The Customer Requirements Value Stream In Lean Project Management

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Table of Contents

Abstract

Lean Project Management aims to reduce waste in the organization and add value to the final customer. A company can identify areas for improvement by using Value Stream Maps. Organizations should map the value stream that links market requirements to project organization models. For defined and static needs, a linear project approach will provide the quickest and least resource intensive results. For uncertain and dynamic needs, an iterative project approach will avoid wasted efforts by allowing updated market analysis throughout the life of the project. This paper identifies and analyzes many of the possible components involved for decision making in this value stream.

Introduction

In the recent economic downturn, organizations are looking at ways to reduce costs throughout their operations. One way to do this is applying Lean methodologies to non-manufacturing units. Operations, Finance, Engineering, and Marketing are all contain opportunities to reduce waste with Lean methodologies, thereby increasing the organizations profit margins. Understanding customer needs in order to optimize their processes is one of the areas that companies struggle with; If organizations incorrectly identify the volatile segmentation [1] of customer needs, they will likely organize their projects around the wrong development model. Traditional phase project approaches are generally the least complex and the fastest tracks to get a product to market. However, if customer needs change during the life cycle of a traditional or linear project, the company could end up wasting resources or creating a product that is no longer desirable. Conversely, iterative approaches provide gates for customer input throughout the life cycle of the project. In this case, if customer needs are static, the organization will waste resources due to project complexity and the time to market will be unnecessarily long. An organization needs to maintain careful analysis of the market in order to implement Lean methodologies.

The Value Stream is a Lean concept that companies can use to analyze the potential areas for process improvement [2]. In the case of project management, a vital Value Stream exists for feeding customer needs into project requirements. This value stream (Fig. 1) starts at the customer, moves through the marketing unit, and finally feeds into the project team. When a company can correctly identify the factors involved, they can create a Value Stream Map to model this flow. The importance of process optimization with a Value Stream Map is that the organization can match the correct project management model to the needs of the market, which saves resources and gets the product to market as quickly as possible.

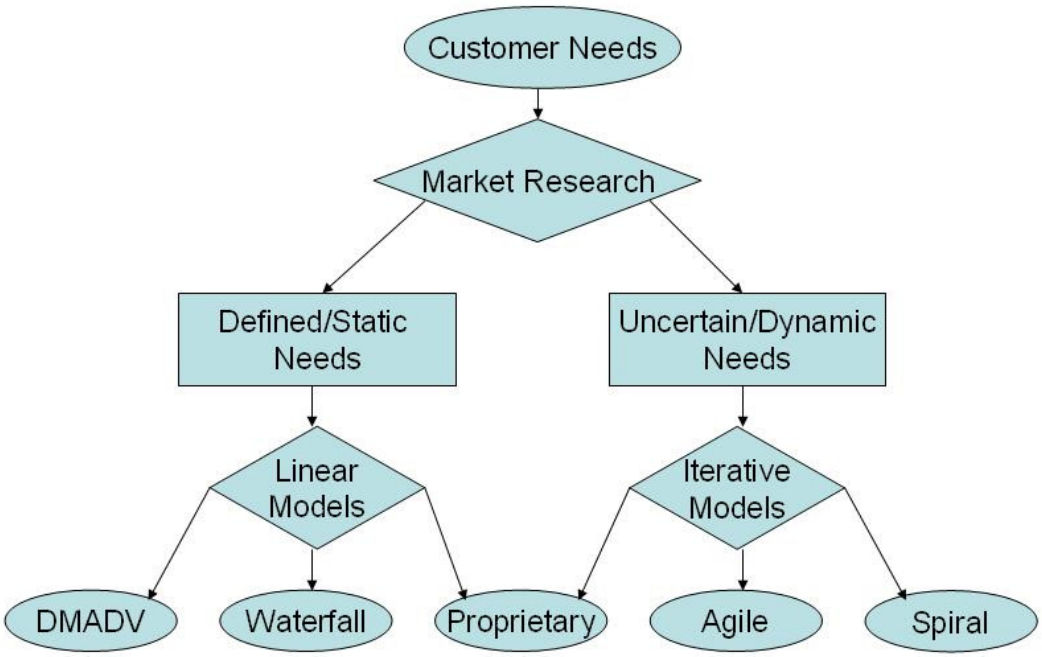

Figure 1: Possible Value Streams for Linking Customer Needs to Project Models

This paper focuses on the elements in the aforementioned value stream. First, it introduces the methodologies of Lean Project Management to illustrate the goal of reducing waste. Then we look at customer needs and how they dynamically change over time and some of the tools to capture those demands. Third, we will analyze the application of traditional phased approaches used in Lean Project Management. Finally, we will review iterative approaches for addressing volatile demand changes.

Lean Project Management

One of the innovative aspects of thinking Lean is the reliance on the identification of the root cause of problems rather than the solution to symptoms. The application of lean thinking will force a revision to the whole supply chain in which the business process sits, and this frequently reveals bottlenecks and pockets of inefficiency. Any bottlenecks in the organization's process will limit the effectiveness and efficiency of the overall design. Companies apply Lean thinking to a number of different business processes. Key among these is Lean Project Management (LPM), the business methodology in which managers eliminate waste from discrete project oriented activities [3], [4].

LPM aligns all activities in the project management chain to the excellence expected by the end-customer. The main goals of Lean methodology are to improve quality, eliminate waste, reduce the time needed to finish an activity, and reduce total costs [5]. Companies achieve quality improvement by designing processes that meet customers' requirements. This is necessary for any company that wants to gain a competitive advantage over other producers in the market. Waste elimination would start by identifying the activities that consume time, resources, or space without adding value to the product. Evaluations of manufacturing processes result in the identification of seven of these activities; overproduction, inactivity periods, unnecessary movement of materials, extra processing, excess inventory, extra steps, and failure to conform to specifications.

LPM is a methodology that is attractive to team leaders looking for fast results on critical turnaround assignments. Many project managers decide to go Lean when faced with budget cuts or other constraints [6]. A Lean manager must develop an effective work breakdown structure that represents the project objectives and identifies which team members hold responsibilities for various deliverables and milestones. The Lean manager should also assure team members that performance indicators focus on getting better results instead of placing blame [7]. A Lean manager must include training time in the work breakdown structure for each new process, especially during periods where team members would otherwise be waiting for colleagues to finish dependent tasks, [8]. With these best practices in mind, a project manager can apply Lean concepts throughout the project, from gathering customer requirements, to termination of the project.

Customer Needs

The examination of the customer's needs play a prominent role in project selection and organization [9]. The marketing group must not only correctly identify the customer's needs, but they must also properly recognize how quickly those needs change. In high-tech industries, changes in customer needs are much more frequent than other fields. Therefore, customer-needs analysis plays not only a role in the overall program, but also

how project managers within the program organize projects. This crucial relationship between marketing and engineering teams under LPM requires stringent research, communication, and organization.

Voice of the Customer (VoC) and Mind of the Customer (MoC) are two channels that marketing groups must monitor in order to translate customer needs into project requirements [10]. VoC is the data that customers directly address. This includes known features and desired specifications. Conversely, customers never communicate MoC needs. This may be because the customer believes the requirements are inherently obvious, or they may not yet realize the value of such features and requirements.

The Kano Concept

The Kano concept (Fig. 2) models the relationship between customer satisfaction and product requirements [11]. There are three qualitative plots in the graph: Must-be Quality, One-Dimensional Quality, and Attractive Quality. Must-be Quality or Basic Needs represent the MoC. These are the unspoken requirements that the customer expects to be included in the product. If these attributes are not present in the final product, the customer will be very dissatisfied. However, if the product meets these demands, it does not add much to the customer's satisfaction. One-Dimensional Quality or Performance Needs symbolize the VoC. In this case, the customer has communicated the expectations and there is a linear relationship between these requirements and customer approval. As the product employs more desired features and tighter specifications, the customer becomes more satisfied. Attractive Quality or Excitement Needs also signify the MoC. These features are the innovations and differentiators that add greatly to customer delight. If these features are not included in the product, it does not adversely effect customer contentment.

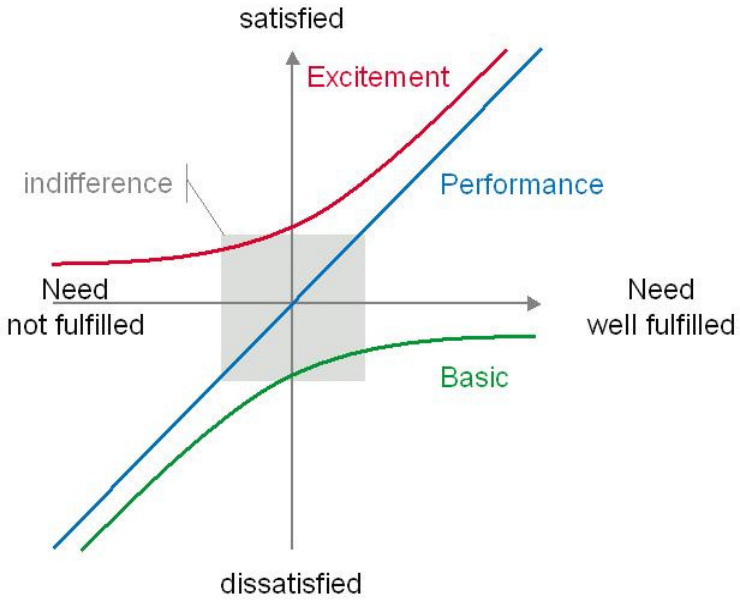

Figure 2: The Kano Concept

Dynamic Needs

Over time, customers needs often become more demanding. In the Kano concept, one can witness this when Attractive Quality becomes One-Dimensional Quality, or One-Dimensional Quality becomes Must-be Quality. To illustrate this point, we will investigate the progression of optical media drives in personal computers. In the late 1980's, some high-end personal computers began shipping with CD-ROM drives. While very little software on the market came packaged on CD-ROM, very few users were dissatisfied with the lack of this feature. However, for those early adopters that could afford the new drive, they were highly delighted with the ability of replacing multiple floppy diskettes with a single disk. Installations became much quicker and media organization became much easier. At this point in PC history, the CD-ROM was an Attractive Quality. By the early 1990's, software manufacturers increased the availability of CD-ROM packages. There was increased value in buying a PC that included a CD-ROM drive, so customers were less satisfied with PCs missing that feature. This marks the point where the CD-ROM drive became One-Dimensional Quality. By the late 1990's, software manufacturers were shipping nearly all software on optical media. The inclusion of a CD-ROM drive in a new PC would not add customer satisfaction, but the lack of this feature would certainly leave customers dissatisfied. The

CD-ROM was then Must-Be Quality for the customer. Other features such as CD-RW and DVD drives went on to become the new One-Dimensional and Attractive Qualities.

In some cases, customer needs can become less demanding over time. When a Must-be Quality feature has become obsolete to customers, it will no longer be required in product requirements. Returning to our previous optical media example, what happened to the floppy diskette drive when the CD-ROM drive became a basic need? Manufacturers no longer distributed software on floppy diskettes, so users no longer needed the drives for loading software. For several years, consumers continued to use the devices for quick file transfers and backups. However, by the mid-2000s, devices such as USB thumb drives had taken over that function. The floppy drive quickly fell off the list of basic needs on a PC, and they soon disappeared from nearly all new PCs on the market. When determining the point at which an item is no longer part of a customer's Must-Be Quality needs, one must weigh cost reduction against waning customer dissatisfaction. There is still a market for floppy disk drives due to needs such as legacy software and capital equipment interfaces, but this is mostly satisfied through add-on products.

The change in customer demands plays a crucial role in how a unit organizes programs and/or projects. The marketing group must be cognizant of not only the customer's spoken and unspoken needs, but at what point in time those needs are likely to change. If the program is going to schedule projects with extended life cycles in a static needs-based environment, a linear or phased approach to the project may be more appropriate. The least complex approach will be to establish the specifications at the beginning of the project and allowing the design groups to move through phases without any changes to the original requirements. This will generally be the quickest and most efficient way to go to market. However, if the customer needs are likely to change during the life cycle of a project, an iterative approach may be more appropriate. When the marketing group is not easily able to predict the changes in customer needs, they may need to review the requirements at pre-determined points within the project.

Market Research

Gathering customer requirements will set the tone for the rest of the project and define which development model should be used. When implementing LPM, getting the requirements correct is crucial, or as previously mentioned, organizations will waste their resources. One can implement these principles in a variety of ways such as determining specifications, costs/pricing, target markets, or value propositions [12]. It is vital to the success of projects for all the departments or divisions within an organization to have identical perceptions of what the product requirements and quality should be or groups could work towards different end goals. There are many ways to gather these requirements – both quantitative and qualitative. Quantitative models include Quality Function Deployment (QFD), represented by the traditional 'House of Quality' (HoQ), conjoint analysis, or through an Analytic Hierarchy Process (AHP). These types of models are only as good as the input data so in projects with a lot of customer uncertainty or rapidly changing demands these models can be difficult to implement. Qualitative methods are more forgiving when it comes to VoC requirements, which are often approximate, undecided, or vague. The VoC can come from different sources including customer surveys, concept testing, and customer visits. This section will analyze the different models available.

Concept Testing

Concept testing can fall into a few different categories – prototype testing, sampling, or beta testing. The goal is to test early stage concepts with customers and get feedback to ensure the deliverable meets specifications. To make the most of early testing it is best to get agreement from the customer to give feedback. In many cases unless an agreement is in place customers will often test until they run into a problem and then set the sample aside to wait for the next revision without ever sending in comments. A common method used to get feedback is to use an Early Tester Program and allow membership based on feedback given. If customers do not submit comments, the researcher can remove the customer from the program so they do not receive future input requests. For the upcoming Microsoft Office 2010 release, Microsoft has created the Send-a-Smile program [13]. When a tester installs the Office 2010 Technical Preview, one of the

components is the Smile feedback tool. As customers test the new software and encounter issues or a feature they like, the customer can click on the happy or sad face to take a screenshot and write a brief comment to Microsoft (Fig. 3). By making the process simple, Microsoft will increase the amount of feedback and be able to improve the new Office program prior to launch.

Figure 3: Send-a-Smile

Customer Interview

Companies that are looking for the next innovation of either products or processes can talk to current users to find out their needs. Often companies will ask their customers what they want and the customer will offer products or services that could help them. Companies will then create these products, but customers might still not buy. This is because customers are the experts when it comes to innovation and do not always see all the possibilities. Rather than ask customers what product they want, researchers should ask customers what outcomes they would like – meaning what a new product or service could do for them. Ulwick has created a five-step methodology to make the most out of customer interviews [14].

The first step is to narrow interviewees into specific groups directly involved with the product. Then select the groups with the most diverse set of individuals to get the most outcomes. Step Two is to capture the desired outcomes from the customers. The interviewer must translate what the customer says into well-formatted outcomes. Ulwick defines outcomes as having both a type of improvement (minimize, faster) and a unit of measure (weight, acceleration) so the outcome statement can be used later by R&D in benchmarking, competitive analysis or concept evaluation. The third step is to organize all the gathered outcomes. If possible, the researcher should categorize the outcomes in a way that makes sense for the product, possibly into groups that correspond to each step of a process. Step Four asks each participant to rate each outcome in terms of its

importance and the degree that the outcome is already satisfied. These values can be used in the "Opportunity Algorithm" which is defined as [Importance + (Importance - Satisfaction) = Opportunity]. The final step is to use this list of ranked outcomes to jump-start innovation in your company. The ranking of outcomes shows the most promising areas as well as the areas that are not worth pursuing. In addition, different groups might rank higher on different outcomes pointing to possible segmentation that which competitors were unaware. By following Ulwick's methodology companies will know which features a customer values and can focus R&D accordingly.

Customer Visits

The same principles in customer interviews apply in customer visits. When talking to the customers, focus on the outcome they desire rather than the product that will do it. Customer visits should include different functional areas such as Engineering, Marketing, and Management within the corporation. Another benefit to customer visits that researchers should take advantage of is the ability to observe customers in their own setting. Spending a visit in a conference room can put the customer in a passive role and make it difficult to analyze their daily activities. Visiting customers in their usage setting will capture realistic feedback about the customer environment.

Related to customer visits, is the concept of customer observation where the goal is to watch how a company operates. Based on anthropology and ethnography, customer observation allows the researcher to develop an appreciation of the current user environment, to extrapolate the evolution of that environment into the future, and to imagine the future needs of the organization.

Conjoint Analysis

Conjoint Analysis is a survey research tool that can quantitatively predict which combination of features customers will prefer to buy. The researcher defines a set of possible attributes and presents all combinations of those attributes as different concept profiles. Customers can score each profile between 1 and 100. With those results, an

ordinary least squares regression will yield a consumer utility function and importance weights for each attribute. The researcher can use these values to calculate the Willingness to Pay (WTP) of each feature and the researching company can determine if they can produce the product for an amount lower than the customer's WTP. A disadvantage to this model is for complex projects the number of attributes can increase causing the number of profiles to evaluate exponentially.

Quality Function Deployment

Quality Function Deployment (QFD) is an engineering tool that emerged from Total Quality Management (TQM) that uses customer inputs into design decisions by mapping the requirements into technical terms for engineers to use in the design process. This process graphically describes the results in an inter-connected set of matrices known as a House of Quality (HoQ). The process ensures the design accounts for the importance from the customer's perspective. The following are the steps involved with the implementation of QFD [15]:

- Collect the VoC needs, generally by one of the qualitative methods described above such as interviews or observation. Prioritize any feedback gathered in order to help engineering determine the trade-offs.
- Collect the customer perceptions of competing products to identify any gaps in current products or processes.
- Transform all the data gathered into project design requirements by mapping the results in a HoQ diagram.

If customers are not able to provide exact requirements then it is still possible to use a QFD model by implementing a model that combines QFD and an AHP decision-making model. The AHP process gives customer requirements a priority by weighting each with techniques like pair wise comparison [16].

Marketing Documentation

After all the customer requirements are gathered, individuals need to summarize them in a format for communicating to the project team. The marketing group often uses two forms of documentation to translate customer needs into project requirements. The Marketing Requirements Document (MRD) outlines the research on customer needs and shows how a product would be able to fill a customer need. The marketing group forwards this document to executive level decision makers and program managers to decide if they should pursue the project, and how the organization should proceed. The document creator will specify if they need to review market demands during the course of the project. From this information, the program manager can decide whether to use a linear or iterative project approach. The Product Requirements Document (PRD) is similar to the MRD, but communicates those ideas after the program manager has determined the project approach. The PRD not only states the specifications for the project, but also includes any changes in requirements that could potentially be necessary. The MRD and PRD should also make the distinction between whether the focus of a project will be to develop a product to be mass-produced for the market, or create a solution for a single customer's needs. Once marketing produces the PRD, management can chose the development model. Depending on the certainty of the customer requirements, this model could be linear or iterative.

Linear Models

One can characterize linear project models with successive phases or gates. The parameters for each phase are generally well defined, and the project team is aware of the milestones that they need to achieve before moving to the next set of tasks. Linear models do not include paths to return to previous phases. DMADV and the Waterfall Model are two project approaches that project managers commonly use in LPM.

DMADV

DMADV is a Six Sigma project approach otherwise known as Design for Six Sigma (DFSS). Many organizations attempting to implement Lean methodologies often use the

Six Sigma approach. This project methodology was inspired by Deming's Plan-Do-Check-Act cycle. Although the Deming model contains a feedback path from the Act phase back to the Plan phase, no such feedback loop exists in DMADV. Instead, customer needs remain a focus during each stage of the DMADV process. DMADV clearly outlines five linear phases for a project. The acronym accounts for the following steps [17]:

- Define the project goals and customer (internal and external) deliverables
- Measure and determine customer needs and specifications
- Analyze the process options to meet the customer needs
- Design (detailed) the process to meet the customer needs
- Verify the design performance and ability to meet customer needs

DMADV differs from the other Six Sigma project approach, DMAIC (Define, Measure, Analyze, Improve, Control) in that DMADV focuses on developing new products and processes, while DMAIC focuses on product and process improvement. The project team can use DMADV in redesign projects when they have previously attempted a DMAIC approach, but the results did not meet customer requirements or corporate Six Sigma goals.

The DMADV project approach is only possible in a Six Sigma organization. Members of the team will include a qualified Black Belt and possibly a Green Belt. These team members will use a data intensive approach to analyze market requirements. The Six Sigma experts will implement tools such as QFD, Quantitative Marketing Research, and TRIZ to ensure the project meets customer demands throughout the lifecycle.

Waterfall Model

The waterfall model has its origins in the manufacturing and construction industries where projects are large, expensive and changes mid-development could be very costly. The waterfall model ensures that the progress will complete the previous step before moving to another. The concept (Fig. 4) consists of five steps steadily flowing

downwards through the phases identified as Requirements, Design, Implementation, Verification, and Maintenance [18]. The waterfall model was one of the earlier pioneer models for project management. The design was very specific to hardware development and eventually adapted for software project development. In this model, the project defines the customer requirements in the first stage. The ideology for this design is to ensure that everything should be complete before moving forward, which in-turn reduce costs and time of completion.

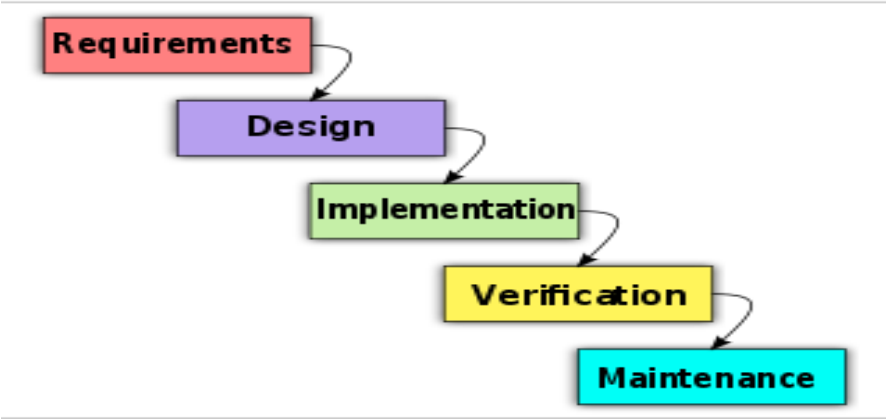

Figure 4: Waterfall Model

There are several supporting concepts for this model. First, the time spent early in the software production cycle can lead to greater economy at later stages so emphasis can shift to documentation. Furthermore, spending the time to ensure completeness and correctness in the current phase before moving to the next one will save a substantial amount of time and effort later. In methodologies that require less documentation, should team members leave, much knowledge is lost and may make it difficult for a project to recover. Additionally, another contributing concept is that it is a simple approach. The waterfall model is a more disciplined and structured approach, using easily understandable and explainable phases. Hence, milestones in the development process are more easily recognizable. The waterfall model is one of the primary development models presented in many software engineering texts and courses. It requires that team members follow a complete design accurately, ensuring that the integration of the system proceeds smoothly.

There are a few drawbacks when using the waterfall model. Team members often feel pressured to move onto a succeeding phase before they are confident they have completed their work perfectly. This leaves little time for reflection and analysis before closing out a phase. Market requirements may also change drastically during a project. If this happens, the cost to change the deliverables may be steep compared to an iterative project management model. Managers of a project using the waterfall model may not be aware of future implementation difficulties when writing a design for unimplemented software. The organization may know entirely know the requirements and limitations before completing the project. With these limitations and the desire to increase efficiency, one realizes how the waterfall model evolved into new models that are more adaptable to complex and constantly changing customer requirements.

Iterative Models

As software programs become more complex, developers find that there needs to be iterations between users and developers. The iterative (or incremental) development model is a cyclical development process developed in response to the weaknesses in the waterfall model. It has a cyclical nature of having a start with initial planning, an end with deployment of a product, and cyclic interactions in between. Iterative models are widely used in the development of software. Teams add software modifications or functional enhancements after each cycle. There is an analysis at each cycle where the user or customer can provide feedback [19].

As discussed earlier, the waterfall model finishes each step completely before going to the next step. The Iterative model (Fig. 5) can cycle through steps repeatedly before completion [20].

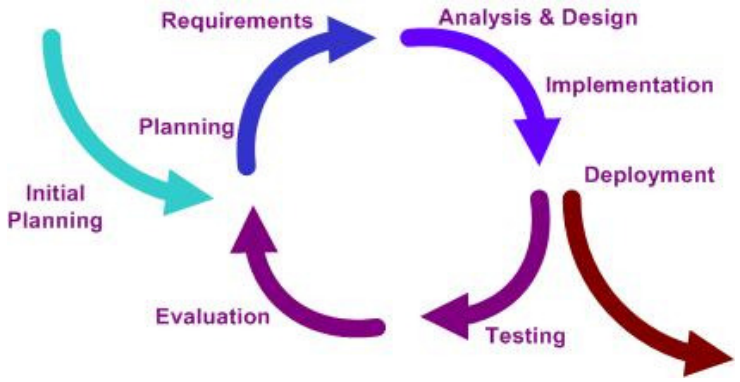

Figure 5: Iterative Development Model

Agile Software Development Methods

In software development, Agile methods are highly used. Agile methods are very lightweight processes that employ short iteration cycles, actively involve users to establish, prioritize, and verify requirements and rely on tacit knowledge within a team as opposed to documentation [21].

There are 12 principles of Agile Software development made by the Agile Manifesto [22]. These principles are useful to define rules and guidelines. The documentation arranges these according to their importance [23]:

1. Work with motivated persons and provide them the best conditions
2. Business people and developers must work together daily throughout the project
3. Direct conversation mode for information interchange within development team
4. The team controls regularly its effectiveness and when needed, adjusts its behavior accordingly
5. Simplicity is essential and advised
6. The best development artifacts emerge from self-organizing teams
7. Accept continuous requirements changes to increase customer satisfaction
8. Providing continuously a set of software versions to ensure customer satisfaction
9. Deliver working software frequently with a preference to the shorter timescale
10. Working software is the primary measure of progress
11. Agile processes promote sustainable development
12. Enhance agility by continuous attention to technical excellence and good design

Agile Software development has several methods. Popular methods are SRUM (not an acronym), Extreme Programming (XP), and Dynamic Systems Development Methodology (DSDM). They share the same philosophy (Fig. 6) and follow the same guidelines presented by the Agile Manifesto [24].

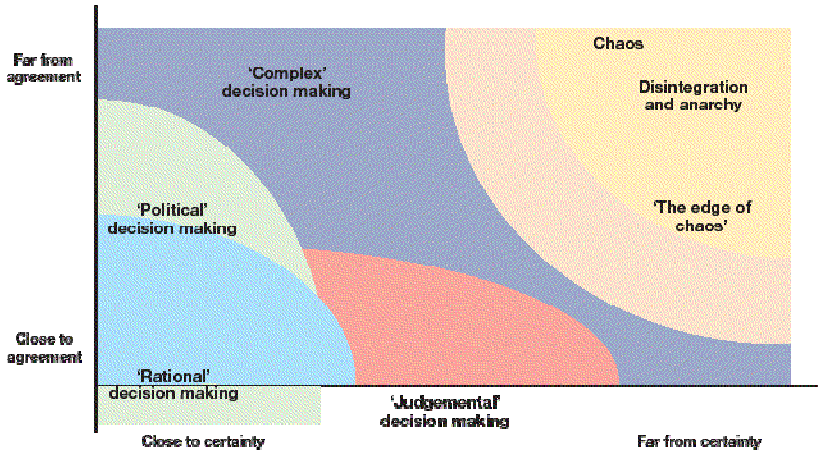

Figure 6: Agile Philosophy

Project teams and customers share in the decision-making and cycles are short [25]. This keeps the costs of changes much smaller as compared to changes made at the end of a long product cycle (Fig. 7).

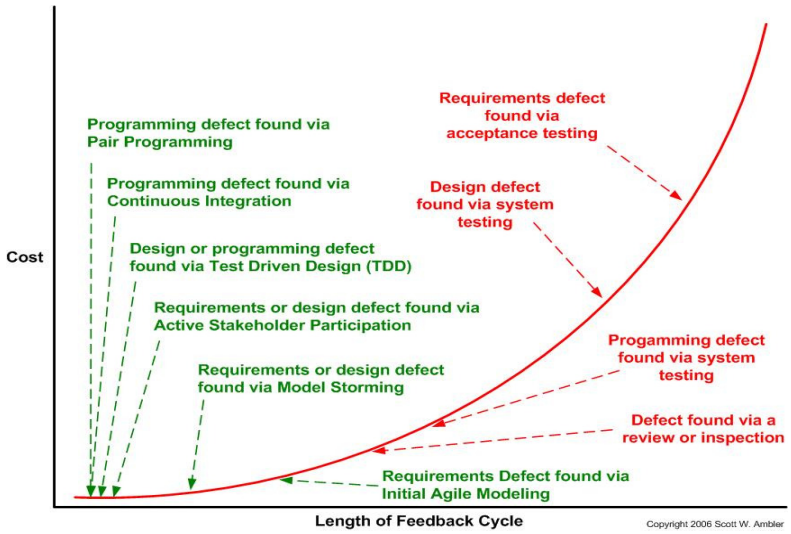

Figure 7: Short Feedback Cycle

Spiral Model

The Spiral Model (Fig. 8) is another iterative process for development [26]. Its' processes are longer than Agile and are typically 6 months to 2 years. Phases are important in this model and as a project goes from one phase to the next. Each full circle in the spiral delivers a prototype. The goal is to keep the spiral to a minimum to keep costs down.

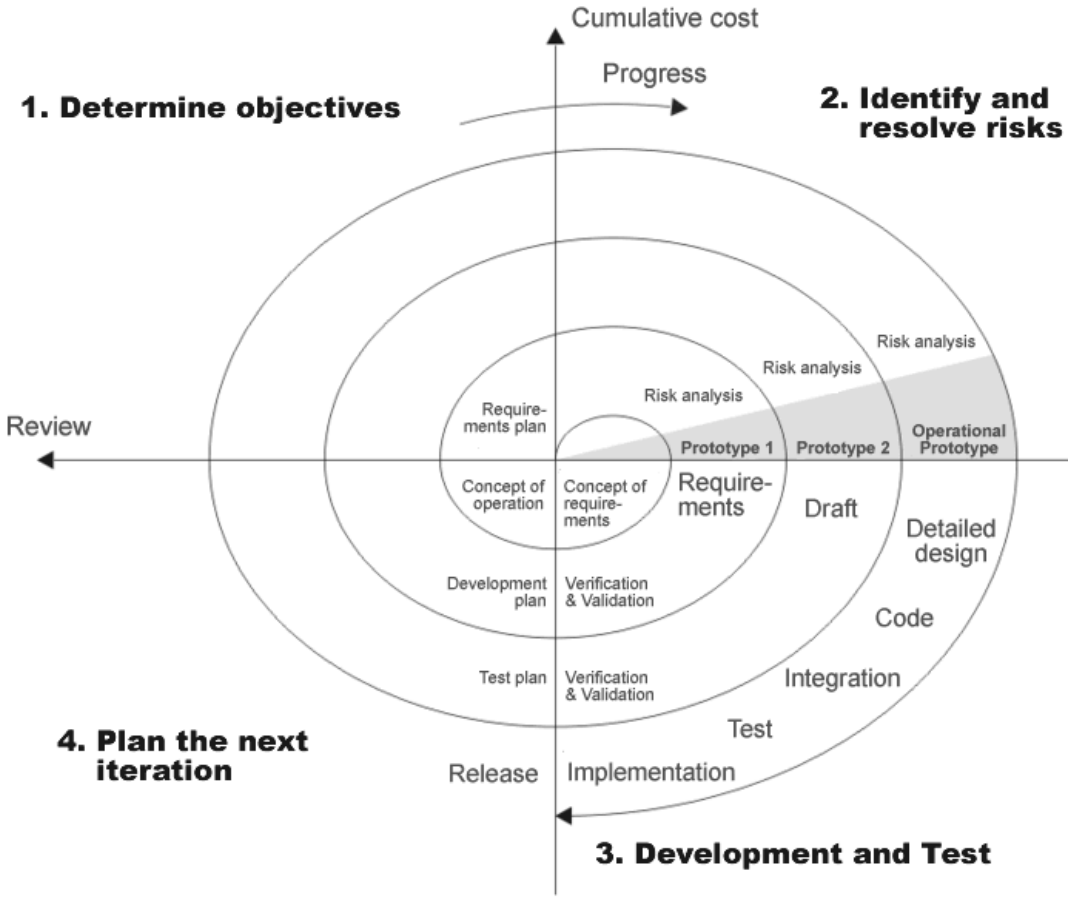

Figure 8: Spiral Model

Conclusion

Under LPM, the relationship between marketing and engineering teams requires stringent research, communication, and organization. These help increase efficiencies and contribute to cost savings.

One should first examine the customer's needs that play a prominent role in project selection. The understanding of customer needs and customer expectations is crucial for customer satisfaction. The Kano Concept explained that there are unspoken requirements. Marketing research, with concept testing, customer interviews, customer visits, and conjoint analysis help identify the customer needs. Using tools such as Quality Function Deployment and good marketing documentation help contribute to this goal. In addition, customer needs are not always static and can be dynamic. The change in customer demands play a crucial role in how a unit organizes program and projects.

Project managers should use a linear approach for projects that have extended life cycles and static needs. This works well when customer requirements are established at the beginning of the project and do not change throughout its life cycle. For projects that have customer requirements that change or a high potential to change, an iterative approach works well. Software projects commonly use an Agile Method such as the SCRUM Model. Its' short cycle and frequent meetings help integrate changing customer needs. If the project yields a physical device, the Spiral Model may be best. Each cycle around the spiral tries to encompass customer requirements. The correct project model decision will both eliminate waste and meet customer demands.

We have shown the importance of process optimization with a Value Stream Map in an organization and methods of choosing the correct project management model to help get the products to market as quickly as possible.

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