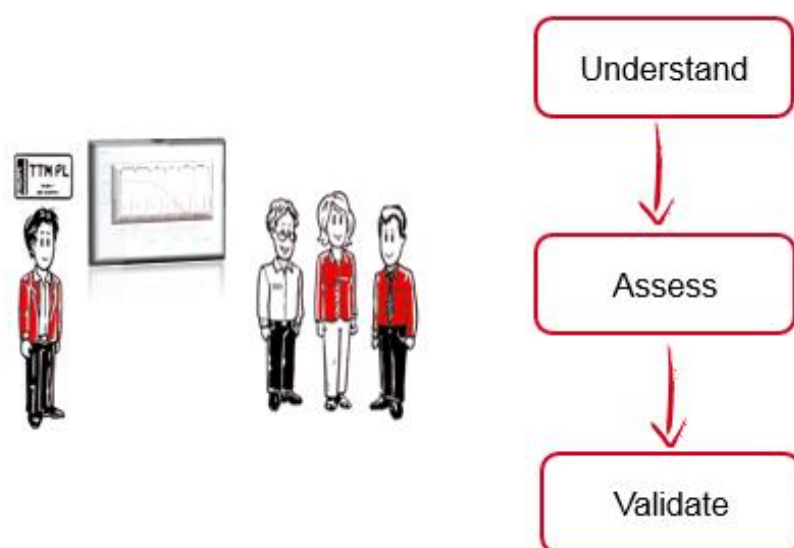


Figure 41
Management committee, Hilti

The development scales measure supply chain, development and go to market readiness. The measures within each of these value streams for a not enough mature product at G1 are different from those for a mature product at G6, but at both gates the product could be considered mature relative to the stage of development.

A concept that is in the initial stage of development will have less detailed information than a concept in late stage, but it can be still considered mature for its relative stage of development.

The factors used to assess the maturity concept should be able to identify the shortfall in capability, identify the needs and determine what is required to meet the needs. Any concept that the decision makers deem sufficient will undergo further maturation with deeper analysis.

6.4 Concept introduction to BUs

Defining a concept that could be applied to different BUs and different approaches is ambitious. The BUs use different techniques and have different priorities.

Even though the BUs use the same TTM framework, they use different tools to manage the process. Therefore, the main difficulty in the development and implementation of the product maturity concept is represented by the integration, application and compatibility with the distinct tools. The product maturity model should be easy to use, and not time consuming, to be efficiently used.

Among various tools that help stimulate and facilitate the decision-making process and the problem solving, used by some BUs, there is the Obeya tool. This tool is part of the lean product development. Obeya is a Japanese term that means “big room”.

It is a dedicated room that provides a common space to communicate efficiently. The purpose of the room is to provide an area where projects progresses are made visible so that the cross functional team of people that interacts with a project can visibly track progresses. It does not have to be a room; it can also be a place where the team members constantly review the project and assess the current state. The idea is to bring people involved in the process in one place so that they can meet face to face improving communication. Obeya helps govern a process in a visual way.

Another tool is Jira. Jira is a software that is used to manage product development, it drives clarity, efficiency and visibility. It allows the team to have full transparency on the

deliverables status during the whole process thanks to relentless prioritization, requirements revisions and status reporting. Thanks to the Jira Core board it is possible to quickly see where the process is at, how much work is in progress, or how many items are stuck in review. It also gives a quick view of what is overdue and who is assigned to issues, so it's easy to follow up. It's possible to create sub-tasks and assign them to different people.

Despite the diversity of the different tools, the product maturity concept is a general concept that can be implemented as a framework to guide the team during the process in order to really understand the logical flow of the deliverables and the importance of doing them correctly and efficiently.

In fact, even if the BUs use different techniques and approaches the product development framework followed is the same and the relevant contents required to pass the gate do not change. Therefore, it is possible to identify common and general value stream that must be present in every TTM project, regardless of the kind of product or BU.

7 CRITICAL DISCUSSION AND CONCLUSION

This chapter presents the main strengths and weaknesses of the product maturity concept and concludes the thesis by highlighting the benefits it could bring to the company if it is used properly.

7.1 Weaknesses

The implementation of a new approach and mentality that replaces the current checklist mindset involves a change in the working mode. In a business context, change can be extremely difficult and costly to adapt to. In order to accept and adopt the change, it's necessary a great deal of effort and willingness to improve. As Henry Ford once said "If you always do what you've always done, you'll always get what you've always got". Change is vital for business development, growth and optimization of productivity. It can be extremely challenging, difficult and frustrating; however, it can also be inspiring and rewarding.

The mindset change was seen, by some TTM PL, as a revolution rather than an evolution. Some project managers did not perceive the value of the change and therefore consider it unwarranted. They were hesitant to embrace the concept.

Therefore, to overcome the resistance, it was presented the idea to organize a workshop to introduce the new concept and the advantages of it by creating interactive scenarios where the attendees would be able to apply the checklist mindset and the product maturity one and see by themselves the benefits of it. This would help to clearly outline the need for a change by understanding the motivations behind the proposed change. The attitude toward change can be conservative until the reasons for the change and the consequences are clearly defined.

The mindset change does not have to impact the quality of the deliverables or results in a general accomplishment of such, at the opposite it should occur in a better deliverables quality with improved focus on important tasks. The focus on the big picture is necessary to understand the process and go beyond the simple task.

By abandoning the checklist mentality, the project leader should not forget about the complete package of deliverables. The product maturity is meant to help concentrate the gate review meeting and the check of the content with an improved attention to the whole process.

The checklist based tool was developed to deal with the complexities of the innovation process. The checklist allows to go on autopilot mode and check the deliverables without really checking the content of them.

The checklist tool helps to execute the project without really thinking, it allows fluency of automatic thoughts, behaviours and interactions with the environment. The automation makes the process much more predictable, and based on the experience it should be clear how things are supposed to go. However, thinking about things the same way over and over again does not foster improvement and innovation, if something does not go as planned it's not easy to react. For this reason, to enhance more flexibility and versatility the product maturity concept is suitable to be adopted to push people to think instead of just executing.

The product maturity concept aims to foster a discussion and question the work that has to be done.

7.2 Strengths

The product maturity concept functions as a support for prioritization. Some deliverables, in a total offer, are bound to be more important than others. From a product maturity perspective, this must be supported to allow teams to focus their time and effort on areas that matter the most. Therefore, the product maturity concept enhances the speed to market and the level of quality of the employees' approach to the accomplishment of the deliverable.

Product maturity supports the elaboration of risk in taking Go-decisions, No-go decision or Conditional-go decisions, based on the quality of the maturity base. It is proposed as a structured but also flexible concept that will empower employees to make better choices by having a full overview of the whole project.

Moreover, it also helps to have transparency and full traceability of the project. The proposed model allows to trace individual factors and contents, and trace their level of maturity. Thus, the model displays the individual value stream influence on the maturity of the total offer.

Product maturity was introduced to support the decision making in the gates review by focusing on the product. More specifically, product maturity supports:

- Considering the product at the centre of attention and allowing decision makers to focus on highlighting and addressing assumptions, uncertainties and ambiguities.

- Assessment of the quality of the decision, thus looking beyond the face value of the deliverables and focusing on the performance of the main evolving concepts at gate reviews.
- The possibility to focus improvement on areas with low product maturity.
- Confidence for decision makers by an enhanced awareness of the overall process weaknesses and strengths.

The maturity tool was developed as a support tool that aims to support decision making in gates by comparing the current (as is) levels of product maturity with required (to be) levels for go decisions.

During the gate review, it is important to show that the project is on track and that is proceeding as expected. The objective of the review is to reach a decision on whether to proceed to the next project phase or not, or whether the project can proceed to the next phase with a “conditional pass”. In order to do so, the management who attends and is responsible for the gate review should be provided with the information needed to reach the decision.

Thanks to the product maturity concept developed, the team knows what to focus on and the management will have a clear understanding of where is the process at, by looking at the maturity tool that shows the overall product maturity.

Prior to the gate review, the project leader should have a complete knowledge of the status of the deliverables, resources and potential issues. A good way to focus on what really matters and what is necessary to pass the gate by having a successful product is represented by the process of underlying the main contents that need to be covered.

In fact, after an analysis of current gate presentations from different BUs and project managers, it was easy to perceive the evolution of certain value streams throughout the whole project.

The developed concept is suitable for every BU and can be applied even using different tools, because what really matters is the scope of it and the key questions will help to follow the red thread.

7.3 Conclusion

The objective of an efficient product development framework is to generate more sales and greater profitability. In order to avoid revenue loss, it is important to avoid being late to market and miss opportunities caused by late launch. A well-structured process is required to effectively collaborate and share information among different team members.

Nowadays, companies are facing relentless pressure to speed the new product development process, because product launch delays can cost an organization a significant percentage of its return on investment. The earlier a product reaches the market the longer the life span of the product. Moreover, an early to market product is less likely to face initial competition.

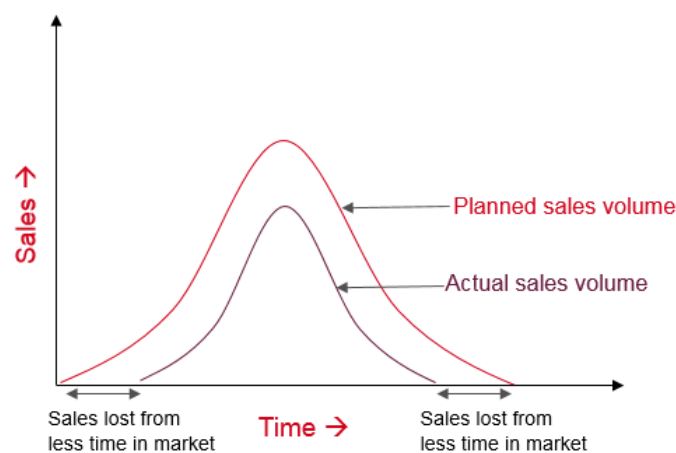


Figure 42
Time to market impacts on revenue and profitability, Sopheon

For these reasons, it is fundamental to apply a systematic framework that forces a timely and informed decision making and foster discussions and improvements.

Hilti's 2020 strategy is focused on increasing the speed of TTM processes, therefore the launch of new products in the markets, and the number of new product families developed and launched in one year. In order to accomplish the strategy and improve the overall TTM process a change that will lead to the improvement of the process is required.

There are many decisions that must be made in running a successful product development process and in order to make the right choice there are a number of tools that entrepreneurs can use. For an effective decision making, it is important to gather the relevant information and weigh the critical factors. Decision making in product development is a crucial activity, since the decisions have high impact on the development and launch of the new product.

Consequences of unsuccessful decisions can be severe and can result in missing out on business opportunities or on wasting time and money.

A key success factor for many companies is the presentation of the information optimally configured for the specific analysis needs. The product development process involves different stakeholders from different part of the organization, such as marketing functions, supply functions and development functions. In order to have a complete picture when it comes to actual performance, analysis and comparison, a good system in place to gather and present information is essential.

Ideally, before each gate, the project manager should check the quality and the content of the deliverables needed to successfully develop the product, he should ensure that they are accomplished on time and present the project status to management. However, it is a time-consuming activity which requires a huge effort and deep knowledge on different topics. Therefore, at the moment the project leader checks if the deliverables have been completed at the right time and presents the status and the risks of the whole project to management by using a checklist.

To move away from this checklist mindset, considered limiting, not flexible and outdated, it was researched a methodology that could help to check the content of the deliverables and improve the precision of the presentation at the gate review meeting, speeding up the TTM process by making easier the decision-making process. The result of a benchmarking analysis of the different methodologies that could have applied to facilitate and assess the project, was focused on the maturity models.

For product development, there are different types of support tools available, and there are different models and methods, such as Milestone Analyses, Quality Gate Systems or Failure Mode and Effect Analysis, but they lead to an estimation of the maturity only at a specific point in time, only a snap shot and do not reflect the real trend of the product maturity. They don't assess the maturity of the whole product throughout the whole process.

The product maturity model proposed in the thesis is a structured, but also flexible, framework that helps to manage the development process milestones efficiently and effectively.

The proposed product maturity concept aims at:

- Improving the efficiency of the project manager in managing the product development process, by presenting a new framework that will foster discussion and will analyse the evolutionary content of deliverables, and more importantly will help to focus on what really matters to develop a high-quality product.
- Improving the decision-making process during the gate review meeting, by using a visual tool to show where is the project at and what are the risks that need to be dealt with. Visuals are faster and easier for the brain to process, and can help drive better business results.

In conclusion, the product maturity model defined in this thesis has the potentiality to improve the quality of the TTM process and reduce the time needed to complete it. Furthermore, the concept can be integrated in every BU, even if they use different tools, and it is compatible with the Agile methodology that is currently running at Hilti.

7.4 Future expectations

The maturity concept was presented to at least one project leader of every BU. It is currently being tested by a BU in a small project and it is being analysed to report advantages and disadvantages.

The expectations are:

- *Higher quality in decision making.*

By providing and presenting high quality and well-structured data to the management committees.

- *A better understanding of the process.*

By clearly defining the main value streams and the key contents that evolve during the process.

- *A clear deliverables' sequence.*

By identifying the logical sequence of the deliverables along with the inputs and the outputs needed to accomplish them successfully.

- *Clear link between deliverables.*

By precisely specifying the key contents that are part of a value streams and by determining the connection between different tasks and roles in the TTM process.

- *Higher efficiency and effectiveness of project managers in presenting the status of the project.*

By setting up an efficient framework, composed by key questions that help structure the main outputs required for a successful new product.

- *Faster TTM process.*

By implementing the product maturity concept and having transparency on the process, on the deliverables and on the evolution of the key contents.

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