Haaga-Helia
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Metrics for agile requirements definition and management

Nina Jussilainen

Final Thesis
YTI degree programme
2013

HAAGA-HELIA
University of Applied Sciences

Abstract

Author(s)
Nina Jussilainen

Degree programme
Master’s Degree Programme in Information Systems Management

Thesis title Metrics for agile requirements definition and management	**Pages and appendix pages** 113 + 5

“You Can't Manage What You Don't Measure” (Origin unknown) was the starting point for this research.

The goal of this research was to define metrics to support and monitor the requirements definition and management in the Alusta P2P Invoice automation and Procurement product development in the target organization.

The research was conducted as a constructive research including document analysis, interviews and facilitated workshop and it was done during June 2016-December 2016.

Theory around agile software development, agile requirements definition and management and metrics was gathered to support the construct.

First the research defined the requirements definition and management process for the target organization to mirror the metrics against it.

The most important measure found during the research was whether the feature is validated with users and enhanced accordingly before implementation or not. With this metric or gate keeper it would be possible to use the customer acceptance as the key measure and increase the validated learning about customers as lean movement suggests. Minimum marketable feature sets could be validated with users too.

In the target organization it would be important to deploy the new design process well in use. To monitor the success, completing the steps on feature level could be measured to view the trend of improvement and it’s impact to the feature quality and efficiency.

Enhancing the data analytics of the service production data would improve both the RDM process and the product quality and cost-efficiency.

Through following the feature quality, it would be possible to explore and find the lean, wasteless way to do the discovery of the requirements via comparing the used RDM techniques and completed process phases to the quality of the outcome of the feature.

Defining the RDM specific objectives against the current KPI’s could help to achieve better results with them.

Evaluating business value and measuring organizational learning were left as areas of future research.

Keywords
Requirement, Requirements definition, Requirements management, Agile, Metrics, measuring

Tiivistelmä

Tekijä(t) Nina Jussilainen	
Koulutusohjelma Tietojärjestelmäosaamisen koulutusohjelma	
Opinnäytetyön otsikko Ketterän vaatimusmäärittelyn ja -hallinnan mittaaminen	**Sivu- ja liitesivumäärä** 113 + 5

“Et voi johtaa sitä mitä et mittaa” (Alkuperä tuntematon) oli tämän tutkimuksen lähtökohta.

Tutkimuksen tavoite oli määritellä mittareita tukemaan ja tarkkailemaan vaatimusmäärittelyä ja vaatimusten hallingaa Alusta P2P Laskuautomaation ja Hankintojen hallinnan tuotekehityksessä kohdeorganisaatiossa.

Tutkimus on konstruktiivinen ja se on toteutetttu dokumenttianalyysien, haastattelujen ja fasilitoidun työpajan avulla. Tutkimus on tehty Kesäkuun 2016 ja Joulukuun 2016 välillä.

Teoriaa konstruktia tukemaan on kerätty ketterän sovelluskehityksen, ketterän vaatimusmäärittelyn ja vaatimusten hallinnan ja mittareiden alueelta.

Aluksi tutkimus määritti vaatimusmäärittelyn ja -hallinnan prosessin kohdeyritykselle, jotta mittareita olisi helppo peilata sitä vasten.

Tärkein tutkimuksen aikana löydetty mittari on onko toiminto vahvistettu käyttäjien kanssa ja tarvittavat korjaukset tehty ennen kehittämisen aloitusta. Tällä mittarilla tai portinvartijalla voidaan saavutaa asiakashyväksyntä tärkeimpänä mittarina ja lisätä leanin ehdottamaa vahvistettua asiakkaista oppimista. Pienimmät markkinotavat toimintokokonaisuudet (Minimum marketable feature) voitaisiin myös vahvistaa käyttäjien kanssa.

Kohdeorganisaatiossa tärkeä kehityskohde olisi jalkauttaa uusi prosessi hyvin. Prosessin vaiheiden toteutumista voitaisiin seurata toimintokokonaisuuksien tasolla ja seurata kehitysvaiheiden suoritustason vaikutusta toimintojen laatuun ja tekemisen tehokkuuteen.

Palvelun käyttödatan analysoinnin kehittäminen parantaisis vaatimuusmäärityksen ja vaatimsuten hallinnan prosessia ja tuotteen laatua ja tekemisen tehokkutta.

Toimintokokoonaisuuksien laadun seuraamisen avulla olisi mahdollista etsiä ja löytää lean, hukaton tapa tehdä vaatimusten löytämisvaihetta vertaamalla käytettyjä vaatimusmäärittelyn ja -hallinnan tekniikoita saavutettuun tuloksen laatuun.

Vaatimusmäärittelyn ja hallinnan päämäärät voitaisiin määrittää tarkemmin nykyisiä KPI:tä vastaan ja näin saavuttaa mittareiden parempi laatu.

Liiketoiminnan tuottaman arvon määrittäminen ja organisatorisen oppimisen mittaaminen on jätetty jatkotutkimuksen aiheiksi.

Asiasanat
vaatimukset, vaatimusmäärittely, vaatimustenhallinta, ketterät menetelmät, mittarit, mittaus

Contents

1 Introduction

This research dives into the agile requirements definition and management from the metrics point of view in context of scaled agile software development of enterprise application. Goal is to find metrics to support the managing and monitoring the requirements definition and management in the target organization.

Literature around agile software development, agile requirements management and metrics is gathered to support the construct of this research.

Empirical part of this research consists of studying the current state of the requirements management and used metrics in the target organization and exploring the beneficial metrics with help of literature, facilitated workshop and discussions.

The output of this study is the justified suggestion for the metrics to the agile requirements management in the target company.

1.1 Subject and goal

The original research question “What to measure of agile requirements management and why?”, was originally raised in the target organization with the old saying “You Can't Manage What You Don't Measure” (Origin unknown).

Subject is currently important to the target organization since there are no metrics in use for requirements management at the moment, existing metrics only measure the application lifecycle management process from the software development life cycle point of view. Also the new Double diamond design model has been introduced to the organization and brings some new details to the RDM process.

Subject is broad and multi-dimensional. It covers both Agile methods, requirements definition and management and metrics to be orchestrated in a challenging environment where the international software is developed for all customers in an enterprise environment, with the challenge of large scale, multi-project, multi-site and multi-culture.

In this research, I aim to recognize the possible valuable metrics for agile requirements definition and management in the target organization and justification for them. I also aim to point out the pitfalls that should be avoided when building the metrics.

The goal of this research is to understand agile, requirements management and metrics better, mirror them in to the context of the target organization and in the end, define the valuable metrics for agile requirements management in the target organization, if any feasible metrics can be found. The possible metrics should help the target organization to follow the development of the measured functions and find the ways to improve the quality and efficiency of both, the quality of the product and ways of working. Metrics also help the organization to follow the trends of the functions.

1.2 Research problem

In this research the area of agile software development and agile requirements management is explored with a research question “Measuring the agile requirements definition and management in the enterprise software development – what to measure and why?”.

The research aims to find an answer to following questions:

- Why should we measure the agile requirements management?
- What should we measure of the agile requirements management?
- What answers can the measurements give?
- How do we analyze the results and why?
- How do the results end up into concrete actions for improvement?

To view the metrics in the context, the scaled agile software development of enterprise application is defined based on the available theory including the definitions for Agile, Lean, Enterprise, Requirement and Agile Requirements Definition and Management.

To understand the soul of metrics and agile metrics, they are described with their benefits and dangers.

1.3 Target Organization

This research is done for Finnish company called Basware (Basware webpages. 2016a.) that was founded in 1985 and now provides networked purchase-to-pay solutions, e-invoicing and innovative financing services for companies to simplify and streamline their key financial processes, strengthen control, reduce costs and boost cash flows.

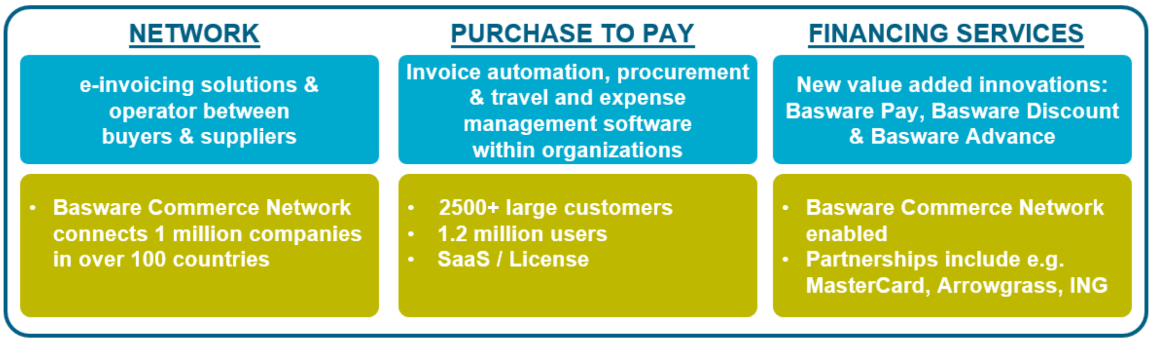
Basware (2015.) has over 1 million organizations using Basware’s solutions in over 100 countries connected via the open and global Basware Commerce Network.

From the largest enterprise to the smallest supplier Basware helps companies unlock new efficiencies and gain greater visibility and control over their business. They offer packaged solutions for SMBs, and tailored solutions for enterprises. (Basware.2016d.)

According to Basware Strategy (Basware. 2015.) cloud revenue growth is Basware's primary objective and where long term value in our business will be created. This is to be achieved among other things by simplifying operations and improving underlying profitability.

Basware (2016) offers solutions for following areas (Figure 1-1):

- NETWORK - e-invoicing solutions & operator between buyers & suppliers.
- PURCHASE TO PAY - Invoice automation, Procurement, Travel and Expense software.
- FINANCING SERVICES - New value added innovations – Basware pay, Basware discount and Basware advance



NETWORK	PURCHASE TO PAY	FINANCING SERVICES
e-invoicing solutions & operator between buyers & suppliers	Invoice automation, procurement & travel and expense management software within organizations	New value added innovations: Basware Pay, Basware Discount & Basware Advance
• Basware Commerce Network connects 1 million companies in over 100 countries	• 2500+ large customers • 1.2 million users • SaaS / License	• Basware Commerce Network enabled • Partnerships include e.g. MasterCard, Arrowgrass, ING

Figure 1-1 Basware Product areas (Basware, 2016)

Basware Purchase-to-Pay business area consists of the following product areas: Accounts Payable automation, Procurement, Travel & Expense management and Analytics (Figure 1-2):

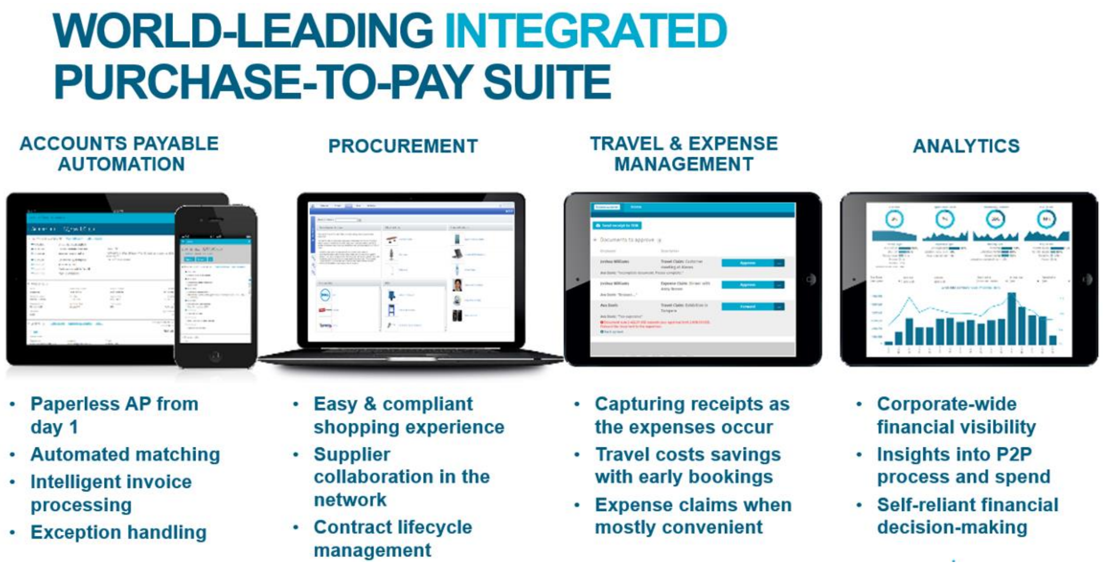

WORLD-LEADING INTEGRATED PURCHASE-TO-PAY SUITE
ACCOUNTS PAYABLE AUTOMATION
PROCUREMENT
TRAVEL & EXPENSE MANAGEMENT
ANALYTICS
• Paperless AP from day 1
• Automated matching
• Intelligent invoice processing
• Exception handling
• Easy & compliant shopping experience
• Supplier collaboration in the network
• Contract lifecycle management
• Capturing receipts as the expenses occur
• Travel costs savings with early bookings
• Expense claims when mostly convenient
• Corporate-wide financial visibility
• Insights into P2P process and spend
• Self-reliant financial decision-making

Figure 1-2 Basware Purchase-to-Pay suite (Basware. 2016)

This research is focused to the Purchase-to-Pay business area product development and requirements management in AP automation and Procurement areas.

AP automation is a feature-rich and configurable Accounts Payable solution to automate the most demanding global processes. AP automation is totally paperless, includes advanced invoice approval automation, reviewing and approving invoices also on mobile devices and forecasting to manage working capital and cash flow. With AP automation it is possible also automate matching of invoices, purchase orders and payment plans. (Basware. 2016c.)

e-Procurement is for increasing spend under management, realizing significant cost savings, and increasing supplier value. e-Procurement enables consumer-style shopping experience with one-click catalog purchasing, flexible free-text forms to manage services procurement and capture input, configurable workflows for increased compliance and control and constant access from mobile and tablet devices. e-Procurement also provides actionable spend and procurement analytics with data visualization. (Basware.2016c.)

Basware Purchase-to-Pay service is developed by several project teams that are scattered in Espoo, Tampere and Pori in Finland and Chandigarh in India. Multi-team, multi-site, multi time-zones, multi-cultures create a complex environment for software development.

Service itself is available all over the world. It has been localized to several languages and follows regional settings for data formatting. The document detail fields and workflow processes can be configured up to certain extent. New parts of the product follow responsive design.

Product development is driven by legislation and business rules, UX guidelines to reach the best user experience and need for consistency through the parts of the product, legacy backend and cloud architecture and continuous delivery in SaaS.

1.4 Limitations/exclusions

This research is focused to product development and agile requirements definition and management of the Purchase-to-Pay business area AP automation and Procurement development in the target organization. Product deployment and customer support are excluded from this research.

Validation of the result of the construct is excluded from this research. This research only provides the construct of the metrics suggested for the target organization.

1.5 Approach and Methods

This research is qualitative. Ojasalo (2014) states that qualitative methods have been used in scientific research when researching the subject that is not familiar beforehand and that is wanted to be understood better. When using qualitative method, the goal is to gather lots of information from the narrow subject and that way understand the phenomenon better and holistically. Baseline for qualitative research is describing real life. Researcher is usually very close to the target and often even takes part to their work. Researcher makes his own justifiable interpretations about the phenomenon. Justifications support the reader to make conclusions about the reliability of the research. (Ojasalo. 2014)

In ‘Insightful-Traditional’ model the base of the knowledge is separated from the methods and the results. It includes summaries and citations from the source materials, but in addition to that also the own thoughts of the writer. (Ojasalo and others, 2014, p. 35)

1.5.1 Constructive research

Constructive research method was selected since there is a need to research the existing theoretical information and combine it with the new empirical knowledge gathered from the target organization. Ojasalo and others (2015, p. 65) suggests constructive research for that kind of a case. They also state that constructive research is a good technique when creating something concrete like a plan, metrics or a model. The goal of this research is to create metrics.

According to Ojasalo and others (2014, p. 65) constructive research aims to practical problem solving by creating a new structure that is evaluated against the benefits it provides to the practical work. According to them, constructive research aims at providing theoretically argumented solution to a practical challenge but it also aims at bringing new information to scientific community. These goals are valid for the research in question.

In constructive research it is important that the practical challenge and the solution are linked to the theoretical information. It is also important to proof that the solution works, in the best case even outside of the target organization. It is not always easy to proof that the solution works in action. (Ojasalo and others, 2014, p. 65).

According to Kasanen, E., Lukka, K. and Siitonen A. (Ojasalo and others, 2014, p. 67) constructive research process consists of following stages:

1. Finding a meaningful question
2. Acquiring deep theoretical and practical knowledge about the target of the research and development
3. Composing the solutions
4. Testing the functionality of the solution and indicating the validity of the construction
5. Showing the solutions connections to the theory and showing the novelty value of the solution
6. Examining the width of the solution in the field of application

This research concentrates to the three first stages of this constructive research process.

Documenting the phases is important in the constructive research. In addition to that the method’s that has been used have to be reasoned always. Implementation challenge must be clearly stated and written and the goals of the research must be clearly explained. In the end of constructive research, the alternative solutions must be introduced, evaluated and the selected solution must be justified understandably. Developed solution can be evaluated in practice meaning in the organization or in the market. There are three different levels of market tests to test the solution made by the structure. In practice the functionality of the solution may be evaluated also later on. (Ojasalo and others, 2014, p. 67-68)

Constructive research does not disqualify any method so various methods may be used. Observation, group discussions, survey and interview are typical methods used in this approach. In addition to the previous, co-operation is important. Usually it is relevant to know well the needs of the future users. In those cases it is profitable to take some of the future users along to the development process at the early phase. For example brainstorming or group conversations can be hold with the users at the different phases of the process. (Ojasalo and others, 2014, p. 68)

In constructive research the researcher or the developer is always also a change agent, whose role is to influence strongly in the environment in question. In addition to the role of a change agent, the researcher or developer may act as a support person for the learning process and a contributor for the learning as on action research. (Ojasalo and others, 2014, p. 68)

1.5.2 Interview

Interview was selected as a method, since the research target is not very well known and the interview enables gathering material that opens new aspects to the subject (Ojasalo and others, 2014, p. 106). They also state that the mission of an interview may be clarifying the issue or get deeper understanding about the issue. Interview was used to find out the current metrics in use in the target organization and for evaluating the management vision and opinion over requirements definition and management and metrics to figure the focus for the theoretical part of the research.

According to Kananen (2015, p. 143) interview is beneficial especially when deep and broad information is needed. He states that interview is a good tool when researching a phenomenon tied to present time. He also describes the interview as a very flexible tool where the researcher can guide the user to understand the questions better or add new questions to the interview if it feels appropriate. He describes that disadvantages of an interview are slowness, costs and possibility of the interviewer to affect to the interviewee by guiding the interviewee, selecting the subjects under discussion and select subjectively.

In this research both non-structured and half-structured interviews (Kananen 2015) are used for gathering the background information and getting to know the current state of the requirements management and metrics in the organization. Both requirements management and metrics themes were discussed in the interviews. In the interview about the current metrics the Quality Assurance Director and Operations and Development Director were interviewed, since they were the experts of the current metrics.

For the analysis of the atmosphere about requirements management, development methods and metrics both Senior Vice President of the organization unit and Directors of Product management, R&D, Quality Assurance, User Experience and Operations and Development in Purchase to Pay Business area organization were interviewed. In addition to those the Senior Manager of Requirements Management in the other organization unit was interviewed for light internal benchmarking point of view.

Interviews were conducted one-to-one. Most of the interviews were conducted face-to-face, but few of them on-line through Skype call due to the long distance between the parties and taking into account that interviewees were already familiar to the interviewer.

Results of both interviews were recorded by writing the discussion down during the interview. Even if the amount of the interviewees was not high, the managerial interview was transcribed by summarizing (Kananen, 2015, p. 163) and segmenting and coding (Kananen, 2015, p. 163). The coded contents were then compared to the theory and each other to analyze the results in the organization context and in global context.

1.5.3 Document analysis

Document analysis is used for drawing conclusions especially from verbal, symbolic or communicative material that has been converted into written format, like interviews, www pages, articles form the magazines, memos from ideation meetings, diaries, photos, drawings, speeches, discussions, reports and other written material (Ojasalo and others, 2014, p. 136). In this research document analysis technique has been used for analyzing the interview results, reports over current metrics and the material provided in the workshop.

1.5.4 Observation

The researcher has been employed by the target organization for 16 years, closely with the requirements management for 5 years. Researcher aims to objectively observe the target organization continuously while performing her daily work.

Participative observation where observer participates into the functions of the target under research in the role of the employee or customer is used. In participative observation, the observer influences as little as possible to the activities and the interaction is led by the terms of target itself. (Ojasalo and others, 2014, p. 116)

Observation is done unstructured since as much information as possible and in as large scale as possible is wanted to be gathered. Theory related to the phenomenon is utilized and the assumptions of possible impacts to the phenomenon under research are derived. (Ojasalo and others, 2014. P. 116)

According to Ojasalo and others (2014, p. 116) the goals for observation needs to be defined and the accuracy for the observation needs to be set. In this research the goal of the observation is to build the bridge between the theory and the daily work by observing the daily work. The researcher participates in the daily work as normally, but also finds new research paths through the work.

1.5.5 Group discussion – falicitated workshop

Group discussion was selected for ideation with all stakeholders and for sharing the knowledge and developing the new knowledge. In creative problem solving process the ideation and evaluation are separate actions. Evaluation kills ideation and motivation to produce new viewpoints. Characteristic for the process is that the most conventional ideas are usually raised first. The ideas squeezed after the conventional ideas are gone through are most probably new ideas. From the aspect of delivering creative solutions it is important to recognize and approve that quantity creates quality. (Ojasalo and others. 2014. p. 158)

Higgins (Ojasalo and others, 2014, p. 159) introduces the process for creative problem solving:

1. Identifying the problem or possibilities for improvement
2. Recognizing the related facts and opinions
3. Setting goals and visioning
4. Producing the approach and ideas
5. Evaluating the ideas and selecting the solution
6. Getting approval and implementing

Nowadays, in the word becoming faster and faster more complex, all experts in the organization, in addition to managers, should be taken along into the creative process of generating ideas. This requires some inspiration and activation, encouragement and creativity which can easily be achieved in facilitated workshop. (Kantojärvi. 2012. p. 11)

Kantojärvi (2012. p. 11) introduces facilitation as a neutral guiding of the group process. The job of a facilitator is to help and encourage the team to work without taking part into the contents of the discussion. He plans the group work process and picks the most suitable tools for it and makes sure that the capacity of the whole team is efficiently exploited, to meet the goals set for the event.

Kantojärvi (2012. p. 29-30) describes the creative problem solving process as the structure for a facilitated workshop as follows:

1. Beginning
2. Clarification
3. Planning the solutions
4. Preparing to act
5. Closing

She describes the steps like this:

In the beginning, it is important to create secure atmosphere, so that everyone feels comfortable attending. The beginning helps the attendees to tune in the creative thinking and comprehensive presence. The beginning sets the focus: why am I here, what is going to happen and how, what are the roles of the actors and the rules of the game and what is the meaning and the goal for the event.

Clarification phase consists of defining the challenge, gathering the knowledge and specifying the problem. The phase clarifies where we start from and what the focus is for the event. In this phase it is possible to create understanding over the focus defined in the starting phase and go through possible concerns related to that. In this phase it is also possible to figure out what do we already know about the subject and how the problem was tried to solve before. In this phase questions around the subject are surveyed and the question describing the core problem is selected.

Planning the solutions phase consist of throwing ideas and the development. In this phase ideas are generated and if possible try to tear away from conventional thinking to enable the creative thoughts. When ideas are found, they are selected and refined further to solutions. Solutions are analyzed and mirrored to the original question.

Preparing to act phase is about the concrete actions. Deploying the solution is planned and plan for to possible change resistance is prepared.

In closing phase the success of the workshop is evaluated, by questioning how were the goals and expectations met. Plan over next steps is done and the workshop is ended with good spirit.

2 Measuring the agile requirements definition and management in the enterprise software development

Defining and managing requirements is a tight share of the software development. The nature of both requirements and development changes with the agility and continuous delivery. The target organization utilizes agile methods in the software development, works in the large-scale and produces enterprise software. Requirements management has been agile for a while in the target organization, but there is room to improve. The double diamond design model has just recently been introduced to the organization as the basis for the requirement discovery and solution validation. The research aims to find the answer to how to set the metrics against the requirements definition and management. This chapter aims to enlighten the requirements definition and management and metrics in scaled agile enterprise software development.

2.1 Agile software development in an enterprise

“Change is the only constant” (Origin unknown)

To keep up with the changing world and priorities, it is important to be agile in software development nowadays. Splitting the work in small junks and prioritizing them flexibly allows the company to change directions according to the business needs.

Agile Software Development is an umbrella term for a set of methods and practices based on the values and principles expressed in the Agile Manifesto. Solutions evolve through collaboration between self-organizing, cross-functional teams utilizing the appropriate practices for their context. (Agile Alliance. 2015c.)

Datta (2007, p.15) states that enterprise software systems usually support business processes. He says that they need to response to changing user needs, they are bound by business and technical constraints and their soundness of design and implementation is of material interest to different groups of stakeholders. In addition to the previous Datta says that one feature that is beginning more common to these systems is that they are used world-wide, by several nationalities and in many cultures.

Datta (2007, p.16) also emphasizes that an enterprise application is usually a confluence of many business processes that are bound by different business rules, don’t usually involve any complex mathematical operations of data but deals with very large amounts of data and their storage, display and simple manipulation. He also mentions that the users of systems are different then the developers and users and developers are different from those who commission the building of the software and these stakeholders need strong communication with each other.

2.1.1 Knowledge management

Software development is knowledge work, where discussion and communication are the keys to success. Knowledge management (KM) is a business process that formalizes the management and use of an enterprise's intellectual assets. KM promotes a collaborative and integrative approach to the creation, capture, organization, access and use of information assets, including the tacit, uncaptured knowledge of people. (Gartner, 2016)

The terms information and knowledge are often used interchangeably. The Knowledge hierarchy consists of levels of data, information, knowledge and wisdom (Figure 2-1).

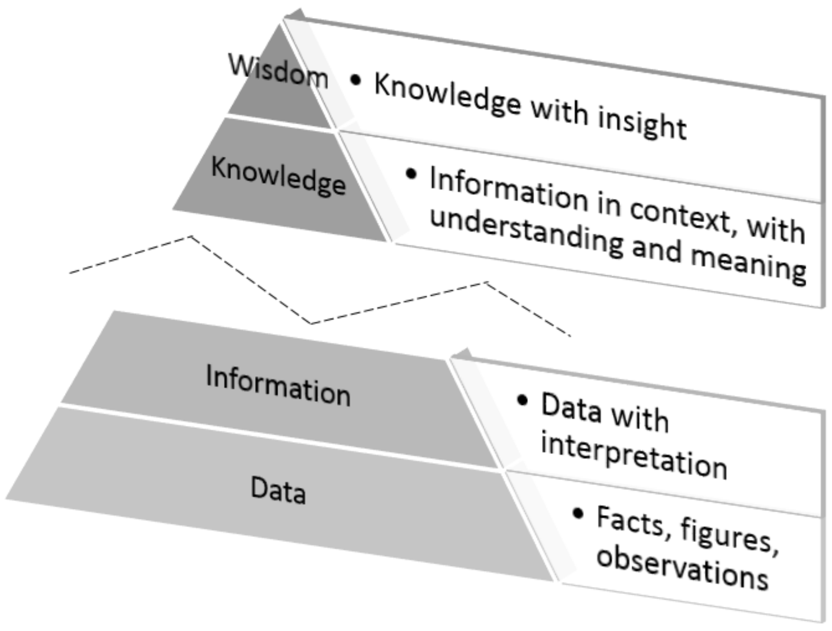

Wisdom
• Knowledge with insight
Knowledge
• Information in context, with understanding and meaning
Information
• Data with interpretation
Data
• Facts, figures, observations

Figure 2-1 Knowledge hierarchy (Skyrme, 2011)

Skyrme (2011) gives examples of the differences between the levels are:

- Data: 03772 41565 83385 10157
- Information (interpretation): Heathrow weather station; visibility 15 km, sky completely cloudy; wind direction north west, speed 85 kts; temperature 15.7 degrees C.
- Knowledge (understanding): my experience says this will cause severe flight delays.

- Wisdom (insight): I shall book a train before other passengers realise the implications.

There is a clear distinction between the lower two levels and the top two. The bottom two are embodied in objects, e.g. documents and databases, while the higher levels are in people's heads. This is also the distinction between explicit and tacit knowledge. (Skyrme, 2011)

This is important to keep in mind with software development. Too often people just ask for a link to a data in a system to be read. More effective way to transfer and cultivate the knowledge would be to discuss the thing through and then use the system only for data storaging purposes, not to transfer data. The same goes with sending the emails to big audience, it usually ends up as data transfer instead of knowledge or wisdom being created.

2.1.2 Web user needs

When building a product, the features themselves are not the only thing that matters, but the non-functional aspects like uptime, usability, performance and quality are important too. Olsen (2015, p. 45) summarizes all the important aspects of a web application comparing the needs of web user to the Maslow’s hierarchy of need where in both the lower level needs need to be met before higher-level needs matter. In Olsen’s web user needs hierarchy, the most important needs to fulfill are uptime, page load time and absence of bugs. If those are missing the dissatisfaction is decreasing (Figure 2-2). Only after those needs are met, the feature set and UX design matters and increases satisfaction. The left side of the figure shows the needs from the customer’s perspective and the right side from the perspective of the service provider.

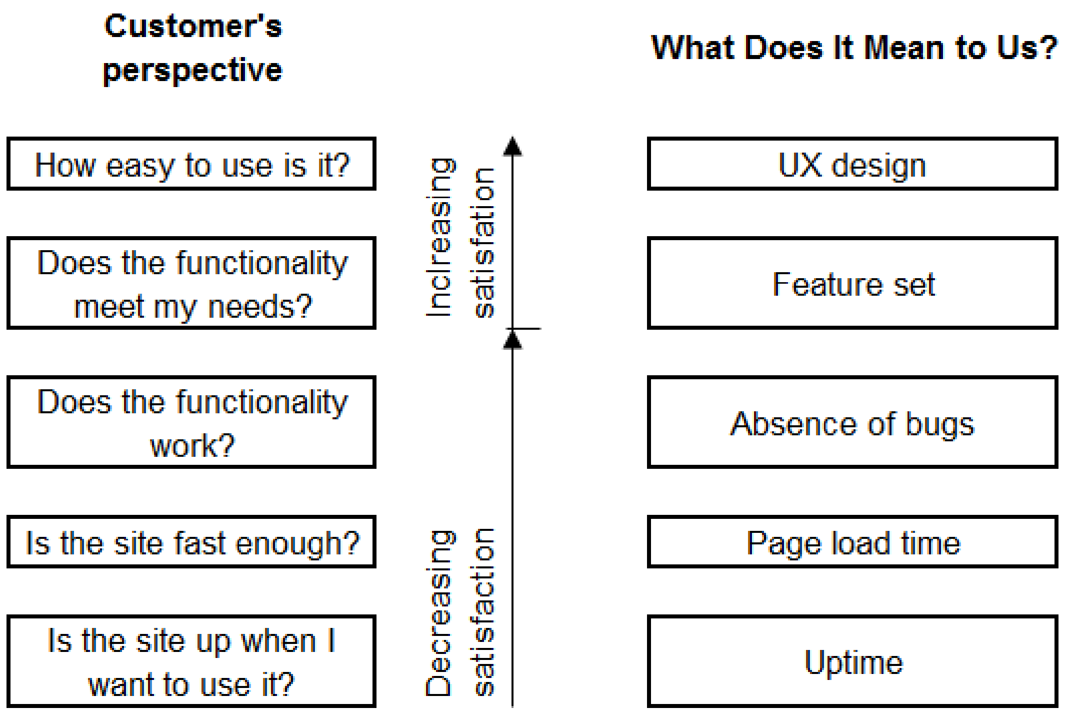


Figure 2-2 Olsen’s hierarchy of web user needs (Olsen, 2015, p.45)

This is an important fact to keep in mind when defining and managing the requirements. Very often the features themselves are required fast, but every now and then the basic needs tend to be forgotten.

2.1.3 Application Lifecycle Management (ALM)

Every application has a lifecycle. Application’s lifecycle includes the entire time during which an organization is spending money on this asset, from the initial idea to the end of the application’s life, even if it often is commonly equated with the software development lifecycle (SDLC). (Chappell. 2008)

Chappell (2008) states that ALM can be divided into three distinct areas: governance, development, and operations (Figure 2-3), starting with an idea and ending when the application reaches end of life and is removed from service.

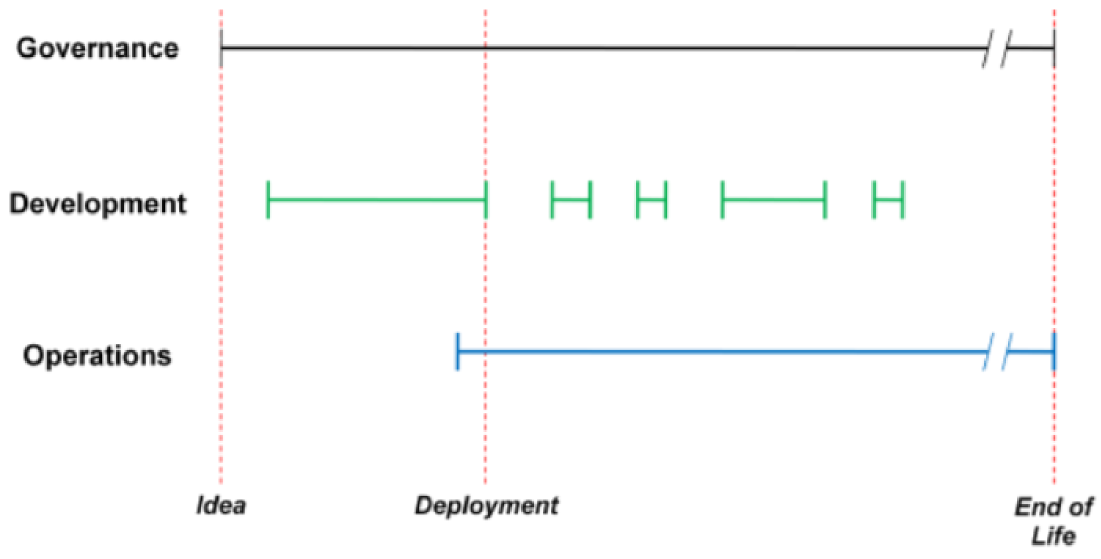
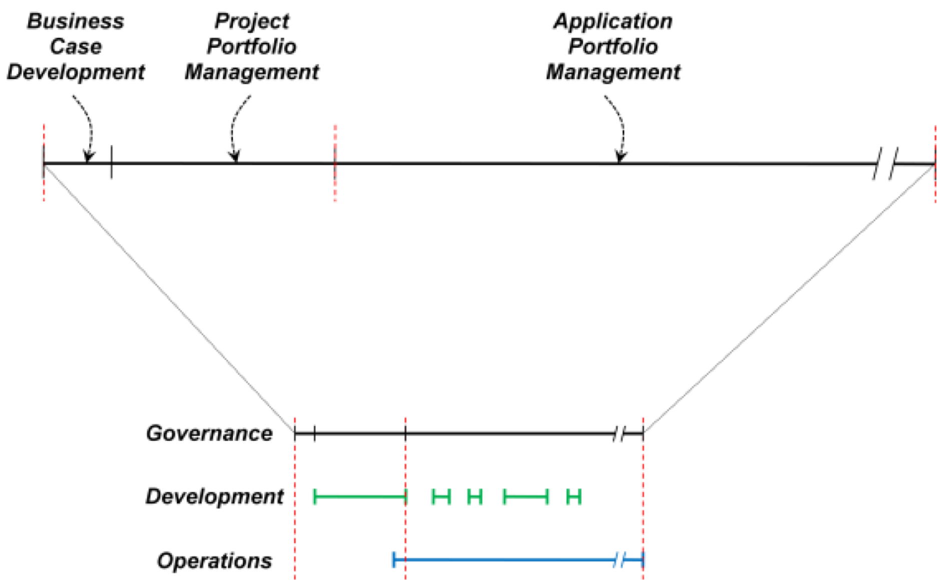


Figure 2-3 Three aspects of ALM (Chappell. 2008)

Chappell describes the ALM areas as follows:

- Governance: The purpose of governance is to make sure the application always provides what the business needs. Governance is the only thing that extends throughout the entire ALM time span. In many ways, it's the most important aspect of ALM. Get it wrong, and you won't come close to maximizing the application's business value.
- Development: Once the business case is approved, the software development lifecycle begins. If the SDLC parts of the Development line shown in the figure was expanded, a modern process would probably show software development as a series of iterations. Each iteration would contain some requirements definition, some design, some development, and some testing. While equating ALM with the software development process isn't accurate, development certainly is a fundamental part of every custom application's lifecycle.
- Operations: Every deployed application must be monitored and managed. Operations begins shortly before an application is deployed, then continues until the application is removed from service.

Chappell (2008) explains the Governance in more details (Figure 2-4).


Business Case Development
Project Portfolio Management
Application Portfolio Management
Governance
Development
Operations
Figure 2-4 Governance extends over the entire application lifecycle (Chappell. 2008)

He states that business analysis happens before the development process begins. Once the business case is approved, application development starts, and governance is now implemented through project portfolio management. Once the completed application is deployed, it becomes part of the organization's portfolio of applications.

He also describes an application is an asset like any other, and so the organization needs an ongoing understanding of its benefits and costs. Application portfolio management (APM) provides this, offering a way to avoid duplicating functions across different applica-tions. APM also provides governance for the deployed application, addressing things such as when updates and larger revisions make business sense.

It is important to view all these aspects of the application lifecycle, that it is not all about coding only, but involves the business case and the production too. And the challenge is to get all these to work smoothly together.

The requirements definition and management should serve both the customer, develop-ment and the operations.

2.1.4 Agile

Target organization utilizes agile methodologies to be able to deliver fast and change the direction according to the changes in the business.

“Agility is all about nurturing a mindset that enables us to constantly adapt to a rapidly evolving situation and look for more effective ways to solve a problem.” (Varma. 2015)

Where building products following the ”waterfall” approach, everything needed to be designed in advance, in agile methodology product is broken into smaller pieces that undergo shorter cycles of requirements definition, design and coding (Olsen, 2015, p. 202).

According to Olsen (2015, p. 202) the benefits of agile development are ability to more quickly react to market changes or other new information, getting customer feedback sooner and easier estimation when working in smaller batch sizes. Agile methods also improve the Return on investment (ROI) since the value delivery starts with the first shippable increment. Sooner the feature is delivered, sooner the customer pays for it (Leffingwell, 2011, p. 17-18).

Still currently, the nature of agile has changed from the early days. Back to the mid-1990’s agile scrum was all about finding innovative solutions. Team had enough time to first try some potential breakthrough approaches before reverting back to a safer approach. Today many teams start with the safe approach and skip the wild ideas that could lead to innovative solutions. That is most probably due to the tightened schedules. (Cohn. 2014)

Manifesto for Agile Software Development encourages to value individuals and interactions, working software, customer collaboration and responding to change. (Beck, K., Beedle, M., van Bennekum, A., Cockburn, A., Cunningham, W., Fowler, M, Grenning, J., Highsmith, J., Hunt, A., Jeffries, R., Kern, J., Marick, B., Martin, R. C., Mellor, S., Schwaber, K., Sutherland, J., Thomas, D.. 2001.)

The Agile manifesto (Beck and others, 2001) provides a set of core principles serving as a common framework for all agile methods:

- Satisfying the customer with valuable software that is delivered early and continuously is the highest priority
- Changing requirements are welcome, even late in development to gain competitive advantage
- Primary measure of progress is the working software
- Working software is delivered frequently, shorter timescale is preferred
- Daily co-operation between business people and developers is required
- Way to get the job done is to build the projects around motivated individuals that are trusted and given the environment and support

- Face-to-face conversation is the most efficient and effective way to transfer the information to and in the development team
- Sustainable development is promoted
- Technical excellence and good design enhances agility
- Simplicity is essential, so it is important to maximize the amount of work NOT done
- Self-organizing teams encourage the best architectures, requirements and designs
- Continuous improvement of the teams working methods is essential

In 2005, a few leading software community leaders came together (some of whom were the original signatories of the Agile Manifesto in 2001) and created the so-called “Declaration of Interdependence ,” or the DOI, that specifically calls out the notion of “interdependence” being vital to the success of software development endeavors, which is a rather broad term that includes customers, stakeholders, teams, and so on. (Varma. 2015.)

Varma (2015) describes following guidelines that this community of project leaders use to link people, projects, and value and achieve highly successful delivery of results:

- We increase return on investment by making continuous flow of value our focus.
- We deliver reliable results by engaging customers in frequent interactions and shared ownership.
- We expect uncertainty and manage it through iterations, anticipation, and adaptation.
- We unleash creativity and innovation by recognizing that individuals are the ultimate source of value, and creating an environment where they can make a difference.
- We boost performance through group accountability for results and shared responsibility for team effectiveness.
- We improve effectiveness and reliability through situationally specific strategies, processes and practices.

Varma (2015) also states that among other things, the DOI also lays a strong foundation for agile project management, specifically by calling out the last value—we could be much more effective by being dynamically adaptive to the situation and to the needs of the projects and teams rather than following overly standardized and static processes.

On the other hand, Olsen (2015, p. 278) describes 10 best lean practices for creating successful products and they are:

1. Have a point of view but stay open-minded: under conditions of risk and uncertainty, stay objective and evidence-based

2. Articulate your hypotheses: share and discuss your hypotheses to make them even better
3. Prioritize ruthlessly: rank order your backlog and other to-do lists to keep the priorities crystallized
4. Keep your scope small but focused: split large tasks into smaller items to reduce risk and iterate more quickly to get faster feedback from customers
5. Talk to customers: your customers are the judges of product fit and you'll learn a lot from them
6. Test before you build: it is faster and less costly to iterate with design deliverables than with an actual product, so validate your hypothesis and product-market fit before building a product
7. Avoid a local maximum: Take a fresh perspective to make further progress from the best alternative you have figured this far
8. Try out promising tools and techniques: don't settle for current tools, but try to seek for better to improve your teams work
9. Ensure your team has the right skills: developing software products requires skills like product management, user research, interaction design, visual design, copywriting, agile development, front-end coding, back-end coding, QA, DevOps and analytics. Assess where your team is strong and where weak and improve accordingly.
10. Cultivate your team's collaboration: A product team creating a new feature is like a basketball team scoring a basket. Strong skills alone don't make a great product team, but team members must understand other's roles and how they need to work together to achieve their goals. Strong collaboration increases your changes of building a successful product.

McDonald (2015, Chapter 1) summarizes following things as guiding principles, based on agile principles, describing desirable characteristics for any initiative:

- You are delivering value when you maximize outcome with minimal output.
- Your team should constantly look for ways to work together to deliver value.
- Shorten the feedback cycle to encourage continuous learning.
- Don't do anything you don't absolutely need to do to deliver value.
- It depends.
- Be intentional about your decision making.
- Learn from the past to improve your future.

To once more summarize these agile principles, Declaration of interdependence (DOI) and lean practices they all in a way or another emphasize:

- providing value for customers in interaction with customers
- producing working, reliable software sustainably, where lean emphasizes that it should be tested before built
- keep the solutions simple, but use fresh perspectives, be creative and innovative
- deliver in short cycles and accept change and uncertainty, where lean emphasizes prioritization and keeping scope small with small tasks
- empower your teams and encourage them to perform as a team and provide quality by evolving the knowledge and wisdom via discussion
- improve teams, tools and practices continuously

2.1.5 Scaled Agile Framework (SaFe)

Target organization is so large that could benefit from features of SaFe, but this far the framework has not been evaluated thoroughly.

Leffingwell draws a very detailed picture of the scaled agile framework (Figure 2-5).

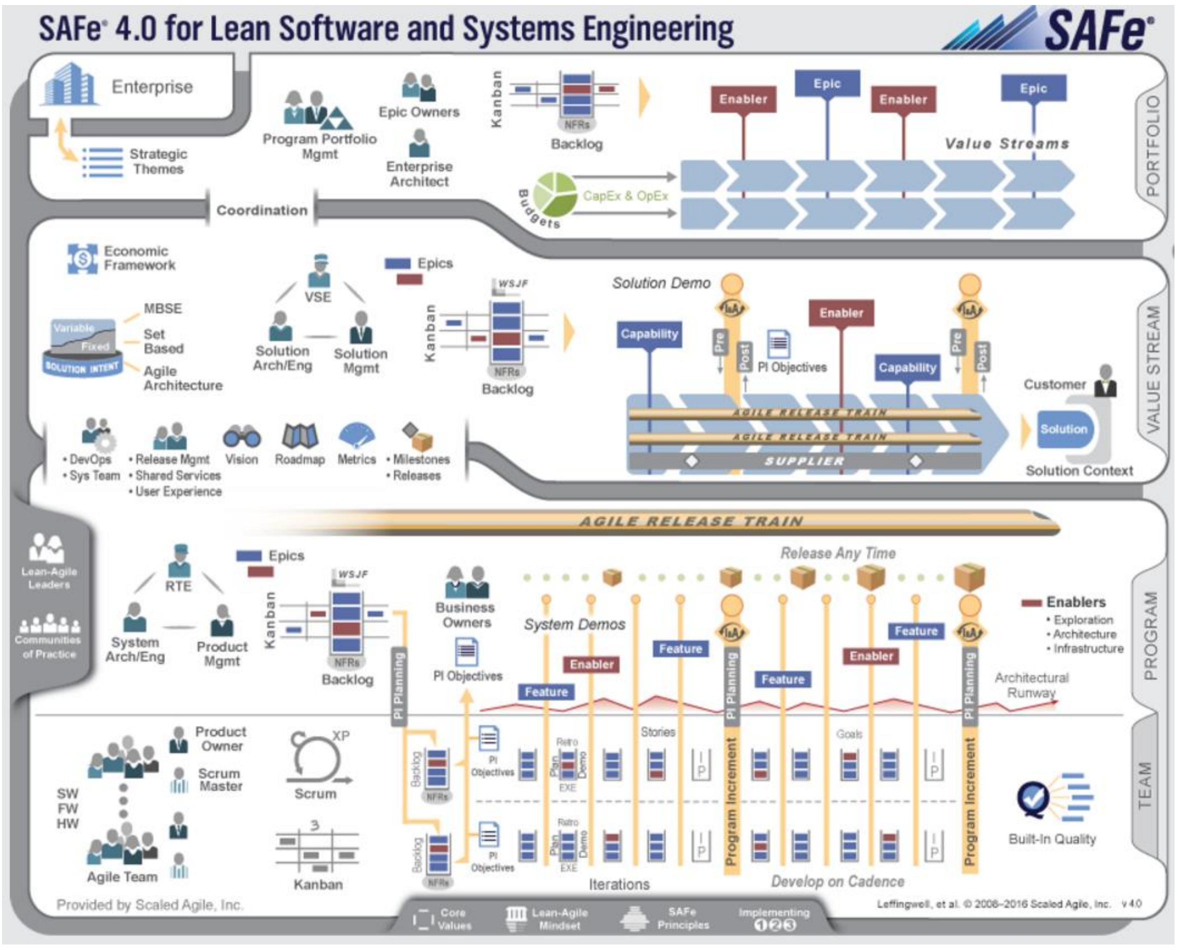


Figure 2-5 Scaled Agile Framework (Scaled Agile. 2010-2016)

Lekman (22.3.2014) summarizes SaFe (Scaled Agile. 2010-2016) very nicely ”SaFe concentrates on team level (How can these be implemented?), in program level (How can we make these happen?) and portfolio level (Where should I invest money?). He stresses that it is not an organization map, but a model for scaling agile and value streams flowing out from the company. The core of SaFe is Agile Release Train (ART), common schedule for the whole organization consisting of iterations of 2 weeks that should end up with Potentially Shippable Increment (PSI).”

Agile teams define, build and test user stories in a series of iterations and releases. In larger enterprises, groups of agile teams work together to build up functionality to complete products, features, architectural components, subsystems and so on. Product owner for the team is responsible for managing the backlog for the team. (Leffingwell, 2011, p.33)

Agile Release Train (ART) is used in the development of large scale system development. The ART provides time-boxed iterations and milestones that are date- and quality-fixed, and scope varies. The ART results releases or potentially shippable increments (PSIs). Product Manager or similar defines the features of the system in this level. (Leffingwell, 2011, p.33)

Investment themes drive the investment priorities for the enterprise and the themes should help to prioritise the work according to business strategy. Investment themes drive also the portfolio vision, which is then mirrored to future release trains as epic-scale initiatives. (p.33)

2.1.6 DevOps

Target organization follows DevOps in their product development to keep the work ongoing, minimize the risks and split the work into more reasonable pieces.

According to Rossberg (2014, Chapter 2) the key concepts of DevOps are continuous development, continuous integration and continuous operations.

He also crystallizes the heart of the DevOps as:
- working with small changes instead of large releases to minimize risk
- getting rid of manual steps by automating processes and
- having development and test environments that are as close as possible to the production environment

DevOps aims to optimize the time from the development of an application until it's running stably in the production environment. He emphasizes that getting ideas rapidly into production helps to quickly answering to changes and influences from the market and keep the business successful. It is not a method on its own; instead, it uses known agile methods and processes like Kanban and Scrum, that are used for development (mostly Scrum) and operations (mostly Kanban). (Rossberg, 2014, Chapter 2)

According to Forrester (2015) faster application delivery requires embracing DevOps practices. Every organization can benefit from these practices; however, each organization needs to assess its current situation and determine which practices are most immediately critical and which can be planned for the future.

According to a Forrester's (2015) in-depth survey with application development and IT operation professionals point to seven key recommendations for companies to follow when looking to adopt DevOps practices to improve their results.

1. Streamline, simplify, and automate the delivery pipeline.
2. Expand test automation to improve quality while increasing delivery speed.
3. Use infrastructure as code and cloud technologies to simplify and streamline environment provisioning.
4. Reduce technical debt to increase responsiveness and reduce cost.
5. Decouple applications and architectures to simplify delivery activities.
6. Collect and analyze feedback to drive better requirements.
7. Measure business outcomes tied to application releases.

Rapid delivery cycles enable organizations to measure whether what they delivered mattered and to know what they should work on next. Rapid feedback enables organizations to deliver increasing levels of customer delight while reducing the amount of time, money, and effort they spend on building things that no one wants or needs. (Forrester. 2015)

When rapid application delivery enables better customer insight, organizations are able to see a close connection between business strategy, execution, customer experience, and business results. Organizations try out new ideas, gather feedback, and rapidly refine their solutions based on customer experiences. This enables organizations to identify and rapidly act upon new business opportunities. (Forrester. 2015)

2.1.7 Trust-Ownership model

“Now more than ever we need to unleash the talent of individuals, team and organization.“ (Pixton, Gibson & Nickolaisen, 2014, Chapter 1)

From the specialist point of view, this sounds more than good to get all the talent in use efficiently. In a large organization the amount of people and way of organizing the people are always a challenge, but should be possible to tackle if wanted.

To build the effective organization it is important to both improve the process performance and build a high-performing, improving teams. This requires the leader to take one step back and let the team to find the answers themselves instead of only following the orders or plans. (Pixton and others, 2014, Chapter 1)

Pixton and others (2014, Chapter 1) introduces the Trust-Ownership Model (Picture 2-6.) that explores the interrelationship between the amount of trust that the Leader or organizational process has in the Team and the level of ownership and commitment that the Team has to the success of the project or business.

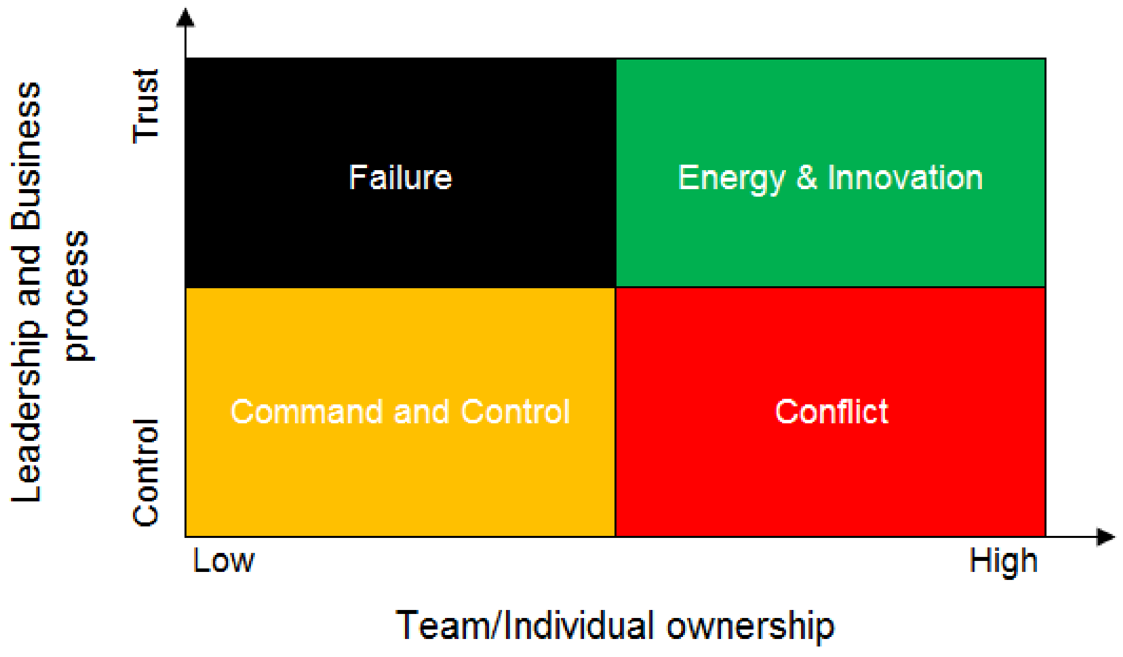


Figure 2-6 Trust-Ownership model (Pixton et al, 2014, Chapter 2)

In the model the Team refers to the individuals and the teams that actually do real work to create customer and business value. This may be a single individual or group of individuals doing the work together, but it is not an organizational entity. The Leader in the model refers to team leads, managers, senior professionals and the business processes and tools they create to control their subordinates' activities, any person or process that has organizational power over Team. Everyone or every team needs to own its results and be trusted. It is old fashioned, inefficient and motivation killer to control and punish. (Pixton et al, 2014, Chapter 1)

In the model the vertical axes indicate Leadership and business process through trust versus control. On the Control end team spends time documenting, reporting and asking permission – wasting time away from creating business value, when the manager wants everything to be controlled, on the Trust end teams and individuals are able to take appropriate actions owning their work. The horizontal axes indicate Team/individual ownership where left hand is for "I'll only do what I'm told" and right end for fully commitment and finding the way to meet the business goal.

In command and control section, team is in fear of failure and lack of trust and the leader takes full control. In failure section leader trusts the team, but team doesn't care. In Conflict there is continuous conflict between team and leader and leader holds the team back while the team feels ownership and wants to make progress. In Energy and innovation Leader works in strategic level and has confidence in the team, team understands business and customer requirements, things get done well and fast and team is committed to them and delivers rapidly. (Pixton et al, 2014, Chapter 2)

According to Pixton and others (2014, Chapter 2) living in failure or conflict cannot last long. The teams in conflict get tired of the fight and move back to command and control and the teams in failure get tired of too high level of control and move back to command and control. High control environment or culture can limit productivity and revenues. (Pixton et al, 2014, Chapter 2)

In addition to trust and ownership, integrity is the foundation to enhance the way of working and get closer to Energy and Innovation. Setting inrealistic goals leads to distrust and demotivation. In addition to the goals being realistic, the goals of the teams must be aligned with the business goals of organization. In addtition to that ambiguity and incertainty needs to be dealt honestly to grow a healthy, high-performing organizaton that works together to provie value and delight customer. (Pixton et al, 2014, Chapter 2)

Pixton and others (2014, Chapter 2) sees Leadership effectiveness, Trust, Ownership and Honestly dealing with ambiguity and complexity important areas of good culture.

Leadership effectiveness: Good leader explains the goals, encourages to think big, asks to link the work to goals and keep customer in mind. Good leader guides by asking questions, not telling the answers. This way the ownership is moved to the team and team learns on the go. (Pixton et al, 2014, Chapter 1)
In addition a good leader acknowledge difference between opinion and fact, change according to new information and learn, expect success, accept mistakes, avoid blame, recognize that plans change, don’t force an aggressive plan, don’t push teams too hard or they will start game playing against the leader, continously consider risks and plan big, but take small steps. (Pixton and others, 2014, Chapter 2)

Trust: To succeed, the leaders must trust their teams and overcome the fear of failure to deliver the maximum value. (Pixton and others, 2014, Chapter 2)

Ownership: Clear ownership helps to move from getting things done to getting the right things done. It is important part of the ownership to know what to own. Understanding the alignment leads to making better decisions about the products, processes, features and functions. (Pixton and others, 2014, Chapter 2)

Honestly dealing with ambiguity and complexity: Pixton and others (2014, Chapter 2) suggests to embrace ambiguity with using iterative methods like Agile. Ambiguity is faced with learning and experimenting for better results.If the organization wants to build fully engaged teams that are committed to business’s success, there is no space for game playing. Instead both the individuals and organizational processes need to act with honestly and integrity. Accepting the uncertainty (of schedule, cost etc.) will help to better understand the unknown of the future. (Pixton and others, 2014, Chapter 2)

2.1.8 Processes

Despite possessing unique characteristics and differentiators, agile methodologies and frameworks generally share some common traits. These common characteristics are illustrated in figure 2-7 in a depiction of a Generic Agile life cycle. (IIBA. 2011. p. 18)

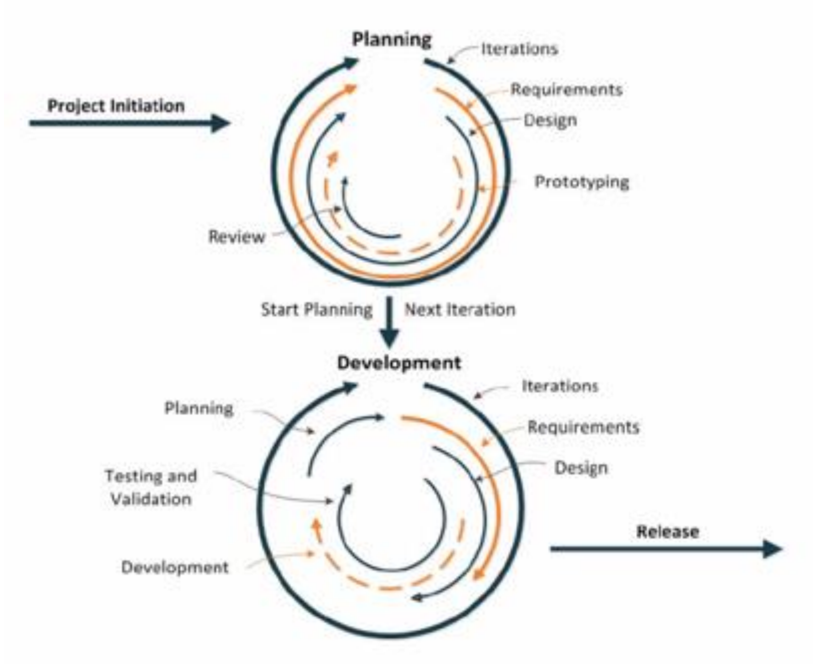


Figure 2-7 Generic Agile Life-Cycle (IIBA. 2011. p. 18)

Regardless of the agile methodology used, successful agile projects follow the consistent planning rhythm or cadence of Strategy, Release, Iteration, Daily and Continuous combined with the notion of frequent and flexible release schedules that allow for high customer involvement with rapid feedback and frequent product assessments. (IIBA. 2011. p.18)

Through the cadence, the requirements for the project are progressively elaborated to an appropriate level of detail. At each step, stable concepts are captured, context is captured and learning opportunities are identified. One of the keys to agile is to perform a sufficient level of analysis at each planning level. Too much analysis up front can result in creation of documents that are subject to change, require the business user to explain their needs multiple times, and may not necessary to achieve the goals of the project. Too little analysis up front can result in irresponsible commitments, rework, and lack of focus on customer value. (IIBA. 2011. p.20-21)

Generic Agile model

Paul and others (2014, Chapter 13) introduces the generic agile model (Figure 2-8).

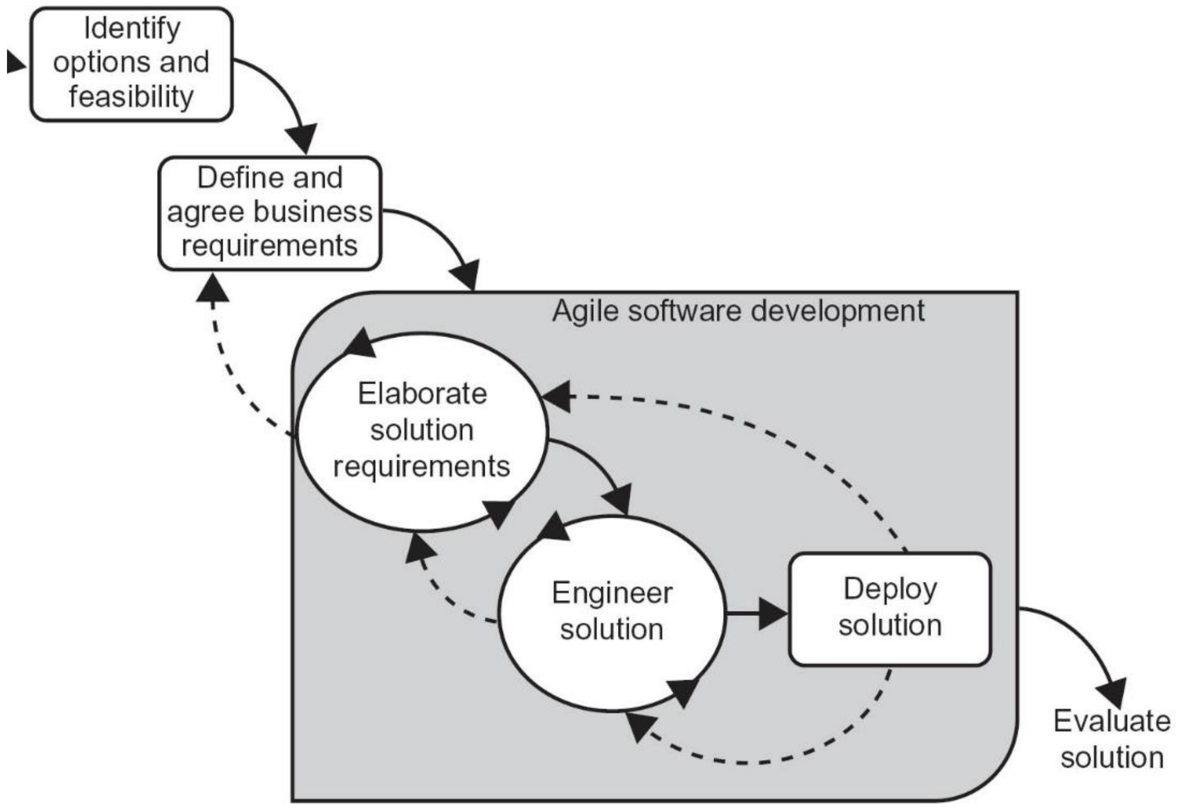

Identify options and feasibility
Define and agree business requirements
Agile software development
Elaborate solution requirements
Engineer solution
Deploy solution
Evaluate solution

Figure 2-8 Generic agile model (Paul and others, 2014, Chapter 13)

Paul and others model begins with the identification of a business need and consists of following stages:

- Identify options and feasibility: A feasibility study is conducted to determine the options that the business might pursue in order to address the business need. This will set out the options available, in particular the costs, benefits, impacts and risks of each alternative option, and possibly a preferred option.
- Define and agree business requirements: Once a preferred option has been selected, the high-level business requirements need to be defined, from which more detailed solution requirements can be derived. This stage identifies the scope for the systems development project by defining a set of high-level features to be delivered by the solution. These high-level requirements are also prioritized during this stage.
- Elaborate solution requirements: The high-level business requirements are explored and elaborated into more detailed requirements for the solution, using techniques such as storyboards, wire frames and prototyping. An iterative approach is adopted in order to develop a final, operational prototype. This confirms the functional requirements to be built and deployed in the current release.

As Agile development projects typically deliver functionality incrementally, this stage and the following two stages (engineer solution and deploy solution) will be repeated for each incremental solution delivery.

- Engineer solution: Once the functionality for the current delivery has been agreed, a production-ready solution is built that can be deployed into the live environment. This stage will addresses the non-functional requirements and technical infrastructure required to turn the operational prototype into a fully fledged, working solution.
- Deploy solution: The tasks necessary to deploy the working solution into the live operational environment are conducted, including data take-on, data conversion, preparation of documentation, end-user training, installation of the live environment and transition to the service delivery team.
- Evaluate solution: Once the solution is 'live', typically some period of time after it has been deployed, an evaluation of the solution is undertaken to determine whether it has met the business objectives and is working satisfactorily. This review may lead to perfective maintenance to improve aspects such as performance and usability. Once the final version is deployed, a benefits review will be conducted to examine whether or not the benefits have been realized and, if not, identify any further actions required to enable their realization.

The lean product process

The core idea is to maximize customer value while minimizing waste. (Ries, E. 2011.)

Olsen (2015, p.9) describes Lean product process like this:

1. Determine your target customers
2. Identify underserved customer needs
3. Define your value proposition
4. Specify your minimum viable product (MVP) feature set
5. Create your MVP prototype
6. Test your MVP with customers

According to Olsen (2015, p. 201) an important part of product-market-fit is having the right product at the right time, earlier than your competitors.

Build-Measure-Learn loop

The Build-Measure-Learn loop (Figure 2-9) is an application of the Plan-Do-Study-Act (PDSA) cycle, originally created by Walter Shewhart and advocated by W. Edwards Deming. The PDSA cycle has been used by organizations for several decades to enable continuous improvement efforts. The main thing that the Build-Measure-Learn loop adds to the PDSA is an emphasis on getting through the cycle as quickly as possible in order to validate assumptions and test hypotheses about solutions, reinforcing the tie between the activities of a startup and experiments. (McDonald, 2015)

It is important to validate assumptions early on in your project so that you can determine if you have identified the right solution to the right problem. Asking your stakeholders for feedback is helpful, but due to the influence of cognitive biases, they can sometimes give you misleading information. That's where the Build-Measure-Learn loop comes in. It provides a way to validate assumptions in conjunction with talking to your stakeholders. It also encapsulates the overall approach to building and getting feedback, which is a key aspect of the guiding principle to reflect and adapt. (McDonald, 2015)

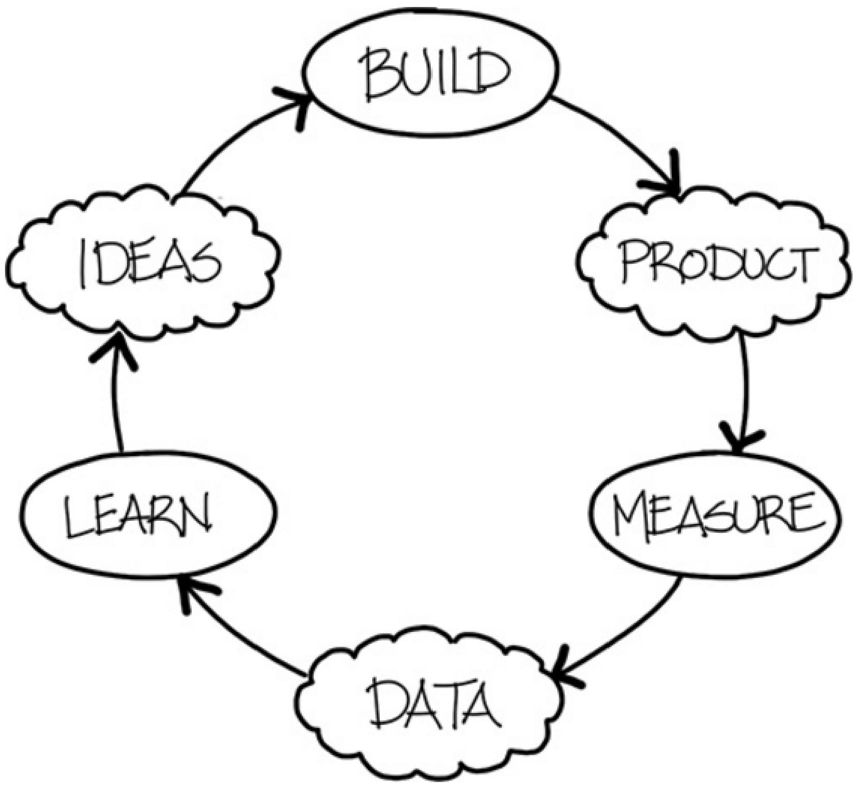


Figure 2-9 Build – Measure – Learn feedback loop (Ries. 2011.p.75)

McDonald (2015) explains the lean feedback loop as follows:

Idea: Your stakeholders have a need. You understand that need and you think you've identified a solution that may satisfy that need. In other words, a desired outcome is based on a bunch of assumptions that you should validate in some way. You need to identify some form or metric based on you overall goal that you can use later on, as a measuring stick to tell whether you are successful.

Build: You pick a specific solution (or piece of the solution) to deliver. This is an output. Impact mapping can help you pick the right output. Your goal in delivering this output is not necessarily the be-all and end-all, it is to understand the impact this output has on satisfying the need (reaching the desired outcome).

Product: The output of the project

Measure: You've delivered this output in isolation so you can see its impact on the outcome free from any other influences (as much as possible at least)

Data: Observe the impact on the metric you identified

Learn: Examine the data and decide whether the change you delivered made the impact you wanted. If it did, you may be done. If not, you have to try something else. And you start the whole cycle all over again by looking at your remaining options and picking the next one.

Iterative development approach

According to Paul, D., Cadle, J. and Yeates D. (2014, Chapter 13) the iterative development approach is founded upon these fundamental generic principles:

- **Evolutionary** – Detailed requirements are evolved through a series of iterative prototyping development stages.
- **Empowerment and collaboration** – It is a fundamental requirement that the team, including business staff and IT developers, are empowered to make decisions during the software development and work as a collaborative team.
- **Fitness for purpose** – The deliverables are required to be fit for purpose rather than aligned slavishly with a set of defined requirements.
- **Testing all the time –** Testing is an integral part of the iterative development approach so the software should be tested continuously. Automated testing tools are very useful in doing this.
- **Re-factoring –** Iterative development adopts an exploratory approach so any work may be reversed if it does not add value. This is not perceived as being a mistake or waste of time but instead as an integral part of the iterative process.

- **Incremental delivery** – The system is likely to be deployed in increments, with each subsequent increment providing additional functionality or improved performance.
- **Prioritisation** – An approach such as MoSCoW (Must have/Should have/Could have/Won't have) is used to identify the different levels of priority amongst the features to be delivered.
- **Timeboxing** – The concept of a ‘timebox’ whereby time limit is set, at the outset, for the development of part of the system. Prioritisation is used to provide some contingency in the timebox, for example by including features of a lower priority that may be deferred or dropped if time does not allow.

Double diamond design process

Teams often focus on the delivery of a thing, instead of its business impact. This happens when we define success by short timeframes, and performance relates to output. We also tend to rely on our intuition or acumen, without seeking any validation. Even with years of experience in a domain, intuition can be flawed by our biases. Left unchecked, we define and pursue solutions before fully understanding the opportunity space. (Schneider, J. 2015.)

Creating successful products requires the skills, expertise and craft of many people. Engineers, specialists, analysts, strategists, designers, researchers, architects and marketers work together. We define a desired future state, before executing upon that vision as one. With such a group of people come diverse personal characteristics – analytical, creative, strategic, pragmatic. And many approaches to working – structured, unstructured, empirical, theoretical. We need something that guides us to define adaptive plans that respond well to new information. A model that helps us to work together to achieve real outcomes together. (Schneider, J. 2015.)

Double diamond design process (Figure 2-10) maps the divergent and convergent stages of a design process. Model is created by The British Design Council and it describes modes of thinking that designers use. Double diamond model seems like a linear process. It describes significant up-front design, before going on to produce a final solution. Working this way means that solutions are generally perfected before public release. That’s because it’s expensive to change a physical product after it has shipped. Another effect is that a lot of time passes before knowing it’s efficacy in a real market. For software products or services, we take advantage of the malleable nature of what we create. Software is easier to change, so we don’t need to perfect the entire solution up front.

Instead, we create smaller packages of value for release. Then we respond to what is learnt in a real market to refine and adapt the architecture of the product. When we do this, the initial solution informs the future, and our strategy adapts. (Schneider, J. 2015.)

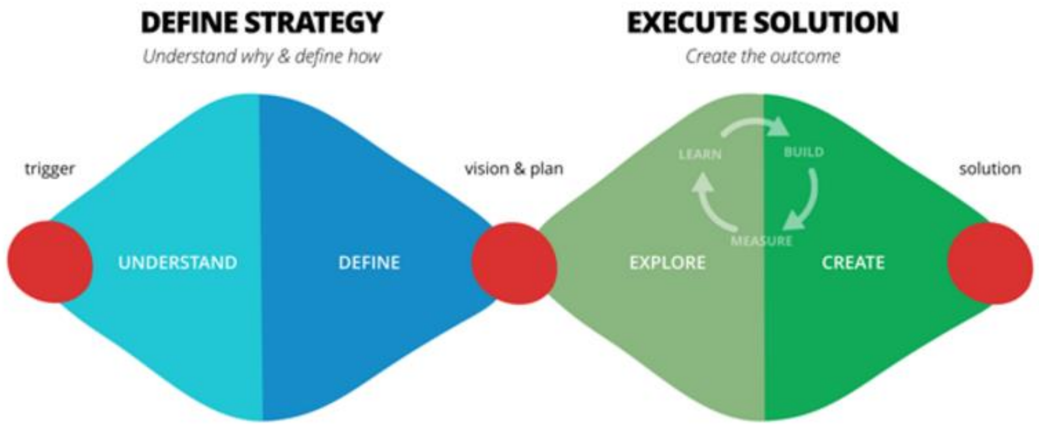


Figure 2-10 Double Diamond model, adjusted for software products and services (Schneider. 2015)

Schneider (2015) describes the phases of the model as follows:

Understand: First is needed to seek to understand the current condition. This phase is divergent and exploratory – it's a search for new questions. Through observation and enquiry revealing customer behavior and business drivers. Opportunities are identified for further consideration.

Define: Synthesizing knowledge into insight. Converging on a vision and defining the first expression of our plans to occupy a future position. Assessing the viability and impact of our plans, and determining how to measure success. This initial strategy guides the execution of a solution, but strategy is never complete. A strategy should adapt when new discoveries are made. All details of a solution doesn't need to be defined. Instead, the focus should be on the desired outcomes or impact to achieve.

Explore: With a vision in place, it's time to explore the best potential solutions. Knowing what to achieve, and by exploring and validating options, the best ways to succeed can be found. This is a divergent and iterative activity. Details and requirements have not been defined – instead, the right solution is discovered.

Create: As confidence in the solution is gained, exploration gives way to engineering to create and optimize working software. The opportunity here is two-fold. First, a working solution delivered to market. Second, gathering real market feedback. As a result, understanding deepens, and new discoveries influence an ever-changing strategy. Software engineering is not merely execution of a plan, it also defines strategy.

Understanding the phases of the Double Diamond and how they interrelate is important (Figure 2-11). It helps decide the right methods and activities for pursuing a problem or opportunity. (Schneider. 2015)

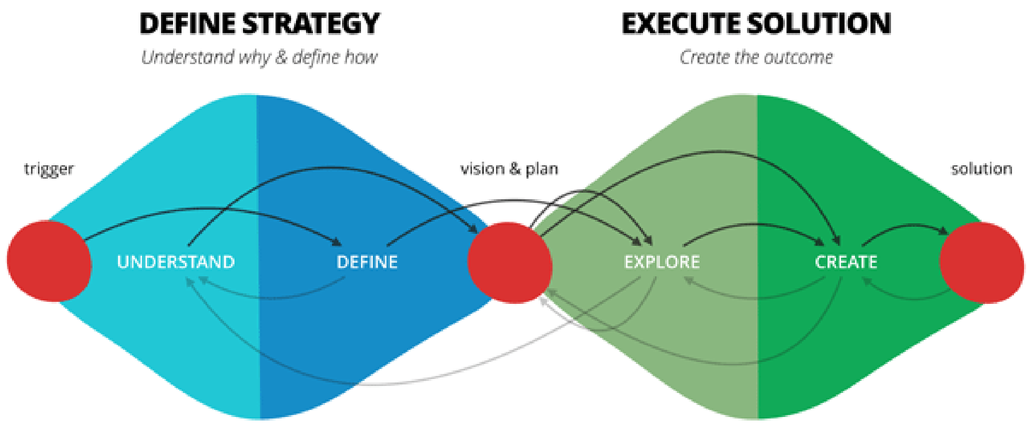


Figure 2-11 Interrelations of Double diamond design model (Schneider, 2015)

Analysis with agile mindset

McDonald (2015, Chapter 6) describes analysis with agile mindset to happen in four steps (Figure 2-12):

1. What is the need?
2. What are some possible solutions?
3. What should we do next?
4. What are the details of this part?

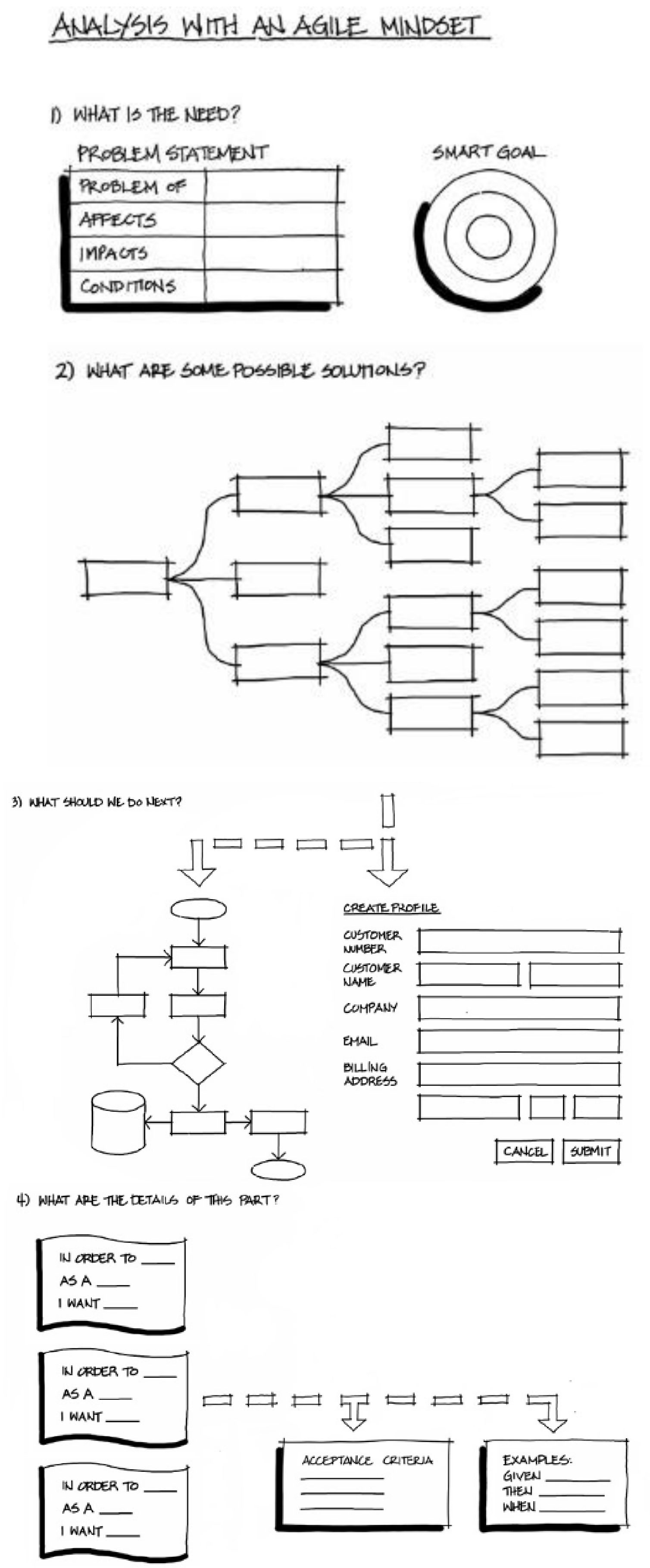


Figure 2-12 Analysis with agile mindset

2.1.9 Value

Robertson & Robertson (2013, p.2) state that optimally valuable product needs to provide benefit that is in proportion to the cost of the product.

In order for a project to deliver value, they must first be able to identify whether a request is actually valuable to the organization. Without a clear understanding of business value, it is possible for the project to deliver something that sounds valuable but is actually not. (IIBA. 2011. p.73) .

A project creates business value when it delivers anything that contributes to an organization’s stated primary goals, for example

- Increasing or protecting revenue
- Reducing or avoiding costs
- Improving service
- Meeting regulatory or social obligations
- Implementing a marketing strategy
- Developing staff

(IIBA. 2011. p.73.) .

Goals and objectives

A goal is a broad, over-arching destination. "We want to achieve 50% market share in two years," or, "I want to compete in and complete a triathlon within 18 months." It does not define how you will achieve this market share; it does not describe a strategy to get there or offer the specific tasks necessary to achieve the strategy. It simply is out there as a destination or target. (Reh, 2016b)

An objective is a specific, measurable activity you will take to work towards a broader goal. For example: "As part of our goal to achieve 50% market share in two years, we will introduce a new product in each market segment every six months." Or, "To achieve my goal of completing a triathlon, I will engage a running coach to help me improve my cardio conditioning, pacing and running technique." (Reh, 2016b)

Reh (2016b) also states that the strategy connects objectives with goals and that focus on the goal as the destination and the objective as the action(s) needed to get to the destination.

Return on investment (ROI)

Beattle (2015) writes that calculating ROI is very simple on paper: ROI = (Gains-Cost)/Cost. In addition, he reminds that it just has to be remembered, that time is not taken into account in ROI. Still it is important whether the investment pays off in short term or only after e.g. 30 years.

Beattle reminds that ROI is a historical measure, calculating all the past returns.

Cost of bugs

Bugs are usually something opposite to quality and value. To assess the value or negative value of the bugs it is important to pay attention to the cost of bugs.

The Systems Sciences Institute at IBM has reported that “the cost to fix an error found after product release was four to five times as much as one uncovered during design, and up to 100 times more than one identified in the maintenance phase.” (Leon, 2015a)

Leon (2015b) expresses the amount of the cost of fixing a bug in separate phases of software development lifecycle with the monetary figures (Figure 2-13). She states that bug fix cost is multiplied with 100 if it is fixed on production, instead of fixing it already on requirements phase.

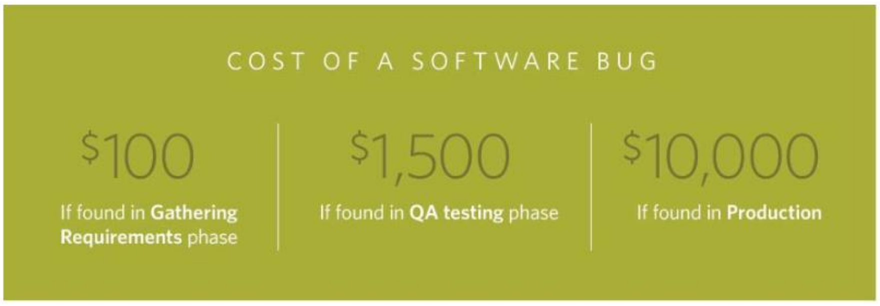


Figure 2-13 Cost of a software bug (Leon, 2015b)

Barry Boehm has ended up with even a cost of 150 times the cost on requirements phase (Figure 2-14) (Superdeveloper.com, 2009).

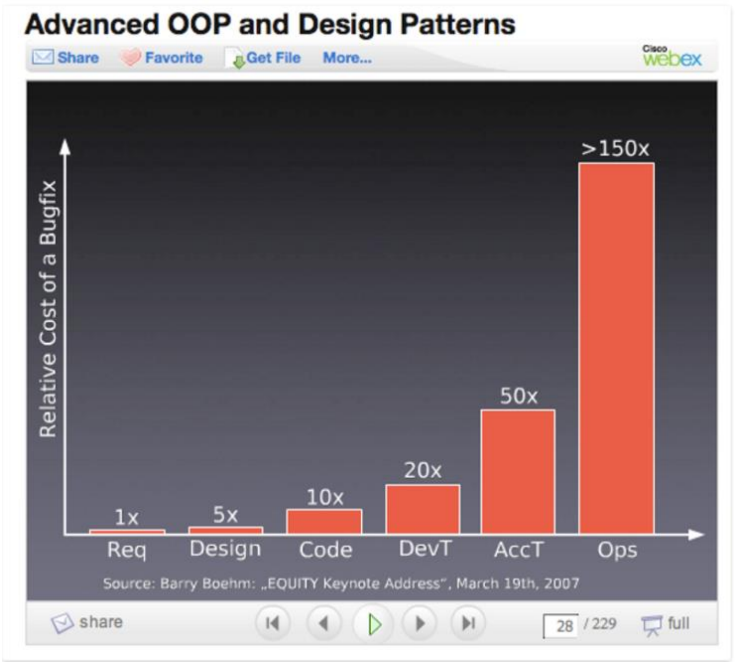
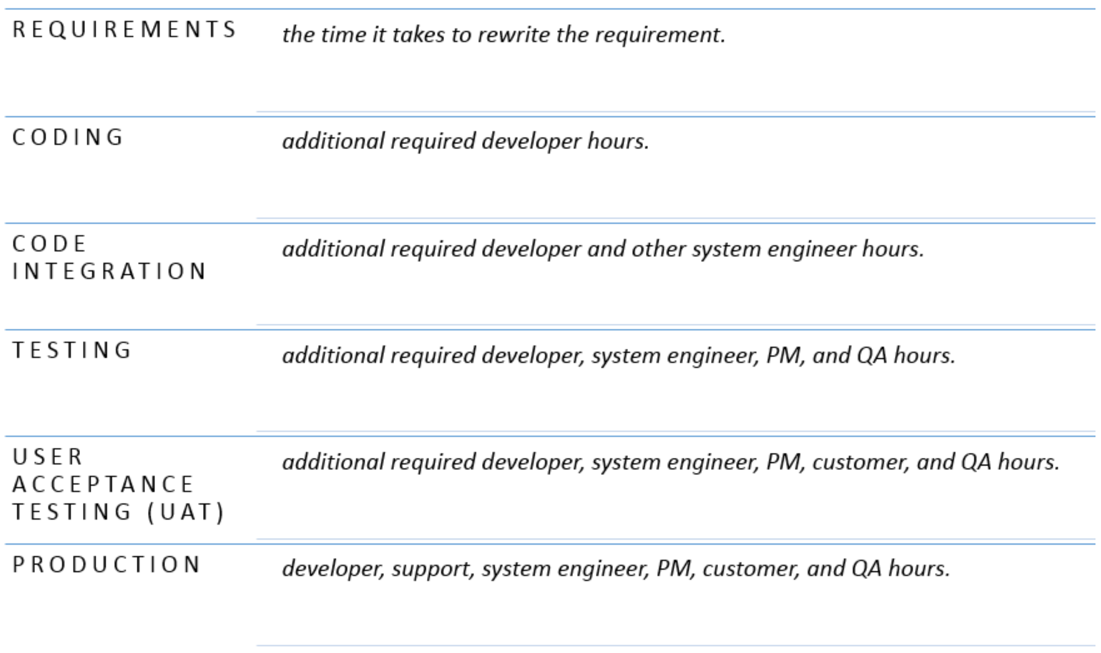


Figure 2-14 Relative cost of a software bug fix according to Barry Boehm, 2007 (SuperWebDeveloper.com, 2009)

Leon (2015b) defines the cost structure of a bug fix during the software development life cycle as follows (Figure 2-15)



REQUIREMENTS	*the time it takes to rewrite the requirement.*
CODING	*additional required developer hours.*
CODE INTEGRATION	*additional required developer and other system engineer hours.*
TESTING	*additional required developer, system engineer, PM, and QA hours.*
USER ACCEPTANCE TESTING (UAT)	*additional required developer, system engineer, PM, customer, and QA hours.*
PRODUCTION	*developer, support, system engineer, PM, customer, and QA hours.*

Figure 2-15 Cost structure of bug fix during the SDLC (Leon, 2015b)

Leon (2015b) explains the accumulation of the cost in different phases:

- In the requirements phase fixing the bug takes only the time to rewrite the requirement.

- In coding phase the fixing time varies depending on the complexity, but it is less than fixing a bug found by someone else.
- In code integration phase time is usually at least twice as much, because the problem occurs at a higher level and there is more investigation needed to find the source of the bug.
- In testing phase QA tester needs to reproduce and document the steps, submit a defect, prioritize it and discuss it through with developer. After the bug is fixed, the code needs to be integrated, retested and verified as fixed.
- In user acceptance testing phase the acceptance tester needs to communicate with tester who tries to reproduce the bug and decide whether it is a bug or not. If it is a bug, it is then reported as a bug and cost is accumulated accordingly. In addition to integration and re-testing, also the user acceptance test needs to be redone.
- In production phase the support is involved and the communication cost between supplier and customer is added.

Leon (2015a) gives few examples of real cost of the software bug:

1. NASA Mariner 1 spacecraft was launched in 1962, attempting to reach Venus. A software bug caused the rocket to veer off course and after 290 seconds after takeoff it had to be destroyed. According to the official report, omission of a hyphen in coded computer instructions in the data editing program, resulted in incorrect guidance signals being sent to the spacecraft. The cost of aborting the mission was 18 million back in 1962.
2. Toyota had to recall more than 9 million cars worldwide in 2010 due to the fact that cars had a software bug that caused a lag in the anti-lock-brake system. Drivers were not able to use the breaks and few people already died car crashes. Due to increased incentive campaigns, legal liabilities, and marketing efforts, the recalls were estimated to cost Toyota as much as $3 billion.

Leon (2015b) states that most of the bugs found in the coding and requirements gathering phases can be substantially reduced by performing Agile methods, like defining acceptance criteria, unit testing and doing test-driven development.

Very often the challenge is still hidden behind the schedules and missing quality targets:

> The question every developer asks is, “What is the simplest, easiest, and fastest way to get something done?” The answer could be open to interpretation, but that is because the long view must be taken into consideration, and that is why software makes use of functions, templates, classes, objects, and design patterns. The work is needed now, but how

will it be possible to understand the software in a few months time when no-one is mentally fresh? How do I share my ideas with other people? How do I take the long view into account? (Superdeveloper.com, 2009)

Attractiveness

Pokémon Go (stylized as Pokémon GO) is a free-to-play, location-based augmented reality game developed by Niantic for iOS, Android, and Apple Watch devices. It was initially released in selected countries in July 2016. In the game, players use a mobile device's GPS capability to locate, capture, battle, and train virtual creatures, called Pokémon, who appear on the screen as if they were in the same real-world location as the player. The game supports in-app purchases for additional in-game items. (Wikipedia. 2016)

Churchville (2016) describes Pokémon Go like it's simple enough up front to get people into it, but offers plenty of complex features to players to look into once they are familiar enough with the app. He continues that the enterprise application also should be complex enough to meet the business need, but not so complex that it makes users tear their hair out.

Churchville (2016) also raises up that the social aspect of Pokémon Go is drastically impacting its adoption and use. According to him, possibility to join teams, help each other out, look for Pokémon together and more, turns the use of the app into a larger social experience. He also asks that if there would be any way the same kind of social aspect that there is in Pokemon Go game could be included into an enterprise mobile app. He wonders if an enterprise application could also encourage collaboration between team members, or reward them for linking up with other users or help facilitate the creation of a team in the future. He wonders if turning the app into something that people can use together could turn it from a technological burden to a blockbuster, also for enterprise applications.

DeMers (2016) explains the qualities that there already is in Pokémon Go augmented reality game and in the future he suggests them to be successful qualities in application development, and they are

- **Augmented reality** that is the most important part of the Pokémon Go and there the players can encounter Pokémon "in the wild," seeing the animated characters on their phone screens as they examine their surroundings, and in addition to that, real physical locations. The augmented reality in Pokémon Go relies on the latest GPS technology, the mobile practicality of our modern devices, and processing power capable of layering new elements over our existing world. In the future, app developers may take this a step even further, even up to the virtual reality (VR), where entirely new worlds can be created before our eyes.

- **Gamification** as the process of turning something ordinary into a kind of game. Being a way to get people more involved, more engaged, and more entertained by specific tasks. In Pokémon Go's case, walking and visiting cultural landmarks and traveling new places has become a game, since by walking user can find more Pokémon and hatch eggs that way and by traveling user can earn rewards and see new Pokémon this way.
- **Unlimited potential**, the future of app development will be customizable, ever-expanding, individualistic, and with practically unlimited potential, all to keep users interested
- **The learning curve**, the ideal learning curve is one that is simple for easy entry, but also rewards users for increasing investment and discovering more complex mechanics. Users should not get bored with application after a few uses or complexity should not scare away the newbies.
- **Microtransactions**, using coins (which you can buy with real money) to purchase helpful items in the game. Pokémon Go made their first priority giving people a game they love to play and purchasing helpful items is not mandatory but only a possibility.
- **The social element**, people talking about and sharing the game with others. In Pokémon Go user can commit to a team, which builds loyalty and encourages instant bonding between like team members, you can exchange tips, and you can go Pokémon hunting together with shared "lures" to maximize your mutual experience. In the future subtle social encouragements like these—instead of or in addition to traditional social modes, like chat features, are likely to increase.

To stay in time or ahead of it, the attractiveness of the software could be calculated as part of the service value. Getting people exited or at least not annoyed, with the business software, provides value in that sense that people recommend service or product to other people. And that is valuable. Whether the qualities mentioned above fit into the business world or not, users should be provided something simple and efficient with a little of twist to make it fun or less boring.

2.2 Agile requirements definition and management

> Requirements are what the software product, or hardware product, or service, or whatever you intend to build, is meant to do and to be. Requirements exist whether you discover them or not, and whether you write them down or not. Obviously, your product will never be right unless it conforms to the requirements, so in this way you can think of the requirements as some kind of natural law, and it is up to you to discover them. (Robertson & Robertson 2013, p. 1)

Since software should exist to solve a business problem, any development project should start with the problem, not with presumable solution. (Robertson & Robertson 2013, p. 4)

Murphy (2010) explains the Requirements definition and requirements management as terms that are used to describe the process of eliciting, documenting, analyzing, prioritizing and agreeing on requirements and then controlling, managing and overseeing changes and risk. IIBA (2015, p. 19) adds validation as a key activity of requirements analysis.

Smart businesses want to do better Requirements Definition (RD) and Requirements Management (RM) (or as Gartner puts them, RDM) to streamline the whole application life cycle. According to Murphy, systematic and effective RDM captures software defects earlier in the lifecycle and reduces the overall likelihood that defects will happen. (Murphy, 2010.)

Murphy reminds that it is quite common to look at the application lifecycle management (ALM) process through only a technology and development lens instead of paying attention also to the strong RDM. She also states that even if implementing strong RDM practices needs resource investments, those investments are not near to the costs of weak RDM. Eliminating requirements discovery will cause both wrong end result and poor quality passing on in the development life cycle. (Robertson & Robertson 2013, p. 4)

Murphy (2010) says that according to Gartner, 40 % of unplanned downtime is caused by application failures, where of a large portion is due to poor requirements introduced during development phase. According to Murphy, the National Institute of Standards and Technology (NIST) estimates that 70 % of software defects are introduced in the requirements phase. The later the bugs are found in the lifecycle, more it costs to fix them.

The organization of the requirements and the organization of the team itself are not independent things in agile. To optimize the efficiency of defining, building and testing code that delivers value to the end users the teams organize around the requirements. (Leffingwell, 2011, p.48) Murphy (2010) names Business Analysts and Software Quality Managers as the pillars of good RDM, but also reminds that in agile all stakeholders should be involved in the development of the user story.

Agile requirements management is temporal, interactive and just-in-time. (Leffingwell, 2011, p.16) In agile requirements management process is very iterative, many stakeholders are involved and requirements are presented in form of user stories and tasks. In Murphy’s (2010) opinion the difference between requirement and user stories is only the structuring, when they both describe a specific condition or capability to achieve an objective or solve user's problem.

2.2.1 Agile requirements definition and management process

Best systems or products are simple and streamlined, therefore the Lean Thinking removes waste from the system. Requirements definition and management is also vulnerable for the complexity factor moving the system toward complexity when getting more mature. Requirements definition in Agile should be considered as its own area of work, not only through the development team. RDM can utilize the same principles that are used in Agile software development (figure 2-16). (Moccia, 2012)

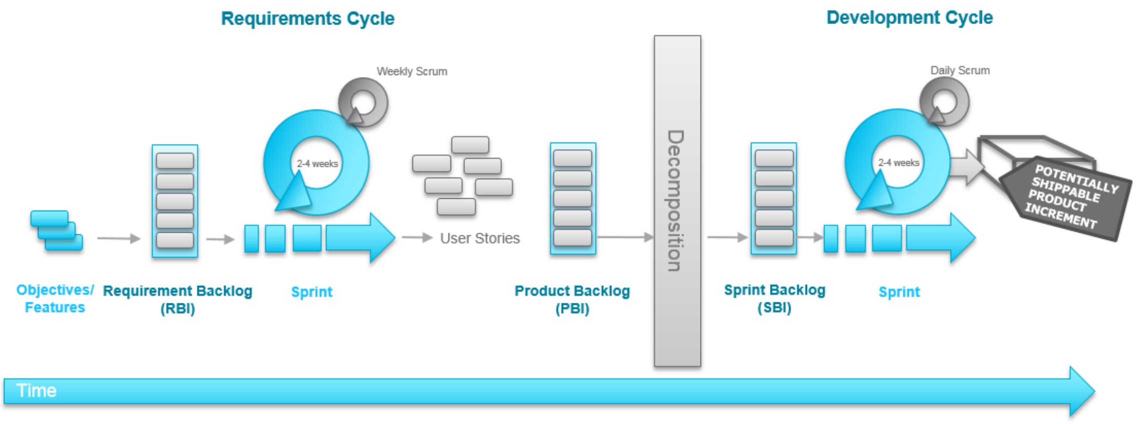


Figure 2-16 Agile requirements definition and management (RDM) (Moccia, 2012)

In scrum the software is built incrementally in two- to four-week events, or sprints. In sprint planning the development team discusses what needs to be developed in a given sprint based on organizational needs and strategy. Product Owner directs the work items that are pulled from the product backlog and Scrum Master controls and manages the process. Business feeds the product backlog and supports and describes the prioritization of the sprint. (Moccia, 2012)

Agile requirements definition and management (RDM) is designed for feeding the product backlog faster than the development team can produce code. The framework enables both just-in-time requirements definition and building a repository of requirements for future use. In both cases the team using scrum is working from the product backlog. The product backlog needs to be filled for the sprints. The Product Owner needs to define what needs to be built and with what level of quality. For this to happen, the requirements cycle follows a Scrum-like process that follows the development cycle but two to three steps ahead. Aim is to get requirements thoroughly vetted, organized and communicated iteratively, timely and quality-focused. (Moccia, 2012)

First the requirements backlog is identified and filled. Based on the business strategy and objectives and using requirements planning and prioritization, the requirements team decides what needs to be defined and built. The requirements team plans its sprints, performs the work and reviews the outputs. If the expectations are met with outputs, they are moved to the product backlog. (Moccia, 2012)

Decomposition in RDM is the process by which the product backlog items are communicated and refined in collaboration with the development team. In Scrum this is called grooming the backlog, where the development teams are brought into the requirements phase to refine the product backlog in a culture of collaboration. The decomposition is also a way to pick up where things left off, when there is any larger gap in time between definition of requirements and development. (Moccia, 2012)

The value of agile development that fosters continuous improvement, time-boxed development cycle and more quickly delivering value to the end users will be driven to a large extent by the quality and clarity of requirements that feed the development process. (Moccia, 2012)

2.2.2 Requirements definition process

Murphy (2010) describes the requirements definition process as follows (Figure 2-17):
In **elicitation phase**, Business Analyst gathers the requirements and delivers them to the backlog to be assessed. She says that usually requirements elicitation practices include JAD (joint application development) techniques like interviews, questionnaires, user observation, workshops, brainstorming, use cases, role-playing and prototyping.

In **elaboration phase** more depth is added to the meaning of the requirements. Epics are broken down into user stories, tasks or technical details. Methods used by business analyst in elaboration phase are developing use cases in rich text, creating flow diagrams, class models, GUI mockups and assigning business rules. Murphy suggests that elaboration phase can also help with addressing known risk factors and establishing or validating the system architecture.

In **validation phase** it is verified that requirements are complete and testable. In this phase the developers and testers should check the “fit criterion” associated with the user story. Techniques used in this phase are discussions, simulations and face-to-face meetings.

Acceptance phase is the final stage in the requirements definition lifecycle. Acceptance is done only when the requirements have been verified and accepted by all the stakeholders. In this phase the baseline for the requirements are created and requirements are allocated to releases and iteration and this is where the technical development can start and test planning begin.

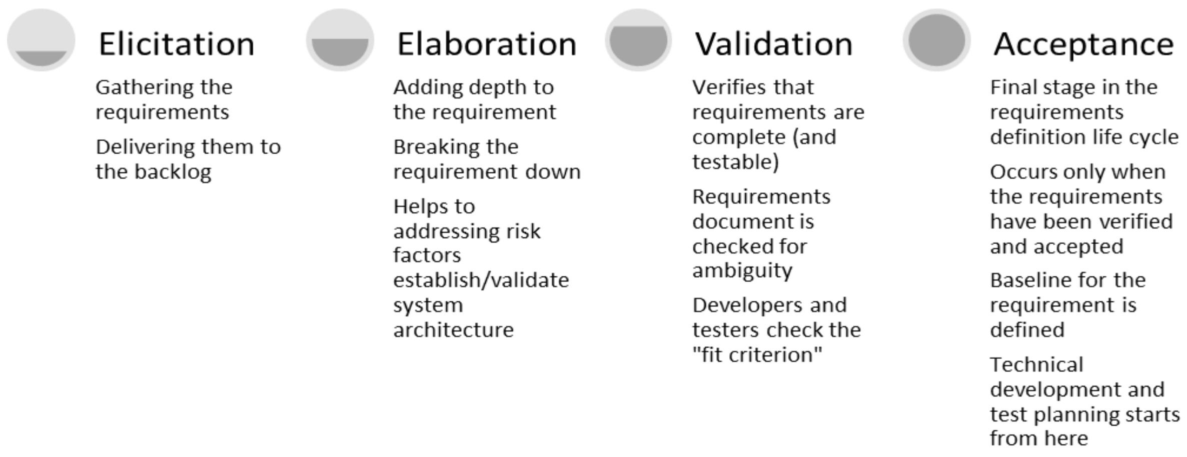

Elicitation
Gathering the requirements
Delivering them to the backlog
Elaboration
Adding depth to the requirement
Breaking the requirement down
Helps to addressing risk factors establish/validate system architecture
Validation
Verifies that requirements are complete (and testable)
Requirements document is checked for ambiguity
Developers and testers check the "fit criterion"
Acceptance
Final stage in the requirements definition life cycle
Occurs only when the requirements have been verified and accepted
Baseline for the requirement is defined
Technical development and test planning starts from here

Figure 2-17 Requirements definition lifecycle. (Murphy. 2010)

Requirements activity is about understanding a business problem and providing a solution for it, not only writing a requirements document. The requirements do not have to be written, but they have to become known to the builders. (Robertson & Robertson 2013, p. 1 and 5)

Murphy (2010) states that requirements may be captured either in simple text format or visualized with pictures, business process flow or simulations, depending on organization’s development method. She suggests to visualize the requirements only when it provides clarity or helps to save time, but not when visualization would end up as too complex diagram or would only be a waste of time. She suggests that visualization could be done e.g. based on requirement type or risk level of the requirement. According to Murphy, visualization is a useful tool to help business to communicate better with IT.

Need/Problem

Real art of requirements discovery is discovering the real problem (Robertson & Robertson, 2013, p. 1). Datta (2007, p. 38) puts it this way: it is hardest to discover the user's real needs from the twaddle of wishes, nice-to-have features and fantasies.

Don Reinertsen emphasizes that customers usually describe the desired solution instead of the real need. This is where requirements management usually fails, providing the solution customer wanted instead of fulfilling the real need. He describes a story where customer wanted a lightweight suitcase that was easy to carry, but when they got one, they still were not satisfied, but bought the ones with wheels from the competitor. (Leffingwell, 2011, Preface)

Don Reinertsen states also that focusing only to the user may lead to missing the non-functional requirements, since the needs has to be balanced with technical decision makers, end users, system operators and financial decision makers and the needs of distributors, regulators, manufacturing and field service has to be understood. (Leffingwell, 2011, Preface) In agile the non-functional elements of the user story are captured as "fit criterion" for the story, where traditional requirements normally brakes the requirement into functional and non-functional blocks. Usability, reliability, performance and supportability are common non-functional requirements. (Murphy, 2010)

Separating consideration of need from solution allows your team to identify multiple potential solutions and have options to pick from when it's time to determine the specific solution that you will deliver. Having those options increases the chance that your team will effectively deliver a solution that meets the needs of your stakeholders while keeping within constraints such as time and budget. (McDonald, K. 2015.)

"When designing a system and writing requirements, it is just as important to figure out what should not be in the system as what should be included. It may be easy to add more, but simplicity by definition means having less."(Tung, 2014)

Solution/Design

Antoine de Saint Exupéry has said "perfection is reached not when there is nothing left to add, but when there is nothing left to take away". (Tung, 2014)

Laakso (2006) explains already 10 years ago why we should first pay attention to user stories and use cases, instead of jumping straightly to the solution.

> “Part of the functional requirements are set according to what kind of a UI solution we are able to define for the user. For example, if without an UI we try to define features for a system where user can book appointments for a barber or hairstylist, the first thing that comes into mind would be a search (and search page), where the customer could search for free appointment times according to the date, the name of the barber or hair stylist and for example by the operation in question.
> Then again, if we produce the UI according to user stories or use cases we might find a better solution to support the user, providing for example a timetable calendar view and show all appointments for every barber and hair stylist side by side per day. In this solution, we don’t need any separate search functionality, but create calendar views and let user change the date from the calendar. These are separate functionalities than the original search page.”

It is important to recognize that business analysts are also responsible for the definition of design, at some level, in an initiative. The level of responsibility for design varies based on the perspective within which a business analyst is working. Requirements are focused on the need; designs are focused on the solution. The distinction between requirements and designs is not always clear. The same techniques are used to elicit, model, and analyze both. A requirement leads to a design which in turn may drive the discovery and analysis of more requirements. The shift in focus is often subtle. The classification as a requirement or a design may become less significant as the business analyst's work progresses to a greater understanding of and eventual fulfillment of the need. (IIBA.2015. p. 19)

Business analysis can be complex and recursive. A requirement (or set of requirements) may be used to define a design. That design may then be used to elicit additional requirements that are used to define more detailed designs. The business analyst may hand off requirements and designs to other stakeholders who may further elaborate on the designs. Whether it is the business analyst or some other role that completes the designs, the business analyst often reviews the final designs to ensure that they align with the requirements. (IIBA. 2015. p. 19)

The following figure (Figure 2-18) provides some basic examples of how information may be viewed as either a requirement or a design.

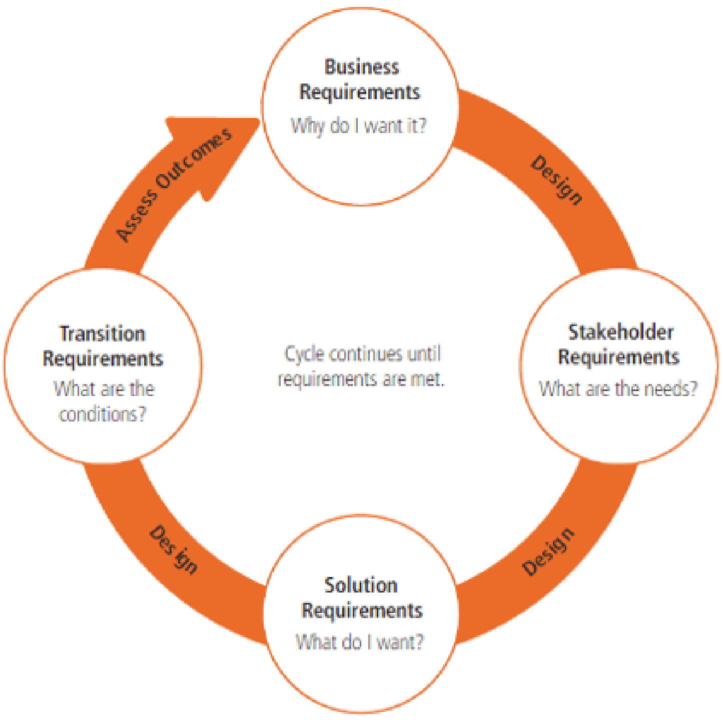


Figure 2-18 Requirements and design cycle (IIBA. 2015. p. 20)

Design occurs during delivery as your team figures out how to technically satisfy the user stories given your chosen technology and architectural constraints. That activity is inter-woven with development and testing as your team will have some initial discussions about design but then revise that understanding as they learn through experience. (McDonald. 2015)

As a result, calling design out as a separate activity doesn't add any value to the process and leads to pointless arguments about whether a particular item is in discovery, design, or delivery, whereas having an explicit split between discovery (getting ready for an itera-tion) and delivery (delivering it) is a much clearer delineation. (McDonald. 2015)

Robertson & Robertson (2013, 4) reminds that there is a challenge with iteratively ask users to accept the features, because it is hard to know when users are satisfied with them or only exhausted by the process.

Feasibility of a systems request

Shelly et al. (2011, p. 63-66) explains a feasibility study that a systems request must pass to see whether is it worthwhile to proceed further. According to them feasibility study has four areas: operational feasibility, technical feasibility, economic feasibility and schedule feasibility.

With operational feasibility Shelly (2011, p. 64) means that the system should be used effectively after it is developed. Technical feasibility points to the technical resources needed to develop, purchase install or operate the system. Economic feasibility looking for projected benefits of the system should cover the estimated costs or more. The benefits may be either tangible like saving the time or money or intangible like enhancing job satisfaction through the user-friendliness or enhancing the company's image. Schedule feasibility refers to a project being implemented in an acceptable time frame.

Definition of Ready

Agile Alliance (2015a) describes the term ”Definition of Ready” as explicit and visible criteria that a user story must meet prior to be accepted into the upcoming iteration, similarly as the ”Definition of Done” is for the completed items. They describe the decrease the amount of costly back-and-forth discussion or rework and possibility for the team to ”push-back” as the benefits of using the ”Definition of Ready”.

Kronfält (2008) adds that before the stories have reached the readiness state, the stories do not exist and will not be considered for sprint planning to save time.

Kronfält (2008) suggests definition of ready to include following facts:

- a user story exists, pointing out the actor, describing the feature and the purpose for it
- the formulation of the story is general enough so that the team has the flexibility to deliver it in increments
- The story is small enough to fit inside a sprint
- Each story has its own unique priority in relation to other stories in the product backlog, to ensure that most important things are implemented first
- The story has a description of how it can be tested or demoed, giving the reader a good sense of when story is completed
- The story has been estimated

Agile Alliance (2015) shows Definition of Ready as a station on Scrum on the Subway map to agile practices (Figure 2-19)

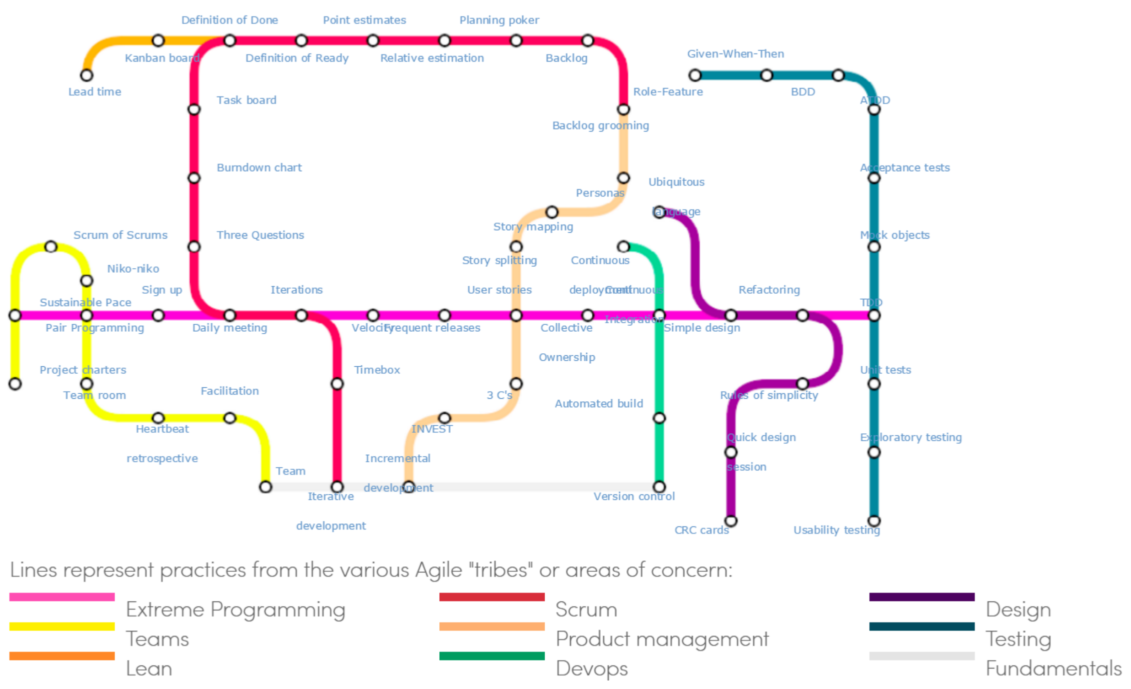


Figure 2-19 Subway Map to Agile Practices (Agile Alliance, 2015b)

Hypothesis-driven development

O'Reilly (2013) guides us to challenge the concept of having fixed requirements for a product or service. He states that when you are in an exploratory, complex and uncertain phase you need hypotheses more than fixed requirements. He also guides us to aim to utilize the full potential, experience and competency of cross-functional multi-disciplined team by encouraging all the members of development team to think and share insights on the problem and potential solutions.

O'Reilly (2013) explains how the traditional user story framework is focused on capturing requirements for what we want to build and for whom, to enable the user to receive a specific benefit from the system.

As A…. <role>
I Want… <goal/desire>
So That… <receive benefit>

He compares the tradition user story framework to the Behaviour Driven Development (BDD) and Feature Injection that aims to improve the original framework by supporting communication and collaboration between developers, tester and non-technical participants in a software project.

In Order To… <receive benefit>
As A… <role>
I Want… <goal/desire>

And finally states that when viewing work as an experiment, the traditional story framework is insufficient. According to him, the indications or signals that indicate that hypothesis is correct need to be stated before testing so that the corrupting the interpretation of the results is minimized.
According to O'Reilly, a user story structure to support Hypothesis-Driven Development would be

We believe <this capability>
Will result in <this outcome>
We will have confidence to proceed when <we see a measurable signal>

He gives an example of Hypothesis-Driven Development user story:

Business Story
We Believe That increasing the size of hotel images on the booking page
Will Result In improved customer engagement and conversion
We Will Have Confidence To Proceed When we see a 5% increase in customers who review hotel images who then proceed to book in 48 hours.

O'Reilly reminds that in agile software development we define working software as the primary measure of progress. He also states that by combining Continuous Delivery and Hypothesis-Driven Development it is possible to define working software and validated learning as the primary measures of progress. He also reminds that ideally we should not say we are done until we have measured the value of what is being delivered – in other words, gathered data to validate our hypothesis.

O'Reilly suggests performing the A/B Testing to test hypothesis and measure the change in customer behavior. Alternatively, he suggests to use customer surveys, paper prototypes, user and/or guerilla testing.

2.2.3 Requirements management phases

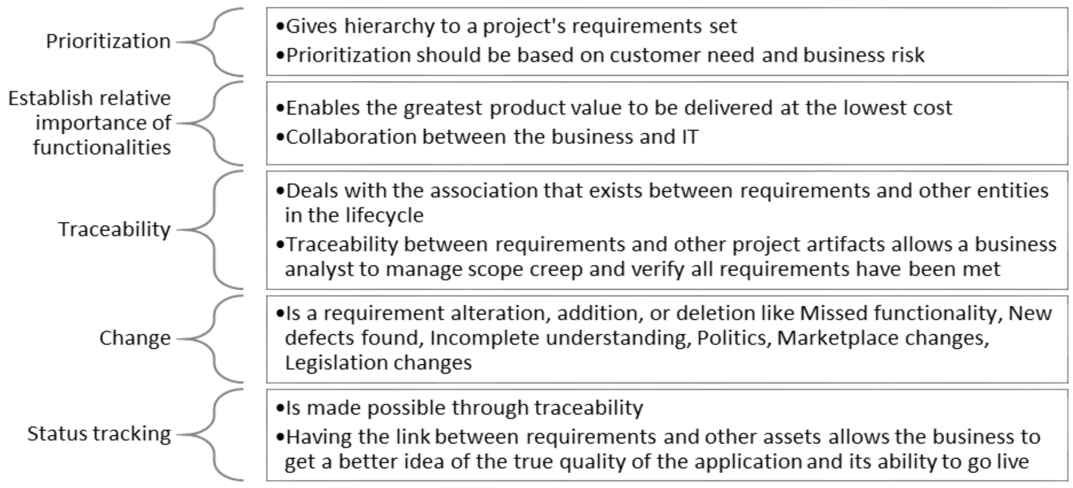
Murphy (2010) says that when requirements are defined and captured, they need to be managed actively and correctly. She says that this is important especially in agile, where user stories and requirements need to be defined, estimated, re-estimated developed and tested in a short period of time.

According to Murphy (2010), successful RM consists of

- prioritizing and assigning resources to highest priority and highest-risk requirements
- baselining the requirements by setting measurable success standards/tresholds for all requirements to keep all stakeholders on the same page
- tracking changes to compare current with pre-defined

According to Murphy (2010) the main role of requirements management is to control and manage the impact of changes to defined operational need. She mentions following phases of requirements management (Figure 2-20):

- Prioritization: With prioritization the hierarchy for the requirements is set. Requirements should be prioritized against customer need and business risk.
- Relative importance: Establishing the relative importance of functionalities is about adding objectivity to the application lifecycle by collaborating between business and IT for finding the agreement about delivering the greatest product value at the lowest cost.
- Traceability: Traceability shows the associations that exists between requirements and other entities in the lifecycle which allows a business analyst to manage scope creep and verify all requirements have been met.
- Change management: Change is a requirement alteration, addition or deletion. Change can be needed almost anytime and from several reasons like missed functionality, new defects found, incomplete understanding, politics, marketplace changes or legislation changes. Murphy states that main role of requirements management is to control and manage the impact of changes to defined operational need and give the visibility for the stakeholders into the alterations.
- Status tracking: Status tracking is enabled by traceability. Linking the requirements and other assets gives the business the better idea of the true quality of the application and ability to go alive. Murphy also states that, comparing the number of requirement changes to baseline, and tracking how many defects are associated with requirements, shows the business analyst how accurate requirements were in the first place. Too many changes or defects are an indication that the requirement may be inaccurate—the sooner this is identified the better.



Prioritization
•Gives hierarchy to a project's requirements set
•Prioritization should be based on customer need and business risk
Establish relative importance of functionalities
•Enables the greatest product value to be delivered at the lowest cost
•Collaboration between the business and IT
Traceability
•Deals with the association that exists between requirements and other entities in the lifecycle
•Traceability between requirements and other project artifacts allows a business analyst to manage scope creep and verify all requirements have been met
Change
•Is a requirement alteration, addition, or deletion like Missed functionality, New defects found, Incomplete understanding, Politics, Marketplace changes, Legislation changes
Status tracking
•Is made possible through traceability
•Having the link between requirements and other assets allows the business to get a better idea of the true quality of the application and its ability to go live

Figure 2-20 Requirements management phases (Murphy. 2010)

In agile development, when splitting features into implementable stories, it should be considered which set of the stories provide value for the users. In agile continuous development it is important to keep stories small to fit in iterations, but when releasing to the customers it has to be taken care that the feature is whole and usable with the minimum scope. Minimal marketable feature (MMF) a chunk of functionality that delivers a subset of the customer's requirements, and that is capable of returning value to the customer when released as an independent entity (IIBA, 2015. p.105).

Prioritization is a process used to determine the relative importance of business analysis information. The importance may be based on value, risk, difficulty of implementation, or other criteria. These priorities are used to determine which business analysis information should be targeted for further analysis, which requirements should be implemented first, or how much time or detail should be allocated to the requirements. There are many approaches to prioritization. Prioritization can be classified for example into: Grouping, Ranking, Time boxing/Budgeting, and Negotiation (Figure 2-21). (IIBA. 2015. p. 310)

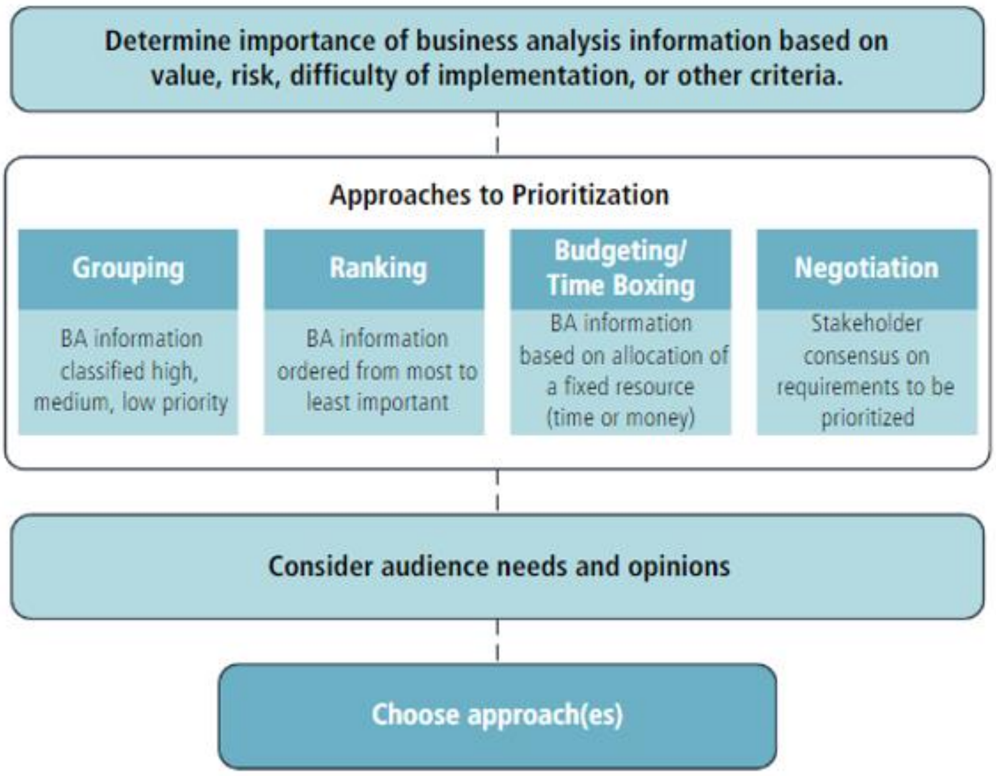

Determine importance of business analysis information based on value, risk, difficulty of implementation, or other criteria.
Approaches to Prioritization
Grouping
BA information classified high, medium, low priority
Ranking
BA information ordered from most to least important
Budgeting/ Time Boxing
BA information based on allocation of a fixed resource (time or money)
Negotiation
Stakeholder consensus on requirements to be prioritized
Consider audience needs and opinions
Choose approach(es)

Figure 2-21 Approaches to prioritization (IIBA. 2015. p. 310)

When choosing a prioritization approach, business analysts consider the audience, their needs, and their opinions on the value a requirement or business analysis information brings to a stakeholder's respective area. Business analysts revisit priorities and utilize different approaches when changes occur in the business environment, to the stakeholders, and to the business analysis information (IIBA. 2015. p. 310)

2.3 Metrics

W. Edwards Deming, the famous quality management expert, has offered: "Without data, you are just another person with an opinion." (Reh, 2016b) And who can tell which opinion is better than others?

Metrics and key performance indicators measure the performance of solutions, solution components, and other matters of interest to stakeholders. (IIBA, 2015, p. 297)

A metric is a quantifiable level of an indicator that an organization uses to measure progress. **An indicator** identifies a specific numerical measurement that represents the degree of progress toward achieving a goal, objective, output, activity, or further input.

A key performance indicator (KPI) is one that measures progress towards a strategic goal or objective. **Reporting** is the process of informing stakeholders of metrics or indicators in specified formats and at specified intervals. (IIBA, 2015, p. 297)

Key Performance Indicators (KPIs) are metrics that measure performance in relation to desired outcomes. All KPIs are metrics, but not all metrics are KPIs. KPIs facilitate the execution of strategic plans by translating desired outcomes into quantifiable targets, measure the success of an organization rather than just tracking activities that have happened in the past, are designed to help organizations achieve targets, so they must be actionable and are strategic, therefore they measure multiple facets of performance, including financial, non-financial, historical and directional. KPIs encompass more than hard numbers. Directional KPIs track ongoing improvements. For instance, a survey designed to measure customer satisfaction provides more indepth information than simply tracking customer service calls. Although this information is subjective in nature, organizations can quantify the data for the purpose of tracking and analysis. (Warwick. 2013)

Metrics and reporting are key components of monitoring and evaluation. Monitoring is a continuous process of data collection used to determine how well a solution has been implemented as compared to the expected results. Evaluation is the systematic and objective assessment of a solution both to determine its status and effectiveness in meeting objectives over time and to identify ways to improve the solution to better meet objectives. The top priorities of a monitoring and evaluation system are the intended goals and effects of a solution, as well as inputs, activities, and outputs. (IIBA, 2015, p. 297)

McDonald (2015, Chapter 3) says that good metrics are a powerful way to describe what you want to accomplish with an IT project and know how close you are to getting there, driving needed behavior change along the way. He also reminds that different types of metrics are appropriate for different situations. Daskalantanakis states that metrics are only the means to an end and the ultimate goal of improvement comes through measurement analysis and feedback (Datta, 2007, p. 45).

Datta (2007, p. 38-39) says that metrics in software are used not merely to measure, but also to guide. He also explains that they are wanted for monitoring, feedback and decision making. Datta (2007, p. 19) also reminds that further decisions are made in combination of observation and perception, facts and hunches, objectivity and subjectivity.

Reh (2016b) states that businesses rely on metrics to measure performance over time and monitoring progress towards achieving key goals. He separates Financial metrics away from non-financial metrics and defines those as follows:

Financial metrics are drawn from accounting measures help management, shareholders and key stakeholders assess an organization's overall financial health at a point in time as well as monitor the improvement or decline in health over a period of time. Typical financial metrics are

- liquidity ratios
- financial leverage ratios
- asset efficiency ratios
- profitability ratios

Non-financial metrics focus on other process, service or quality measurements important to monitoring the organization's health and success. Typical non-financial metrics are

- Measures of customer satisfaction measures, including net promoter score
- Measures of employee engagement or satisfaction
- Quality metrics
- Measures of learning and developments

Reh (2016b) points out that often metrics are collected and displayed in a format called a scorecard. The scorecard consists of those metrics agreed upon by management as the most important leading and lagging indicators of business performance. This scorecard is used by a firm's functional managers to identify areas to improve and to evaluate the effectiveness of prior investments and changes. Ideally, management teams prefer to identify metrics that foreshadow positive changes in financial results at some point in the future. These leading indicators help management teams fine tune programs and investments to ensure ongoing strengthening of the metric. (Reh, 2016b)

2.3.1 Qualities of the metrics

Despite the metrics, good individuals and teams will often do what is correct for the customer and the business, but well-intentioned teams will eventually be worn down by poorly targeted metrics and conform to the bad measures until management changes the direction with better metrics. (Pixton and others, 2014, Chapter 9)

Croll and Yoskovitz (McDonald, 2015, Chapter 3) describe five areas to consider when identifying the metrics to IT projects: Quality versus Quantity, Vanity versus Actionable, Exploratory versus Reporting, Leading versus Lagging and Correlated versus Causal (Figure 2-22)

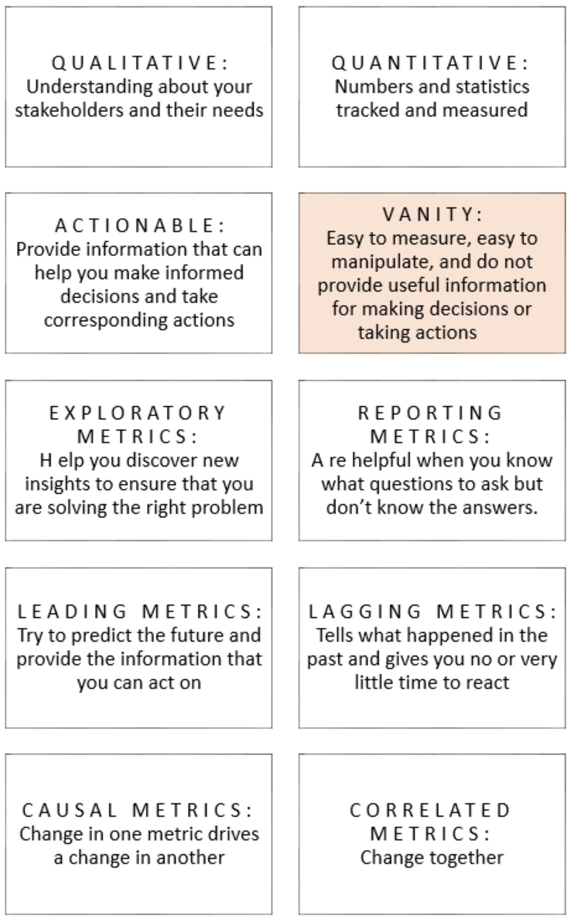

QUALITATIVE:
Understanding about your stakeholders and their needs
QUANTITATIVE:
Numbers and statistics tracked and measured
ACTIONABLE:
Provide information that can help you make informed decisions and take corresponding actions
VANITY:
Easy to measure, easy to manipulate, and do not provide useful information for making decisions or taking actions
EXPLORATORY METRICS:
H elp you discover new insights to ensure that you are solving the right problem
REPORTING METRICS:
A re helpful when you know what questions to ask but don't know the answers.
LEADING METRICS:
Try to predict the future and provide the information that you can act on
LAGGING METRICS:
Tells what happened in the past and gives you no or very little time to react
CAUSAL METRICS:
Change in one metric drives a change in another
CORRELATED METRICS:
Change together

Figure 2-22 Five personality traits of the metrics according to Croll and Yoskovitz (McDonald, 2015, Chapter 3)

Qualitative gives you understanding about your stakeholders and their needs and answers to the question ”What?”.

Quantitative data is the numbers and statistics tracked and measured, hard numbers but not total insight.

Actionable metrics provide information that can help you make informed decisions and take corresponding actions.

Vanity metrics are the ones that are easy to measure, easy to manipulate, and do not provide useful information for making decisions or taking actions.

Exploratory metrics help you discover new insights to ensure that you are solving the right problem.

Reporting metrics are helpful when you know what questions to ask but don't know the answers. An example of a reporting metric is velocity.

Leading metrics try to predict the future and provide the information that you can act on.

Lagging metrics tells what happened in the past and gives you no or very little time to react.
Correlated metrics change together and with causal metrics change in one metric drives a change in another. Identifying a correlation can help you identify causation. Finding even a partial causal relationship between metrics can help to identify a successful outcome.

2.3.2 "What you measure is what you'll get"

Ariely (2010) states that by measuring only what is easy, you only maximize what is easy, but no more. He explains the case where the CEO usually is measured by stock value, which may lead to only raising the value even short-sighted, when the attention should be put to the real drivers of sustainable success, like amount of jobs created by the firm, satisfaction of both the customers and employees, the level of trust in the company and brand.

Eckel (2011) describes getting what you measure via the example about the schools in the U.S., where they measure test scores which leads to the fact that students learn how to take tests rather than learning how to think and be creative, which would be needed in real life more than the skill of taking the tests. He also states that deciding what to measure equals to setting your goal, both are about predetermining what is going to be important.

Also Bozarth (2014) warns about falling into easy measures and vanity metrics. She gives an example about getting only what you measure: when grading the employee by the number of the tickets closed, they only concentrate to closing the tickets and may do it even ruthlessly.

Data and the organization of it into performance metrics and scorecards is a critically important task in today's organization. Nonetheless, managers are cautioned to remember that, "what gets measured gets done." Choose your metrics and measurements carefully. (Reh, 2016b)

According to Datta, the biggest mistake about metrics is trying to evaluate teams and individuals with them. Instead that, the metrics should be used for guiding us in making decisions and better understand situations. (Datta, 2007, p. 67)

Pixton and others (2014, chapter 9) point out that metrics are likely to be gamed when they are used to comparing the efficiency of the teams or to place blame. They explain that people try to avoid the blame by any means, which leads the fact that instead of gaining the improvement, effort is put to the gaming and the improvement is lost. Also if teams or individuals believe that the metrics will be used against them, it is very likely that the data will be adjusted to make the results look good in the eyes of the business. (Pixton and others, 2014, chapter 9)

2.3.3 Examples of metrics and their impact

Pixton and others (2014, chapter 9) suggest to use customer acceptance as the key measure instead of internal development metrics. They also state that many project failures arise from measuring the process rather than the results or the outcomes.

They give an example of using following the plan as a worst measure can be made, because then there is no space for improvement during the implementation, but the only important thing is to stick to the plan.

Pixton and others (2014, Chapter 9) gives following examples of the metrics, their possible impact and suggestions for better metrics:

1. **Challenge: quality suffering from growing technical debt**
   Suggested measure: how much of the code submitted to the library was covered by automated testing scripts
   To be noticed: they captured the data and, without announcing anything specific to the teams, started displaying the results on a wall that was visible to the entire team. over the next three months—and without ever formally announcing an initiative to improve automated test coverage—unit test coverage increased dramatically and the problems with product integration evaporated.
   It was interesting to recognize that the team members obviously knew that they were cutting corners but, until the metrics made their compromises visible, their motivation to deliver on schedule was stronger than their motivation to deliver validated quality. By creating and publishing the measure, the leaders clearly

demonstrated that they valued validated quality and the team modified its behavior accordingly. The leaders wanted to achieve improved quality and they found a metric to hit that goal.

2. **Challenge: problems with code stability**
   Suggested measure: team decided to measure the number of check-ins per day
   To be noticed: Over time, the team got into the habit of checking the code in several times a week. The code was then integrated and tested more frequently. As the code became more stable, they stopped measuring check-ins.

3. **Challenge: Stage-Gate process for product development and they assessed product quality just prior to product launch**
   Consequences: They ended up with difficult discussions about how many of the known remaining defects they should let loose on their customers
   Suggested measure: how often they completed a cycle without any known defects
   Reasoning: This would align with a goal of avoiding the delivery of any known defects to their customers (which never seemed to make the customers happy or satisfied with their products)—a much better measure of customer value.
   To be noticed: In parallel with this useless activity (and unknown to the executive), the product teams spent time looking for and getting to the root causes on what created the problems. They then attacked these and measured those results. This measure, as compared to the meaningless metric, was highly useful to the teams and reinforced their ownership of product quality and the customer experience. Focusing on this metric delivered an ongoing improvement trend that was largely ignored by the customer support executive.

4. **Using velocity measures to assess and project progress**
   Consequences: Management was misusing the measurement by rewarding or punishing the team based on delivered velocity. This led to the fact that the team adjusted both the delivered value and causing their delivery velocity to be always exactly on target, making the whole measure pointless when the team was not able to assess their progress and improvement.
   Suggested measure: actual unadjusted velocity
   To be noticed: It was pointed out that this required significant work that did not add any value.

5. **Using detailed "causal" analysis and categorization of every defect that they fixed in development.**
   Consequences: To ensure that the analysis was done, the problem management system did not allow the defect to be closed until all the 20 or so questions had been answered. The time and cost to the individual developers to fill in the difficult questionnaire were so high that many admitted to randomly selecting causes and characteristics (gaming the metric). In fact, the items at the top of the list of causes were the ones most often chosen (it took less effort to select from the top than to scroll down the list).
   Suggested measure: provide more useful insight much more easily with a brief discussion between the developers as part of their retrospectives.
   To be noticed: The goal of this exercise was to give insight into weaknesses in the product, but it was totally ineffective.

6. **Measuring effectiveness of the teams by the amount of code**
   Consequences: amount would rise as the highest priority over e.g. quality.
   Suggested measure: use unit test escapes to measure the productivity instead
   Reasoning: doesn't straightly tell the level of the productivity, but helps to keep the quality high and therefore have a big effect on overall productivity, due to the cost of the fix on the unit testing phase is clearly lower compared to a fix in later phase

7. **Measuring programmers by schedule**
   Consequences: result in poorly targeted code with low quality, that is costly to maintain and decreases revenues.
   Suggested measure: measure by created business value instead

8. **Measuring that team follows the process**
   Consequences: to gaming, meaning getting around the measurement, can result in products that no customer wants to use, even if the implementation process was followed.
   Suggested measure: Focusing on meeting customer and business needs

9. **Measuring the effectiveness of testing by the number of defects found by a set of independent testers**
   Consequences: In this situation, testers are actually rewarded when they are given poor-quality product to test. They can then generate a large number of "found"

defects that have the same underlying cause. By finding a large number of defects, they prove their value!
Suggested measure: measure the growth in testing successes rather than defects found
To be noticed: Binging the development and test teams together to enables effective collaboration to deliver quality. In this arrangement, the testers sit next to and work with individual developers—even during unit test phases—and communicate face-to-face. Morale is higher and the whole team is working together to deliver increased business value.

10. **Measuring unit success independently for each division with the intent to motivate teams to deliver increasing value**
Consequences: The nasty side effect of that measure lead the business units to compete against each other, often even in front of the customer, and the units ended up with no motivation to help each other to deliver the best end-to-end, totally integrated solutions.
Suggested measure: reward schemes were modified to cover larger organizational elements until they were eventually based on the performance of the whole company.
To be noticed: This not only removed the motivation for competition with internal teams and individuals, but also sent a strong signal that collaboration to deliver business value to the customer was the highest priority

In addition to the previous, Pixton and others suggests to keep in mind that reporting should not end up as the waste on the teams lap, but the manager could for example take part to the daily meetings or follow the teams dasboard for following the status or then gather the data to be reported himself. This should both remove waste and create trust.

They also remind to be aware of statistical noice on minor variations in the reports and encurages managers to trust teams on those situations, instead of wasting time to big investigations, when the matter is only statistical noise.

2.3.4 Successfull metrics

To succeed in measuring, the project should be committed to the metrics, not vice versa (Datta, 2007, p. 72-76). Datta also guides that in metrics-driven development, it should be clarified what is wanted from the metrics before doing anything with metrics.

McDonald (2015, Chapter 3) says that good metrics focus on outcome rather than output. He suggests that a good metric should be derived from goals and objectives.

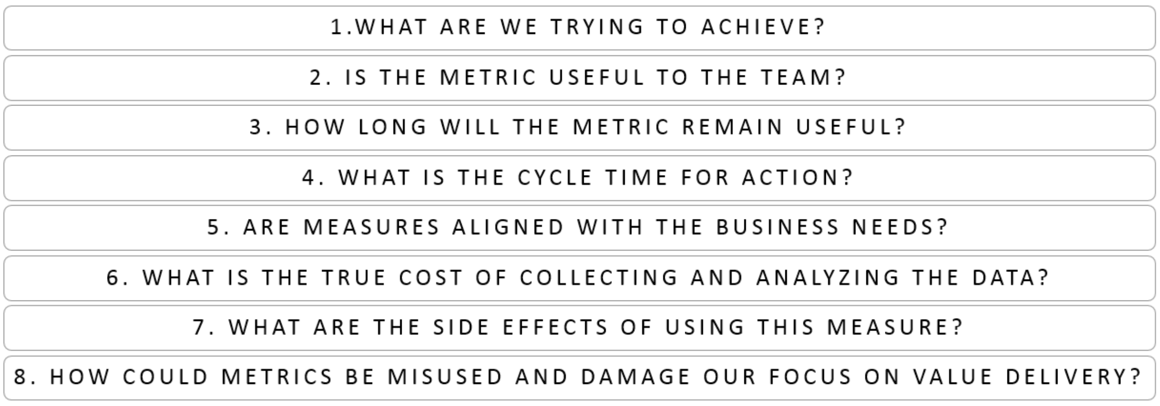
Pixton and others (2014, Chapter 9) suggest that we need metrics that focus on delivering business value, foster trust and do not take the ownership away. Metrics are also needed as an indication of the progress of culture improvement. They also state that good metrics are essential in enabling and encouraging fact-based action in business and can have a powerful effect in helping teams focus on business value and collaboration.

Pixton and others (2014, Chapter 2014) also points out that metrics should help us discriminate between activity and accomplishment. With good metrics, it is possible to know that we are getting things done, not just being busy.

Important aspects of metrics are:

- Motivate the right behaviors and inspire improved performance rather than punish wrong behaviors or use as a weapon against others
- Use productivity measures to motivate individuals to deliver more instead of only giving the results to the manager.
- Measure progress toward business goals—thus meeting the accomplishment-over-activity criterion.
- Measure processes, not people - meaningful metrics help us identify when processes, not people, need to be fixed.
- Integrity and honesty are the foundational requirements of good metrics. Failing with integrity and honesty will end up as a wedge between the delivery teams and the business.
- Keep metrics few in number—otherwise the sheer volume makes them meaningless, good rule of thumb is that you need only five to seven metrics.
- Keep them simple to measure and simple to understand.
- Make measures objective.
- Do not expect accuracy where it does not exist and some level of uncertainty must be accepted for example with the work estimates.
- No matter what you measure, make sure the ownership stays with the delivery team. (Pixton and others, 2014, Chapter 9)

In addition to the previous, Pixton and others (2014, Chapter 9) suggests to reason following issues when evaluating or setting up effective metrics (Figure 2-23).



1.WHAT ARE WE TRYING TO ACHIEVE?

2. IS THE METRIC USEFUL TO THE TEAM?

3. HOW LONG WILL THE METRIC REMAIN USEFUL?

4. WHAT IS THE CYCLE TIME FOR ACTION?

5. ARE MEASURES ALIGNED WITH THE BUSINESS NEEDS?

6. WHAT IS THE TRUE COST OF COLLECTING AND ANALYZING THE DATA?

7. WHAT ARE THE SIDE EFFECTS OF USING THIS MEASURE?

8. HOW COULD METRICS BE MISUSED AND DAMAGE OUR FOCUS ON VALUE DELIVERY?

Figure 2-23 Things to evaluate when setting up effective metrics (Pixton and others, 2014, Chapter 9)

1. What are we trying to achieve?
   - What decisions needs to be made, what questions need to be answered?
   - Beware of vanity metrics, things should never be measured just because it is easy and possible.
   - To keep the focus, the most important issues should be selected to be measured for improvement and when they are improved, next important issues should be selected to be measured instead.
2. Is the metric useful to the team?
   - Metrics are most powerful when the teams choose those that will benefit them the most.
   - Team should also decide whether there are any current metrics that do not serve them anymore.
3. How long will the metric remain useful?
   - The metrics that are no longer useful should not be used anymore. Once the goal or the metric has been achieved, dropping the metric should be considered unless it is motivational over the long term.
4. What is the cycle time for action?
   - Cycle time of the metrics should be used to evaluate the effectiveness of the measure. The shorter the cycle the better.
   - Waterfall report vs. daily automated test code coverage with action cycle time was a single day
5. Are the candidate measures actually aligned with the business needs?
   - It is essential to honestly assess whether improvements in the metric will actually lead to the delivery of increased business value.
6. What is the true cost of collecting and analyzing the data?

- It should always be ensured that the cost of collecting the metric is significantly less than the value that it can deliver.
- As the data collection can be expensive, so can the analysis.

7. What are the side effects of using this measure?
    - Look out for negative or unexpected side effects. Consider how teams and individuals are likely to respond in both the short and the long term.
    - Consider the scope of a metric to ensure that it doesn't create suboptimal behavior.
8. How could metrics be misused and damage our focus on value delivery?
    - With all metrics there is a potential for misuse.
    - Ideally collect the data automatically, so that there is no possibility for anyone to enhance the data.
    - Possibilities for gaming and green shift, where the tendency of the outlook and status to get better as they are reported higher up the organization, should be noticed and taken in account and their impact should be minimized

"The most effective measures are strongly aligned to outcomes such as business and customer results. No amount of internal measures can disguise actual customer satisfaction or real business results. Results or outcome-based measures cannot be gamed." (Pixton and others, 2014, Chapter 9)

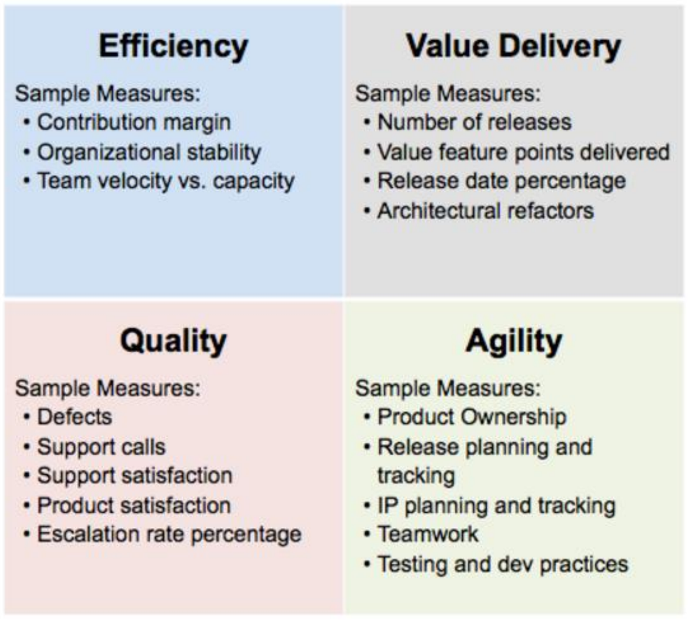
Pixton and others suggest to base the metrics on learning. They encourage that every problem is an opportunity for improvement and every failure is an opportunity to learn a better solution. They also remind that innovations can be developed learning what customers really want.

The lean movement has been preaching waste reduction for many years. Instead of measuring the creation of value by our ability to produce tangible high-quality artifacts, startups measure value by validated learning about customers. This approach clashes with classic product management and product development. The detailed specification documents that PMs demand go stale too quickly to keep up with a fast-learning team. Massive data warehousing reports used in product dev do what warehouses do well, store data. They don't promote learning, because people learn best when presented with a small number of actionable metrics. And engineers who build heavyweight architectures may design a technical triumph, but lack the agility to adapt when the goal of the system changes radically. (Ries. 2010)

Croll and Yoskovitch (2013) introduce the concept of the One Metric That Matters (OMTM) meaning that at any given time, there's one metric you should care about above all else. They say that communicating this focus to your employees, investors, and even the media will really help you concentrate your efforts. They emphasize that OMTM is not meaning that there should only be one metric you care about.

2.3.5 Enterprise balanced score card

Scaled Agile (2010-2016b.) introduces also the enterprise balanced scorecard as a set of portfolio metrics (Figure 2-25). The measures to be mapped to executive dashboard are efficiency, value delivery, quality and agility.



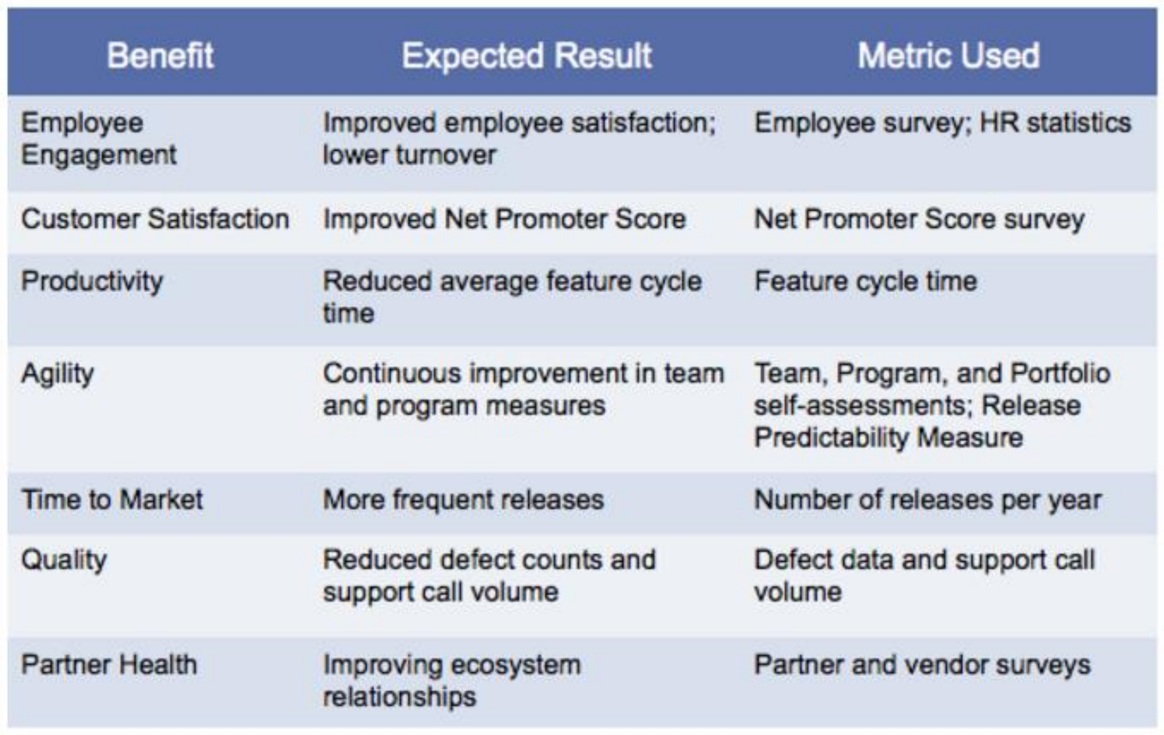
Efficiency	Value Delivery
Sample Measures: • Contribution margin • Organizational stability • Team velocity vs. capacity	Sample Measures: • Number of releases • Value feature points delivered • Release date percentage • Architectural refactors
Quality	**Agility**
Sample Measures: • Defects • Support calls • Support satisfaction • Product satisfaction • Escalation rate percentage	Sample Measures: • Product Ownership • Release planning and tracking • IP planning and tracking • Teamwork • Testing and dev practices

Figure 2-24 Enterprise balanced scorecard (Scaled agile. 2010-2016b)

Popularity of this approach has been declining over time in favor of the Lean Portfolio Metrics. (Scaled Agile. 2010-2016b.)

2.3.6 Lean portfolio metrics

Scaled Agile (2010-2016b.) introduces the lean portfolio metrics as the simplest set to measure the transformation to agile (Figure 2-24). The metrics aim to measure employee engagement, customer satisfaction, productivity, agility, time to market, quality and partner health.



Benefit	Expected Result	Metric Used
Employee Engagement	Improved employee satisfaction; lower turnover	Employee survey; HR statistics
Customer Satisfaction	Improved Net Promoter Score	Net Promoter Score survey
Productivity	Reduced average feature cycle time	Feature cycle time
Agility	Continuous improvement in team and program measures	Team, Program, and Portfolio self-assessments; Release Predictability Measure
Time to Market	More frequent releases	Number of releases per year
Quality	Reduced defect counts and support call volume	Defect data and support call volume
Partner Health	Improving ecosystem relationships	Partner and vendor surveys

Figure 2-25 Lean portfolio metrics (Scaled agile. 2010-2016b)

Lean portfolio metrics expands the scorecard metrics to the partner health and employee satisfaction. These metrics measure the total portfolio success.

2.3.7 Business value

Shore (2006) states that productivity is defined as ”amount of output per unit of time” or ”Output/Time”. He states that velocity is not a metric for measuring productivity, but only hours worked and estimate accuracy. Shore suggest measuring revenue, return on investment or some other number that reflects to business value. Shore continues that measuring value-based productivity requires the whole team to focus on releasing quickly, acknowledging the importance of product vision and understanding how users will really benefit from the software.

In the other hand Van Cauwenberghe (30.12.2009) raises a question that ”How do you estimate the Business Value of User Stories?” And answers that “You don’t.” He states that already the question is wrong, that we should ask that “How do we find the User Stories that deliver the Business Values?” Also Thomas, a reader of his blog, commented the post by an opinion of a colleague, that from the lean perspective User Stories Business Value Estimation ==waste+waste(inventory +over processing) and Thomas himself suggests only to decide what is the most important stuff that we want to see running. (Van

Cauwenberghe, 30.12.2009) So it is good to keep in mind that evaluating the value should not grow too big effort that it ends up as waste.

In addition Ariola, W. and Dunlop, C., 2014 has stated that “We mustn’t accept that the trend toward accelerating the development process will magically improve software quality, but we should expect the opposite. And if we are going to mitigate risk in today’s environment, we need to reengineer the software development process in a way that considers business risk to be one of the metrics, along with the other traditional results of our automated testing and Continuous Integration systems.“ (Parasoft, 2015)

Value velocity

Later Shore (2007) critizises his previous thoughts about measuring the value. He states that the problem with measuring business value is separating out the effects of the team's work from all of the other things going on in the organization. Although this is usually a strength of the metric, sometimes the team's contribution gets lost in the noise. He suggests that rather than trying to measure the business value after the delivery, you should to get the business experts to estimate the business value beforehand as relative value velocity.

With the value velocity Shore (2007) still reminds that stories don’t always have value of their own, but require multiple stories to create one feature with recognizable value. Therefore it might be feasible to estimate and score the features instead of stories.
He also states that some type of stories don’t provide value in traditional way. It is hard to evaluate value of fixing a nasty crash bug, value of the entire software or value of fit and finish, meaning adjusting color schemes and making sure all the pixels line up neatly. He puts it nicely that “One fit and finish story may not have value, but there is often value in having a polished presentation.”
He also reminds to keep in mind the vulnerability of value velocity against the gaming.

Purpose alignment model

Purpose alignment model can be used to assess ideas in the context of customer and business value (Figure 2-26). From agile perspective the model aids in making prioritization decisions and focusing investment on those features or capabilities that are of greates value to the organization. To rate activities, processes, products or capabilities in two dimensions and then recommend the best actions to take to improve them based on those ratings. First dimension is whether or not the activity creates market differentiation the second is whether or not the activity is critical for the continued functioning of the organization. (IIBA. 2011. p. 79)

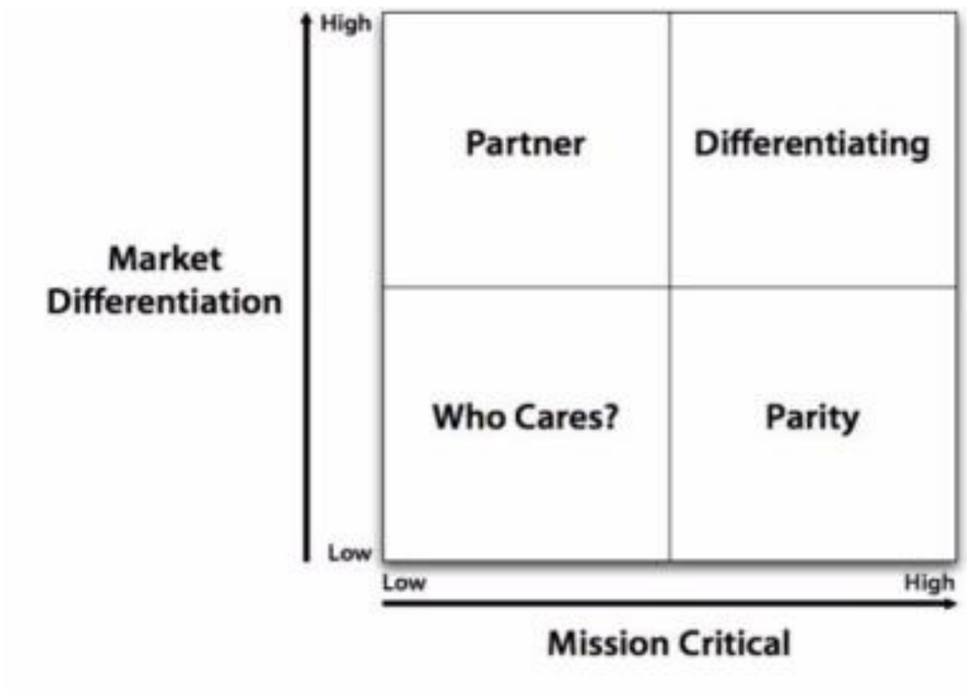


Figure 2-26 Purpose alignment model (IIBA. 2011. p. 79)

IIBA (2011. p. 80) explains the use of quadrants as follows:

- Differentiating quadrant - Features, products or services that both serve to differentiate the organization in the marketplace and are critical to the functioning of the company are part of the differentiating quadrant. These are the things in which the organization should be prepared to invest to offer something that is distinct from competitor offerings.
- Parity quadrant - Things which are mission critical, but not maket differentiating, fall into the parity quadrant. That means that it is usually sufficient to be operating on par with other firms in your industry.
- Partner quadrant - Activities that may have unique value to customers but which are not critical to the functioning of the organization fall into the partner quadrant. Even though theses activities are important to customers or other stakeholders the organization doesn't need to perform them to survive.
- Who cares? Quadrant Finally activities which are neither mission-critical or help to differentiata the organization in the marketplace fall into the who cares quadrant. As these activities do not add customer value, and the organization can function withouth performing them, they are prime candidates to be eliminated and the resources reallocated to support more useful work.

Model is designed for use by for-profit organizations that face competition in the market-place and it provides guidance on whether something should be an area of strategic concern but does not provide any guidance on what strategies or decisions might be the correct ones. This model is simple and easy to use in a facilitated collaborative environment. It can be applied all the way up and down the investment decision process, from strategic investment down to an individual feature in a system. It is fast and entire backlog can be analyzed in less than an hour. Disadvantage is that the model assumes positive intent in the business strategy and does not incorporate ”spoiler” behavior by corporations. (IIBA.2011. p. 80)

Agility Index

Evidence-Based Management for Software Organizations introduces the Agility Index for measuring the value of your investment in Agile processes, tools, training and coaching. They say that traditional metrics might give the insight into improvements of operational efficiency but the real conversation is about the value created for your organization by the improved processes. (EBMgt. 2016)

Financial success and stakeholder satisfaction are a great way to start thinking in terms of the value delivered by your teams. Numbers tracking ITs ability to deliver this value frequently and of high quality are leading indicators of this success. Current Value metrics show how your strengths generate business value. Time-to-market and Ability to Innovate metrics measure your organizations ability to sustain its value in the future.
The Agility Index™ enables you to measure the improvement in business outcomes and track the return of your investment. (EBMgt. 2016)

Agility index evaluates product cost ratio, employee satisfaction, customer satisfaction, revenue per employee, total defects, release frequency, release stabilization, cycle time, installed version index, usage index and innovation rate (Figure 2-28). (EBMgt. 2016)

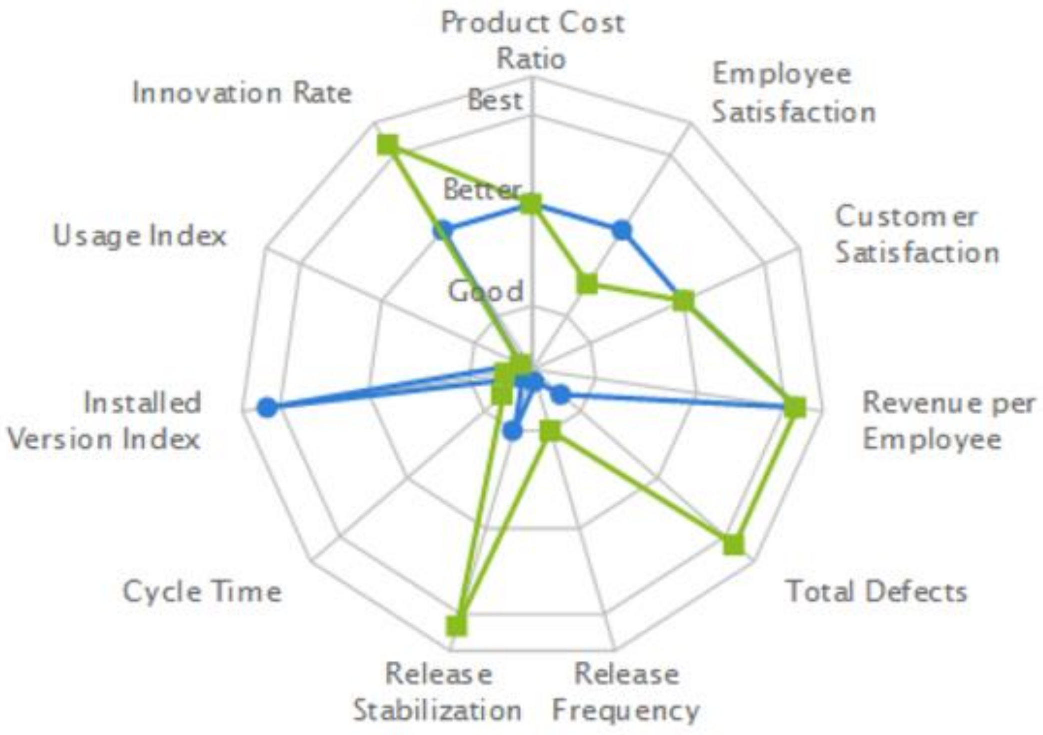


Figure 2-27 Agility index

Despite of the marketing speech that is given about the Agility index, they list interestingly together the important areas of the value and quality.

2.3.8 Customer satisfaction

Olsen (2015, p. 229) explains that customer research techniques for a new product differ before and after launch. Olsen introduces a framework that his colleague Cristian Rohrer has created for research methods. Simplified version of that framework is shown on figure 2-29.

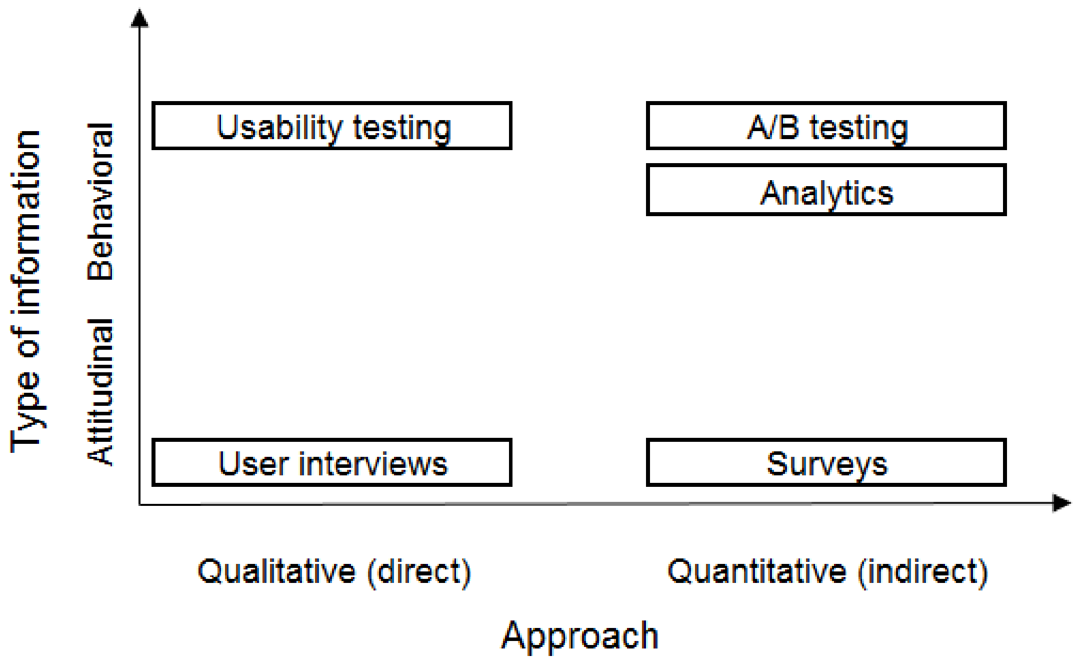


Figure 2-28 Research Methods Framework from Christian Rohrer (Olsen, 2015, p. 230)

Olsen (2015, p. 229-230) explains the framework like this: Vertical axis shows the type of information that is collected whether it is attitudinal or behavioral. Attitudinal means the opinions and attitudes that customers explain. Behavioral again, is what the customers really do, the real action.

Horizontal axis shows the approach for collecting the information and there the options are qualitative or quantitative. Interviews and usability tests are qualitative research methods, where surveys and analytics provide statistical information from large group and therefore they are quantitative.

Olsen (2015, p. 231) says that qualitative and quantitative learning complement each other. He explains that quantitative research tells you how many of the audience does or does not do something, but leaves out the reasoning why where qualitative helps you understand why customers do what they do but leaves out the fact that how many of the customers think the same way.

The Rohrer's framework (Olsen, 2015, p. 230) describes interviews as qualitative and attitudinal research methods where users are asked open ended questions to understand their needs and preferences and thoughts and attitudes, but they are not observed.

Usability testing

The Rohrer's framework (Olsen, 2015, p. 232) suggests usability testing for gathering qualitative and behavioral information about users.

Surveys

The Rohrer's framework (Olsen, 2015, p. 232-233) describe surveys as quantitative and attitudinal research method. Olsen says that surveys are a good tool when you want to ask simple questions about user's attitudes, importance, and satisfaction, how they feel about the product or brand or how they see your product compared to the competitors. He mentions that using surveys asking same questions at periodic interval helps to identify trend over time. He also states that the danger of using surveys is that surveys very often are misused if they are not well designed. If users have too little information about the product under survey, they cannot give true answers. Another danger is that user's opinions often don't end up matching behavior and therefore in some cases a smoke test might give more reliable answers to the same question than a survey. Also the survey results may differ a lot depending on the wording used in survey, so you must pay attention to how you set up the questions.

Pixton and others remind that to get realistic answers it is beneficial to use anonymous survey instead of asking people in person. (2014, Chapter 9)

Net promoter score

Olsen (2015, p. 233) mentions that Net Promoter Score is the one of the most widely used survey-based metrics. According to him the Net Promoter Score is based on the result of the question "How likely are you to recommend [product x] to a friend or a colleague?". Scale of likelihood is from 0 to 10, where o is "not all likely" and 10 is for "extremely likely". Answers are scaled as follows: 9 or 10 are called promoters, 7 and 8 are called passives and from 0 to 6 are called detractors. To calculate the Net Promoter Score take the percentage of promoters and subtract the percentage of detractors. The score can range from -100 to 100. Olsen (2015, p. 234) describes Net Promoter Score as attitudinal measure of customer satisfaction with your product and also as a proxy indicator of product-market fit.

The Rohrer's framework (Olsen, 2015, p. 235) leaves analytics and A/B testing as the quantitative and behavioral research method. Olsen (2015, p. 235) explains that analytics gives you the real picture of what user's do and you may reach statistically significant conclusions.

Kano analysis

Kano analysis helps agile team understand which product characteristics or qualities will prove to be a significant differentiator in the marketplace and help to drive customer satisfaction. It assists in identifying features that will have the greates impact on customer satisfaction, either because they are exceptionally important or because their absence will cause intense dissatisfaction. This helps the team determine which features are the most important to implement before releasing a product to market. (IIBA. 2011. p. 74)

Kano analysis rates product charachteristics on two axes, Extent to which the feature is implemented in the product and Level of customer satisfaction that will result from any given implementation level. Resulting graph is plotted on 2x2 matrix. Based on the resulting profile, the product characteristic should fall into one of three categories: Treshold, Performance or Exitement. Analysis can be used to try and identify characterisics that will give the product a unique position in the marketplace (IIBA. 2011. p. 74)

IIBA (2011. p. 74) describes the categories as follows:

- Treshold characteristics - Those absolutely necessary for stakeholders to consider adopting a product. Absence will cause intense dissatisfaction but as they represent minimun acceptance criteria their presence will not increase customer satisfaction beyond certain low level.
- Performance characteristics - Those for which increases in the delivery of the characteristic produce a fairly linear increase in (75)satisfaction. They represent the features that ustomers expect to see in a product (speed, ease of use etc).
- Excitement characteristics - Those that significangly exceed customer expectations or represent things that the customer did not recognize were possible. Their presence will dramatically increase customer satisfaction over time.

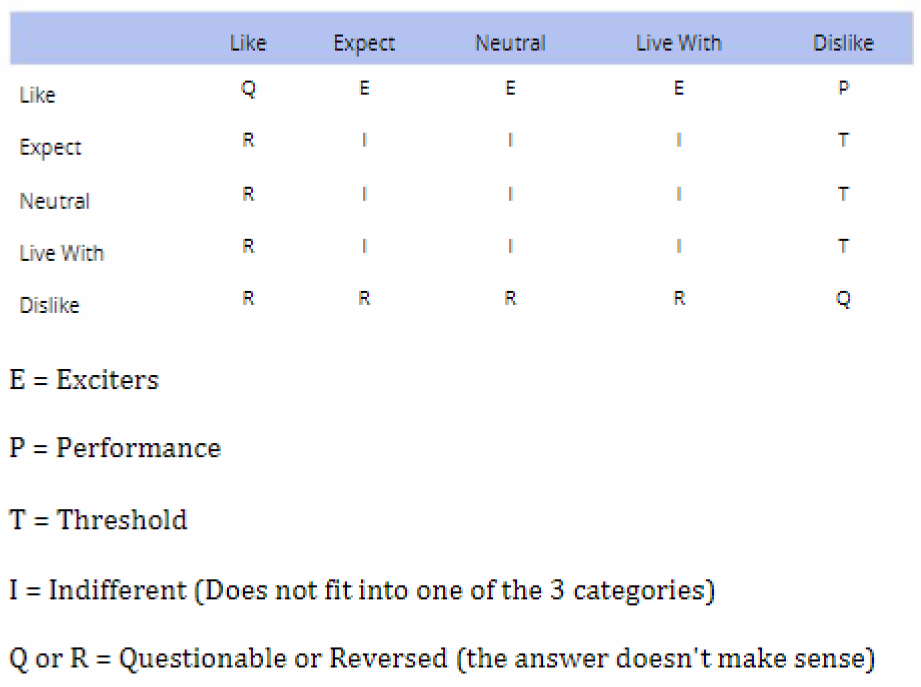
According to IIBA (2011. p. 74) customer should be surveyed over the feature both functional and dysfunctional with questions

- Functional: how do you feel if this feature or charactheristics is present in the product?
- Dysfunctional: how do you feel if this feature or characterisic is absent in the product?

And possible answers to each question form are

- I like it that way
- I expect it to be that way
- I am neutral
- I can live with it that way
- I dislike it that way

Determining the category is based on mapping the answers to both forms of the question to the grid in the figure 2-27. The top row represents the answers to the dysfunctional form of the question and the left column represents the answers to the functional form of the question. (IIBA. 2011. p. 74)



	Like	Expect	Neutral	Live With	Dislike
Like	Q	E	E	E	P
Expect	R	I	I	I	T
Neutral	R	I	I	I	T
Live With	R	I	I	I	T
Dislike	R	R	R	R	Q

E = Exciters

P = Performance

T = Threshold

I = Indifferent (Does not fit into one of the 3 categories)

Q or R = Questionable or Reversed (the answer doesn't make sense)

Figure 2-29 Kano analysis (IIBA. 2011. p. 74)

The approach is most applicable for consumer products of goods that will be resold, as it focuses on identifying the requirements that will encourage widespread use or adoption of a product. The categorization of a particular characterisic tends to shift over time, as customers grow to expect features or characteristics to be present in a product. Eciters eventually become a standard expectation and treshold characteistic. (IIBA. 2011. p. 74)

A/B testing

A/B testing (also known as split testing or bucket testing) is a method of comparing two versions of a webpage or app against each other to determine which one performs better. AB testing is essentially an experiment where two or more variants of a page are shown to users at random, and statistical analysis is used to determine which variation performs better for a given conversion goal. (Optimizely, 2016)

Data analytics

Analytics is the discovery, interpretation, and communication of meaningful patterns in data. Especially valuable in areas rich with recorded information, analytics relies on the simultaneous application of statistics, computer programming and operations research to quantify performance. Analytics often favors data visualization to communicate insight. (Wikipedia. 2016b.)

When setting up the data analytics, you should

- define the questions where you want answers (e.g. buying pattern, navigation pattern, customer service history, matching of similar patterns, profiling customers into behavior patterns)
- find answers to ‘what must be true questions’ like what must be true to get the information or what must be true to use the gathered information
- break big uncertain things into pieces and eliminate uncertainties in small phases
- take care that the data needed is in consumable form
- find an analyzing tool to do profiling and predicting

(Pixton et al, 2014, Chapter 1)

Efficient data analysis could help to improve both requirements definition and management, if the results answered to correct questions and were provided automatically regular basis and as trends. A specialist being in charge of the data analysis would be a treasure for Product Owners.

2.3.9 Employee engagement and satisfaction

Leaders need early indications for modifying their course. Improving the ways of working and moving to the Energy and Innovation can be followed by measuring Leadership effectiveness in enabling the change, Trust, Ownership, Business alignment and purpose and Honestly dealing with ambiguity and complexity. (Pixton and others, 2014, Chapter 9)

Pixton and others (2014, Chapter 9) suggests to survey the workers within the organization and ask them to rate those five characteristics in their environment. They suggest to use the Net Promoter Score for measurements, if it only feels comfortable, since it will be enough to give the working-level view to the situation.

According to Pixton and others (2014, Chapter 9), running a collaborative sticky note session with the team is another method to measure the progress to the green. In this session the team is asked what would make them more effective. Power of this session is that it will point out the areas that need work.

To measure the culture improvement Pixton and others (2014, Chapter 9) suggests to measure the following areas:

1. Leadership Effectiveness Metrics: Pixton and others (2014, Chapter 9) states that the most critical factor in building a powerful culture is the effectiveness of our leaders. They raise the Net Promoter Score (NPS) as the most useful measure of leadership effectiveness in promoting a new culture or approach. In leadership NPS teams could be asked how much value there is in a new approach (e.g. by asking whether they would recommend their leader's approach to their peers). This gives the insight into progress in building and understanding the value of the approach. In addition to identifying the action areas, carrying out a survey demonstrates that leaders are engaged. According to Pixton and others, IBM measured its progress on both mindset and deployment when promoted the use of Agile across the company.

2. Trust: Measuring the amount of trust needed or the felt level of trust is difficult to assess. Simply asking teams what would make them more productive and then looking to see where "increasing trust" appears in the list can give a good idea of what the team believes it needs. NPS is a good tool for gathering the results anonymously. (Pixton and others, 2014, Chapter 9)

3. Ownership: Assessing the level of ownership of the business commitments is also challenging. Best way to do it is to look at the behaviors or the team by finding out do the teams make their own commitments, do they meet their commitments, do they track and manage their own progress, do they understand the business pressures and the needs of the business, do they understand the unique value proposition of their project and business goal. . (Pixton and others, 2014, Chapter 9)

4. Honestly dealing with ambiguity and complexity: Dealing Honestly with Ambiguity is one of the most important and yet challenging measures, because of our personal and organizational quest for certainty. The easiest way to get the team's view over this is to use the NPS with a question like: On a scale of 1 to 10, how well do you feel we deal honestly with ambiguity?. In addition it is worth to revisit the ideology, whether it is required to follow a plan or is it allowed to change the plans on go, is uncertainty

included in estimations, are people in charge of implementation involved in making commitments.

3 Agile requirements management in Basware P2P development

This chapter introduces the current software development model and the requirements management practices in the target organization. It also describes the results of managerial interviews about requirements management and measuring, investigation over current state of the metrics and the facilitated workshop that was held among the Product owners, Product managers and Project managers to find the proper metrics.

3.1 Company strategy

In summary company strategy (Basware. 2016.) defines the future goals like this:

Basware's vision of the significant growth potential in the markets it operates in and Basware's ability to capture that opportunity is unchanged.

Cloud revenue growth is Basware's primary objective and where long term value in our business will be created. Cloud revenues are comprised of revenues from SaaS, other subscriptions, network transactions and financing services.

An additional set of actions to boost future growth, simplify our operations and improve our productivity have been identified. These actions will mainly be targeted at:

- Continuing to strengthen sales and marketing to drive cloud revenue growth
- Focusing on Customer Success by further improving customer satisfaction and experience
- Continuing to grow and monetize the network and data assets with financing and other value added services, focusing on product development and partnerships
- Increasing productivity by simplifying our operations and increasing scalability
- Evolving our culture and way of working to focus more on performance

As before, organic growth is the key focus and this will be supported by a disciplined acquisition strategy.

Simplifying Basware's operations begins with rationalizing its targets. For the period from 2017 to 2020, Basware will focus on three key metrics aimed at boosting cloud revenues:

- Cloud revenues to increase by more than 20% CAGR on an organic basis
- Annual net sales greater than EUR 220 million
- Recurring revenue approximately 80% of net sales

At the same time Basware will continue to improve underlying profitability (excluding growth related investments) over the period.

3.2 Alusta development model

The organization development model consists of agile product management, program planning, project planning, feature based development and releasing supported with governance, tools and support (Figure 3-1).

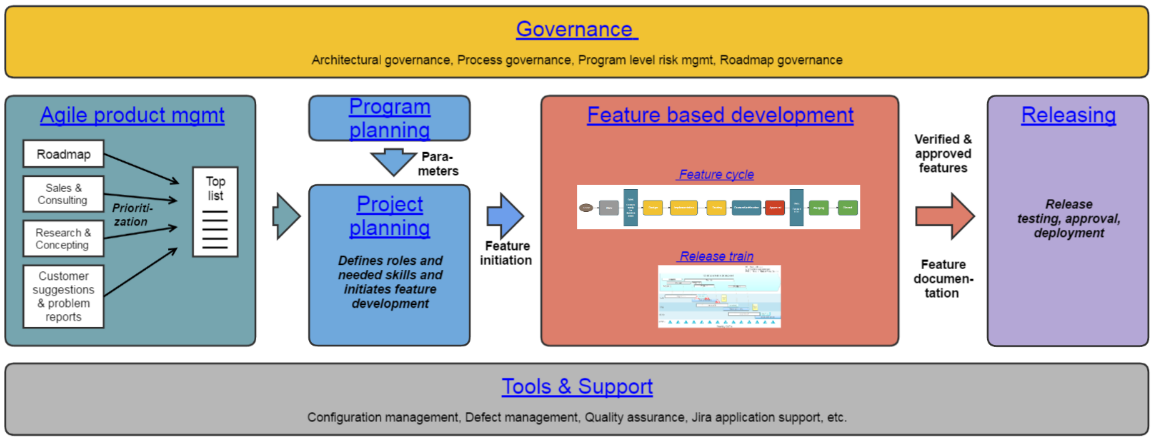

Governance
Architectural governance, Process governance, Program level risk mgmt, Roadmap governance
Agile product mgmt
Roadmap
Sales & Consulting
Research & Concepting
Customer suggestions & problem reports
Prioriti-zation
Top list
Program planning
Para-meters
Project planning
Defines roles and needed skills and initiates feature development
Feature initiation
Feature based development
Feature cycle
Release train
Verified & approved features
Feature documen-tation
Releasing
Release testing, approval, deployment
Tools & Support
Configuration management, Defect management, Quality assurance, Jira application support, etc.

Figure 3-1 Basware Alusta development model

Feature development lifecycle

Feature development lifecycle describes the feature development process in the organization (Figure 3-2). The process describes how the features go through the implementation process with few gates described on the way.

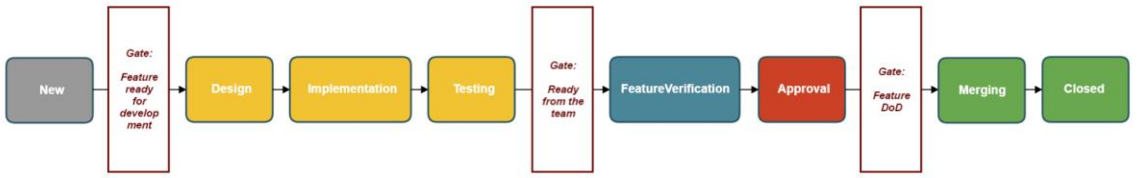
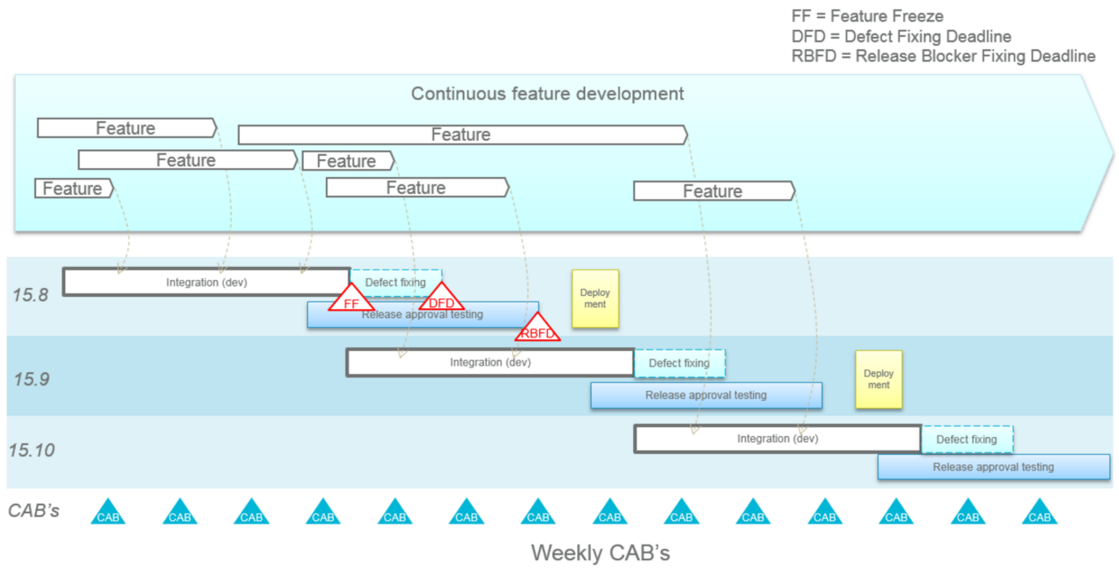


Figure 3-2 Feature development lifecycle

Alusta development is based on release train approach (Figure 3-3). In this approach, release schedules are fixed and scope is flexible. Each team develops features continuously staring the next one when the previous one is finished. In practice, each team has several features ongoing at the same time.



Alusta monthly release train

Figure 3-3 Alusta monthly release train

Each release has a specific timeframe called "integration window". If a feature is finished during that window, it is to be released in that corresponding release.

Alusta P2P Requirements Management model

Alusta requirements management model uses the following functional requirement hierarchy (Figure 3-4) where the Business feature level refers to theme, Epic user story to Epic that are split to user stories that can contain additional artifacts.

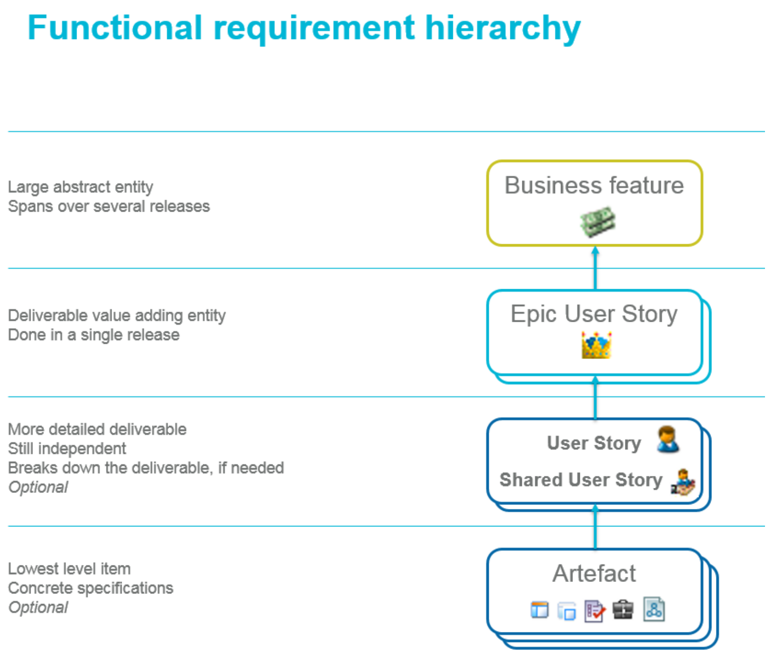


Figure 3-4 Basware Functional requirement hierarchy

The Business feature is not assigned to any release, but is an umbrella item for the rest of the items.

Program/Project management

Program release schedule, release specific constraints and resourcing allocation between projects / teams are managed at the program level.

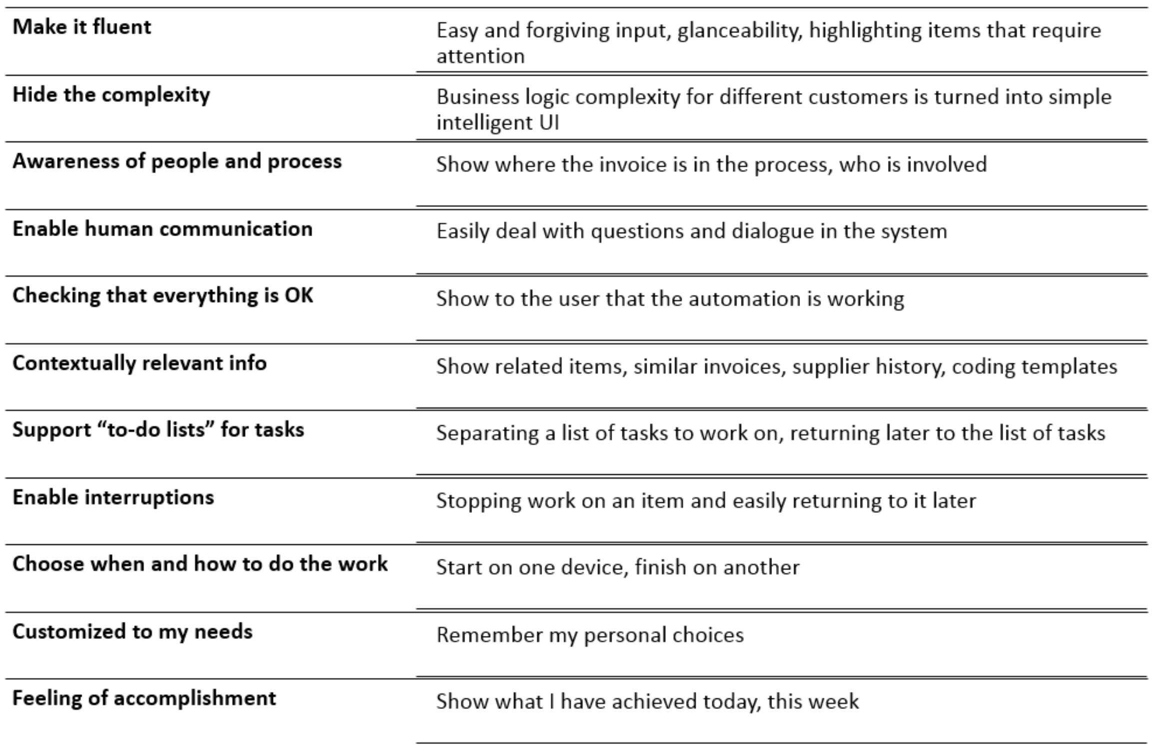
Release cycle for the projects is one month.

Projects manage their own backlog priorities according to roadmap priorities.

Kanban technique for managing a software development process in Toyota's "just-in-time" (JIT) method is used for backlog management and work assignment. Jira is used as a tool for backlog management.

Design drivers

Following design drivers has been defined to guide the product development work (Figure 3-5).



Make it fluent	Easy and forgiving input, glanceability, highlighting items that require attention
Hide the complexity	Business logic complexity for different customers is turned into simple intelligent UI
Awareness of people and process	Show where the invoice is in the process, who is involved
Enable human communication	Easily deal with questions and dialogue in the system
Checking that everything is OK	Show to the user that the automation is working
Contextually relevant info	Show related items, similar invoices, supplier history, coding templates
Support "to-do lists" for tasks	Separating a list of tasks to work on, returning later to the list of tasks
Enable interruptions	Stopping work on an item and easily returning to it later
Choose when and how to do the work	Start on one device, finish on another
Customized to my needs	Remember my personal choices
Feeling of accomplishment	Show what I have achieved today, this week

Figure 3-5 Design drivers (Basware. 2016)

Utilizing these design drivers is not measured at the moment. Heuristic evaluation could be considered to be conducted during the solution design and validation.

Double diamond design process

The target organization has recently internally introduced the double diamond design process (Figure 3-6) tailored to the organizations needs to be followed in the design work. It has several levels, depending on the scope and importance of the area in question.

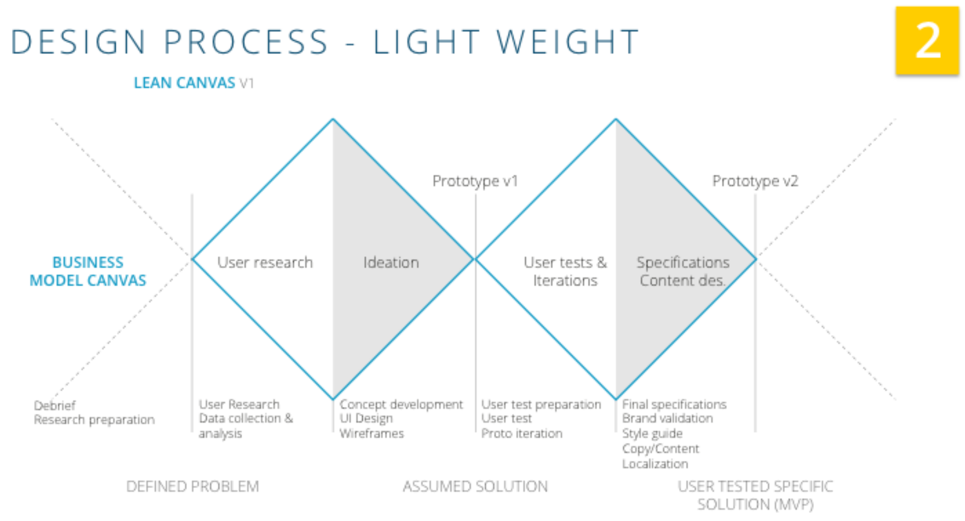


Figure 3-6 Design process – light weight (Basware, Mika Röykkee, 2016)

The design process aims at validating the solutions well before implementation to save time in implementation phase.

3.3 Current metrics

Current metrics used for Basware P2P development were collected via interviewing the responsible persons over current metrics and after that performing a document analysis for the reports of current metrics.

3.3.1 Interview over current metrics

Open face-to-face interview with subject of “Process and KPI metrics” was held in Espoo on 17.5.2016. Director, Operations and development, P2P Product, Management Marko Malmberg and Director, Quality Assurance Ala-Huikku were interviewed, since they were responsible over current measures.

Interviewees stated that current metrics follow productivity and quality in high level. This far the measures have concentrated on the R&D part of the process, starting from technical design.

It was discussed that what could be the interesting measures for requirements management, and the expressed ideas were

- Lead time for the whole process (specification, technical design, implementation)
- Potential waste of specifying too early
- Minimun scope and how it is fulfilled and how much the scope changed during the way

The question was raised whether we should investigate the metrics to follow the quality and challenges per epic. During the discussion, another question was raised, whether the requirement was the same as the specification.

It was mentioned that the ALM tool Jira is handy for metrics, since it enables the creation of the reports in hours.

During this interview, the sources where to find the current reports and metrics were introduced, and they are analyzed in the next chapter.

3.3.2 Document analysis over current metrics

Document analysis over current metrics shows that current metrics measure product quality and schedule through the amount and categories of bugs on both product, project and program level, releases through content, risk, priorities, categories, timing, deployment model and team, roadmap through priorities and themes and velocity through story points of project and investment categories. Alusta KPI’s are tied to the amount of internal and customer bugs.

Also the gates of the feature development process are measured or audited so that certain phases cannot be completed without certain information filled, like the approval phase cannot be completed, unless the documentation is also ready.

3.4 Management interview over current situation

Vice President P2P Product Management, Sami Peltonen, Vice President P2P R&D, Jari Antikainen, Director, Quality Assurance Ala-Huikku, Director, Operations and development, P2P Product Management Marko Malmberg, SVP Purchase to Pay Business Area Ilari Nurmi and Senior Manager, Requirements Management, NBA Product Management were interviewed during 14.-21.6.2016. Interviews were held face-to-face or online. Interviews were done one-to-one. Inteviews were held half-structured. The questions were sent beforehand (Appendix2), but additional questions were asked during the interviews, according to the journey of the discussion.

The goal of the interviews was to survey the managerial vision over both requirements management and possible metrics for requirements management. Also current development methods and possible future vision for the development methods were discussed. In addition, possible other tips for the survey were asked.

In the interviews when discussing about what is important in requirements management, all phases of the requirements definition and management were mentioned. Defining business need, business priority and the problem to be solved were raised. Concern that customer doesn't always know what he wants and therefore we should be careful with defining the problem was also raised. Also the facts that proper solutions for the problems should be defined, non-functional requirements taken into account and design should be done according to the requirements came up. In work planning, prioritizing according to business priorities was mentioned. The requirements should be clear, small and implementable for development. Quality is wanted from both requirements and the product. Accountability was raised as an important issue and the need for traceability. These answers followed the roles of the persons in question and together they build very solid general view over the requirements definition and management.

For the metrics interviewees suggested things like quality, bug backlog, usage of the features, testability, amount of iteration after release, ROI or how much money we get per feature, where do we invest/where we think we invest, Net Promoter Score for customer satisfaction, process metrics for creativity or documenting the requirements, time and size of the requirements, correctness of the requirements, team responsibility, following the accuracy of decision making, pre-studies with users, usability of the product and fullfillment of non-functional requirements.

The themes for metrics were: changes after release, cost effectiveness, customer satisfaction, investment, process, quality of the procuct/service, quality of the requirements, responsibilities, usability, usage of the provided features and user research. From which the quality of the product and the quality of the requirements were mentioned most often.

Interesting thing here is that many of these suggested metrics were not raised high in the discussion what is important in the requirements management, but it must be due to the fact that it is hard to separate the role of requirements away from the whole development process.

In the interview, it was pointed out that any method needs some adjusting in the organization. There is aim to grow more lean in years to come. SaFe has not been thoroughly examined yet and there are no plans to study it further in the near future. In the other hand, there is no reason why good practices from SaFe could not be taken into use, if they are proven good.

Other tips that came up in the interview were P2P product vision and product strategy, specification process, success crtieria, service design, optimizing piloting and go-to-market that and optimizing the big and scattered group of people to work together.

3.5 Workshop for recognizing valuable metrics

Group discussion or rather a facilitated workshop with the requirements management stakeholders was arranged. The invitation was sent to all Product Owners, Product Managers and Project Managers in P2P Invoice automation and Purchase product areas. In addition to that, the directors interviewed earlier were invited. Also few main Architects and Lead software engineer and Project Manager from UI were invited. Eventually, no architects, few directors and few Product Owners could not attend the workshop, but together 17 participants joined the session.

The goal of the workshop was both to get all the stakeholders to discuss and gather ideas for common good and create deeper knowledge around the area and to share and deploy the information.

3.5.1 Beginning

People were welcomed and at the same time the information about people from Tampere being late due to a train being stopped, arrived. The decision was made to wait them for a while, but then to start if they have not arrived.

With half of the people, the agenda for the day was gone through and the idea of the day, to go through few facilitated exercises was introduced.

People in this workshop knew each other beforehand. Still as a starter, safe environment and focus for the issue under workshop was created by the facilitation technique called Cocktail party (Kantojärvi, 2012, p. 195), where the attendees first had to draw the entrance ticket for the party. The ticked had to contain the attendees nick name or second name, answer to the question how the person arrived to the workshop and answer to the question “Why am I here/what are my expectations for today?”.

After the tickets were drawn, people started ‘the party’, meaning mingling around and discussing with each other about the information on the entrance ticket. This way the attendees got to know each other a little bit better still and set their thoughts to the subject of the day by discussing together about the expectations for the day. After the party the tickets were collected to the wall (Figure 3-7).

Figure 3-7 Cocktail party entrance tickets from the workshop

People that arrived from Tampere did the same exercise and then after that, the new party was kept with the carousel idea (Kantojärvi, 2012, p. 178), where the attendees were put in two rings face to face for discussion and the pair was changed by moving the ring after the discussions, three times during the exercise.

After both cocktail parties, the attendees were asked about the expectations for the day, and the following list was collected (Figure 3-8):

- unify
- improve
- money
- discussion – share
- concretic actions
- possible issues (identify)

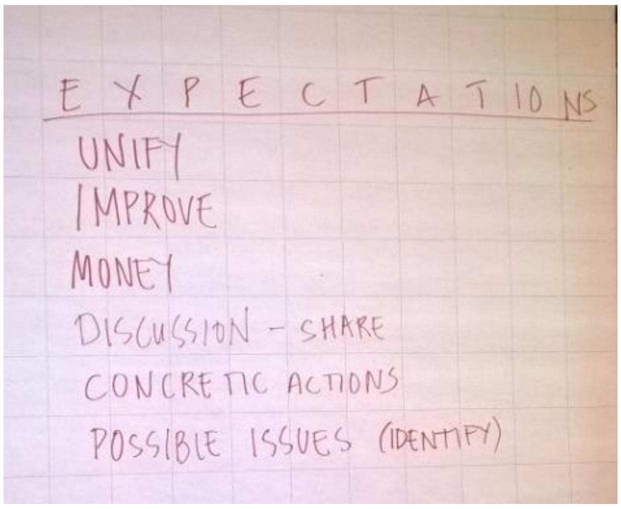

EXPECTATIONS
UNIFY
IMPROVE
MONEY
DISCUSSION - SHARE
CONCRETIC ACTIONS
POSSIBLE ISSUES (IDENTIFY)

Figure 3-8 Expectations defined for the workshop

3.5.2 Clarification

Clarification phase was started straightly with an exercise with predefined question "What is important in requirements definition and management" to collect a common understanding around the issue and set the basis for the further exercises of the day.

Exercise was done using method me-we-us (Kantojärvi, 2012, p. 54). First attendees listed their ideas alone to the paper. Then they discussed the ideas through with a pair and picked together 3-5 most important topics and wrote them to the post-it stickers. After all pairs were finished, the stickers were brought to the board and introduced to other attendees.

After that, attendees grouped the stickers together (Kantojärvi, 2012, p. 84) and following groups of importance were formed:

- customer need (Figure3-9)
- business justification
- vision
- who
- internal process
- external communication and
- design drivers

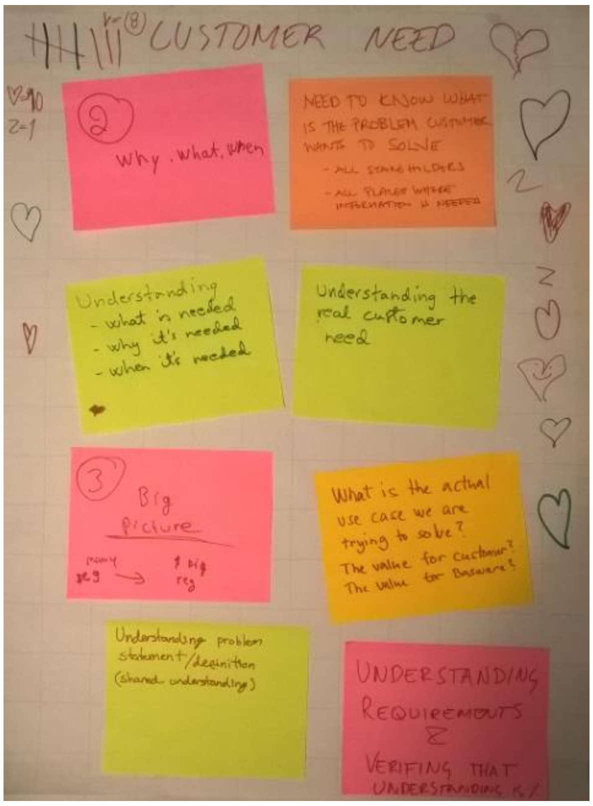
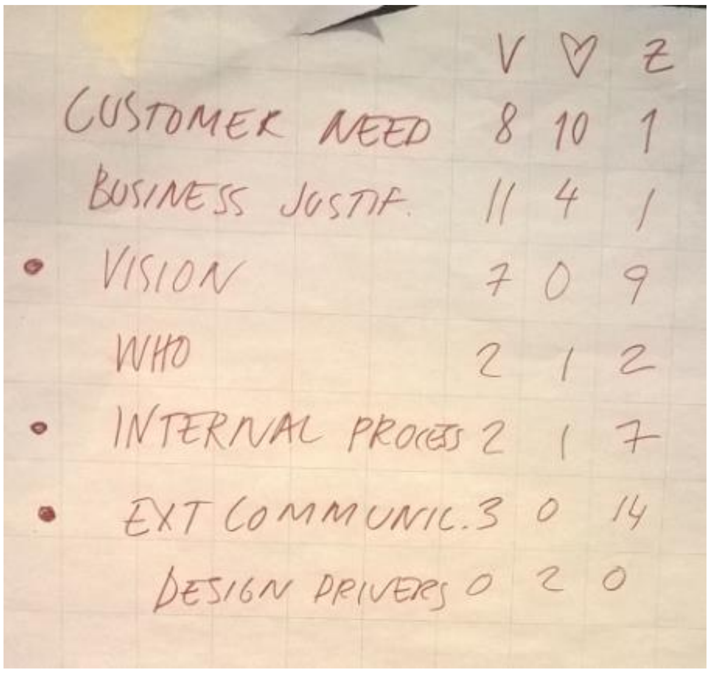

CUSTOMER NEED
2
Why, what, when
NEED TO KNOW WHAT IS THE PROBLEM CUSTOMER WANTS TO SOLVE
- ALL STAKEHOLDERS
- ALL PLACES WHERE INFORMATION IS NEEDED
Understanding
- what is needed
- why it's needed
- when it's needed
Understanding the real customer need
3
Big picture
many req → 1 big req
What is the actual use case we are trying to solve?
The value for customer?
The value for Basware?
Understanding problem statement/definition (shared understanding)
UNDERSTANDING REQUIREMENTS & VERIFING THAT UNDERSTANDING IS

Figure 3-9 Customer need exercise board with stickers and votes

After the groups were formed, attendees voted about the importance of the areas by 5 votes per pair (Kantojärvi, 2012, p. 190-192). Attendees were allowed to distribute votes together how they liked, if they wanted they could put 5 votes to one subject or one vote to 5 separate subjects or anything in between, as long as they used 5 votes.

After that there was another round of voting for the subjects about how attendees feel 'what we do well alredy' they had to mark with heart (❤) and 'where we still need to improve' they had to mark with (Z). This voting was done by personal votes, where every attendee was given 3 hearts and 3 Z:s to use in voting. It was also agreed that they didn't have to use all 3 hearts and Z's, but maximum to use was 3 of each.

After voting, the areas to work forward were selected. It was decided to pick the ones where we should improve. The selected areas were Vision, Internal process and External communication (Figure 3-10).



	V	♥	Z
CUSTOMER NEED	8	10	1
BUSINESS JUSTIF.	11	4	1
• VISION	7	0	9
WHO	2	1	2
• INTERNAL PROCESS	2	1	7
• EXT COMMUNIC.	3	0	14
DESIGN DRIVERS	0	2	0

Figure 3-10 Voting results of the importance, what is done well and what to improve

Voting results explanations:
V = votes for importance
♥ (heart) = we do well already
Z = we should improve

Before a lunch break there was a short exercise where people were forced to take an opposite point of view to the same issue to turn on the creativity (Kantojärvi, 2012, p. 152, 154). Next question was: “What could we leave out from our RDM?”. Attendees were asked to write at least one thing to a sticker around the subject. It was argued that this was a tough question, but everyone still answered. The answers contained everything from “last-minute changes requested by customers” to “too detailed specs --> more iterative discussion” and from “bad ROI requirements” to “overthinking (when we have solution already)”.

These results were read to the audience, but left unstructured to the flip board being available to be used as background information for next exercises. Thinking from the opposite direction raised interesting ideas to investigate further when developing the internal process.

After the lunch, one more exercise was held. The three selected areas for improvement were selected to be workshopped for further ideas for improvement with the question “How to improve the selected areas?”.

Selected improvement areas were: Vision, Internal process and External communications. Productivity, picked from the strategy, was added as a bonus subject by the facilitator.

The exercise was held with a World café method (Kantojärvi, 2012, p. 178), where people were split into four groups. One group per subject. The name of the subject was written into a flip chart and one group took one flip chart to start with. Idea was to discuss in the group collect ideas to improve certain subject and write ideas to the board. After certain period of time groups changed flip charts so that one member of the original group stayed with the old board and explained the previous discussion results to the new group of people. The rest of the group moved to the next flip chart. The next subject was discussed through with new people and the new ideas were collected to the board. Groups were changed still 3 times, so that all people could visit all boards, while always someone that had not stayed with the board and explained the contents to the next group stayed with the board.

After the round of ideation, groups were asked to pick 3-5 most important things from their boards. Results of this round were following:

VISION
- Create S2P Product vision collaboratively across all silos (prod mgmt. facilitates)
- Vision should be discussed, challenged and defended
- How vision links to everything else and how it is implemented
- Is a living thing NOW - 2020 – 2030

INTERNAL PROCESS
- Rapid prototyping
- validating new concepts/features fast with customers without any investment in development (=coding)
- More focus
- fewer parallel things --> more efficiency
- Feature KPI's

EXTERNAL COMMS
- Best practices
- default settings
- new feature visibility and training for end users
- feedback to specifications (customer, consultant)

PRODUCTIVITY/EFFICIENCY *bonus item

- focus on less items
- knowledge base usage in support
- issue --> 2. resolving issue --> 3. Resolution --> 4. Re -use
- Do things simple --> MVP

The results were introduced and explained team by team to the whole audience.

3.5.3 Planning the solutions

Planning the solutions phase consist of throwing ideas and the development. In this phase ideas are generated and if possible try to tear away from conventional thinking to enable the creative thoughts. When ideas are found, they are selected and refined further to solutions. Solutions are analyzed and mirrored to the original question.

The last exercise for the day was about the metrics, with the me-we-us method using only me and us parts. First a small introduction to the basics of metrics was given showing the vulnerability of the metrics via gaming and the importance of measuring only something that brings you value. During the presentation and short while after that, attendees listed their own ideas what to measure around the requirements definition and management in the target organization to the stickers.

After ideation, the stickers were gathered to the flip boards and introduced to everyone. The result of the ideation was like this:

1. Measure how many % of our system is actually used (per feature) per tenant
2. Transaction done by feature (if possible) e.g. # invoices matched with service PO
3. "Count of the number of bugs per item delivered
4. Can we get it lower by having more discussions + other actions"
5. Clarify how customers value our features
6. How to measure we have/had to implement the feature x? Is / was it really necessary/worth it?
7. Value based further metrics (value velocity, value/release, value realization (value according to usage metrics))
8. Define and start using FEATURE VALUE SCORE for prioritizing development items
9. Define FEATURE KPI's as part of design phase and follow them up to ensure success

10. Calculate RELEASE VALUE from FEATURE VALUE SCORES
11. How to measure outcome/customer value per feature
12. Ratio of discussions about requirements /items delivered

The final exercise was to throw ideas in groups what would be the goal per metric, how the metric could be gamed and how the metrics should be built. Since the time for the last exercise was short, attendees were split to three groups where one group discussed one board through.

3.5.4 Preparing to act

Preparing to act phase should have been concrete actions, but this phase was left out from the workshop and was discussed further with the Operations and Development manager afterwards.

3.5.5 Closing

Closing part ended up to be very fast, since time was run out. People were still asked to fill a short questionnaire (See Appendix 3) around the subject of the day and then the day was ended with thanks and goodbyes.

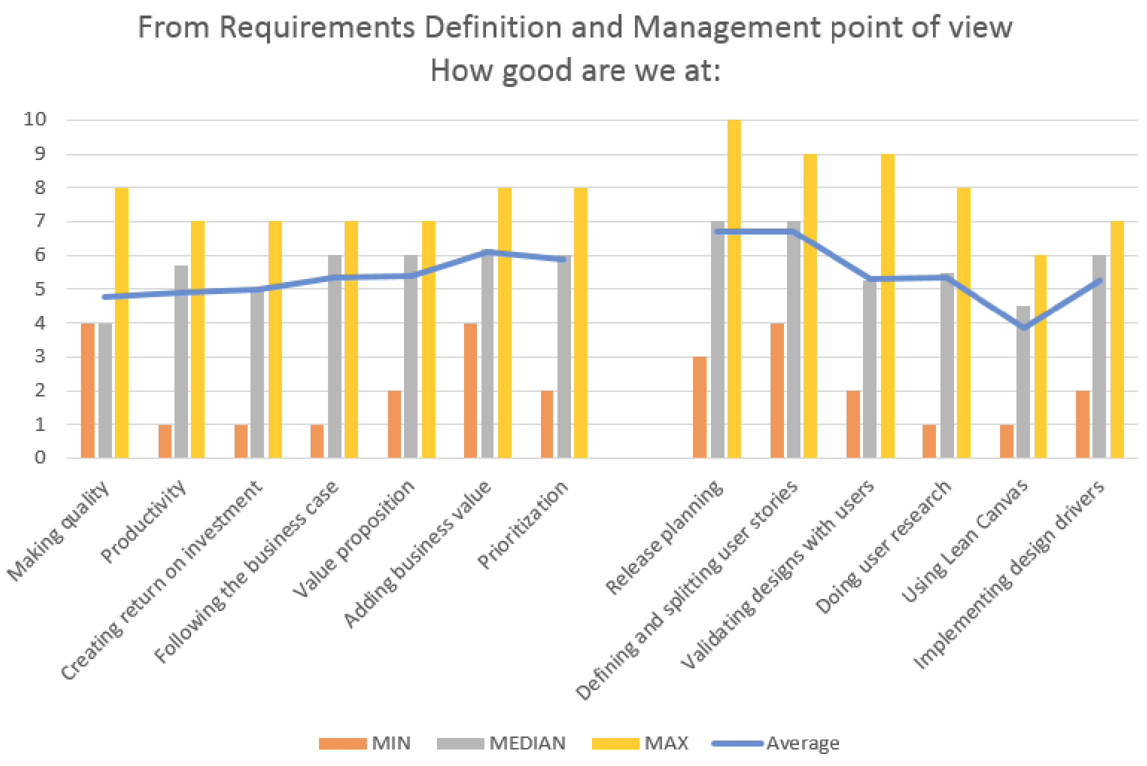


Figure 3-11 Workshop final survey

The results of the survey (Figure 3-11) shows that the opinions differ a lot from each other, but in average the opinions are in middle level, that means that things are quite ok or neutral. There were 13 respondents in this survey.

3.6 Conclusions

Based on the interviews, document analysis, discussions and workshops and in the light of the literature, what to measure?

This high level value stream draws a picture of the symbiosis between the customer, supplier organization and the product/service (Figure3-12).

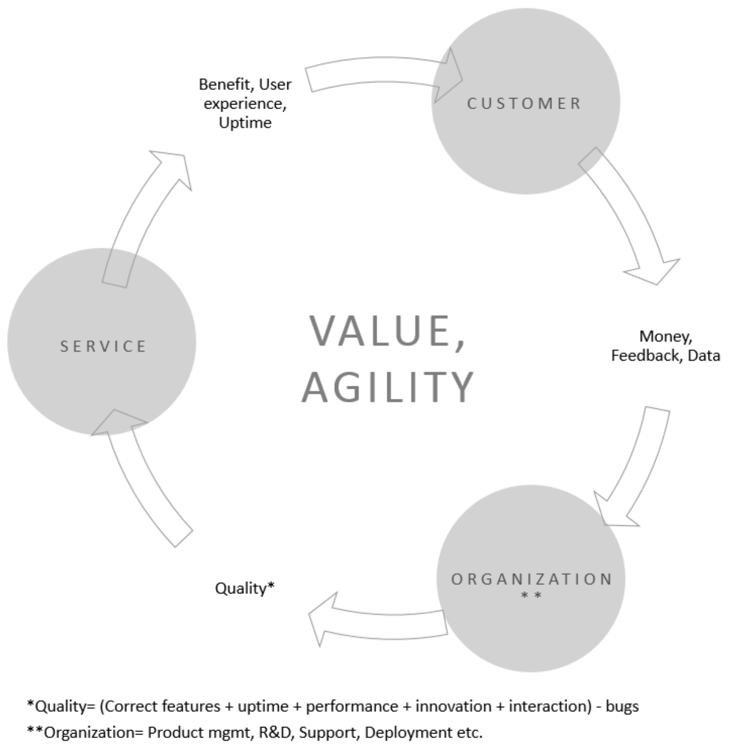

Benefit, User experience, Uptime
CUSTOMER
Money, Feedback, Data
ORGANIZATION **
Quality*
SERVICE
VALUE, AGILITY
*Quality= (Correct features + uptime + performance + innovation + interaction) - bugs
**Organization= Product mgmt, R&D, Support, Deployment etc.

Figure 3-12 High level value stream

Basically the value is given to the customer when providing them benefit, quality, uptime and user experience. Still while providing one product/service to all customers, the amount of backlog items grows very high and it is hard to prioritize them in single line.

Requirements definition and management process

It was said in the interview and document analysis of the current metrics, that the gates of the feature development process are measured or audited. This process could easily be widened to contain more detailed starting point than ‘New’.

To visualize the beginning of the process the chart describing the work that is done in the requirements definition and management phase (Figure 3-13). The current feature development process is shown in the process under the Delivery and Implementation sections.

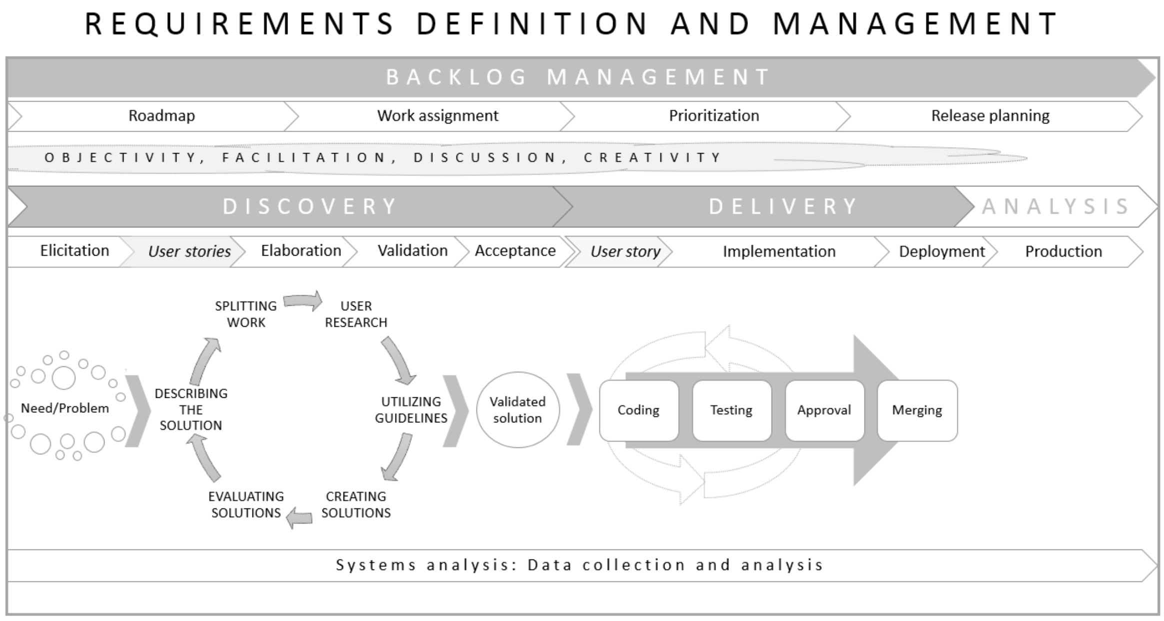


Figure 3-13 Requirements definition and management in target organization

The chart shows the three themes of the big everyday themes in requirements management: Discovery, Delivery and Backlog management.

Backlog management part is ongoing all the time. In the target organization Kanban is used for backlog management and items are pulled by the team to the implementation. Backlog management includes following the roadmap with the priorities, assigning the work to the project teams, prioritizing user stories, enhancements, technical items and bugs for implementation and planning the releases so that something valuable is released every month.

This research, along with the currently in the target organization introduced Double diamond design model, clarifies the dimensions of the discovery part.

The important part in discovery phase is the **Elicitation** (Murphy, 2010), where requirements are gathered and studied with users. The most important thing during the Elicitation is that output from that phase is a clearly defined problem or problems where the future process of product development seeks the solution for. The biggest mistake that could be done during the product development is to solve wrong problem. Customers do not usually know how to describe the need, but they very often describe the solution that they want.

Elicitation phase contains already defining the problems as epics or high level user stories to the backlog and may contain also some preliminary solution ideas related to the stories.

In **elaboration phase** more depth is added to the meaning of the requirements. This is also a phase for ideation where people should put the creative gear on and try to figure possible solutions to the problem. More user research can be done in this phase too if it is needed to widen the knowledge around the theme and the data analyzed to support the solution creation. There is still a possibility to end up with poor solution that for example solves only part of the original problem or totally different problem than what the real need was. Solutions can therefore be validated with users to help to select the best solution and find the enhancement ideas for the solution. A/B testing could be a helpful tool here. At any suitable phase of elaboration, the feasibility study (Shelly et al., 2011, p. 63-66) for the solutions should be done, the feasibilities of the solutions should be considered from both operational, technical, economical and schedule point of view and the most feasible solution should be selected to be implemented. Of course, the emphasis to the separate feasibility areas could be weighted differently if it is seen appropriate for the feature or theme. If some feature area is mentioned to be a market differentiator or an excitement feature it should be weighed from that point of view.

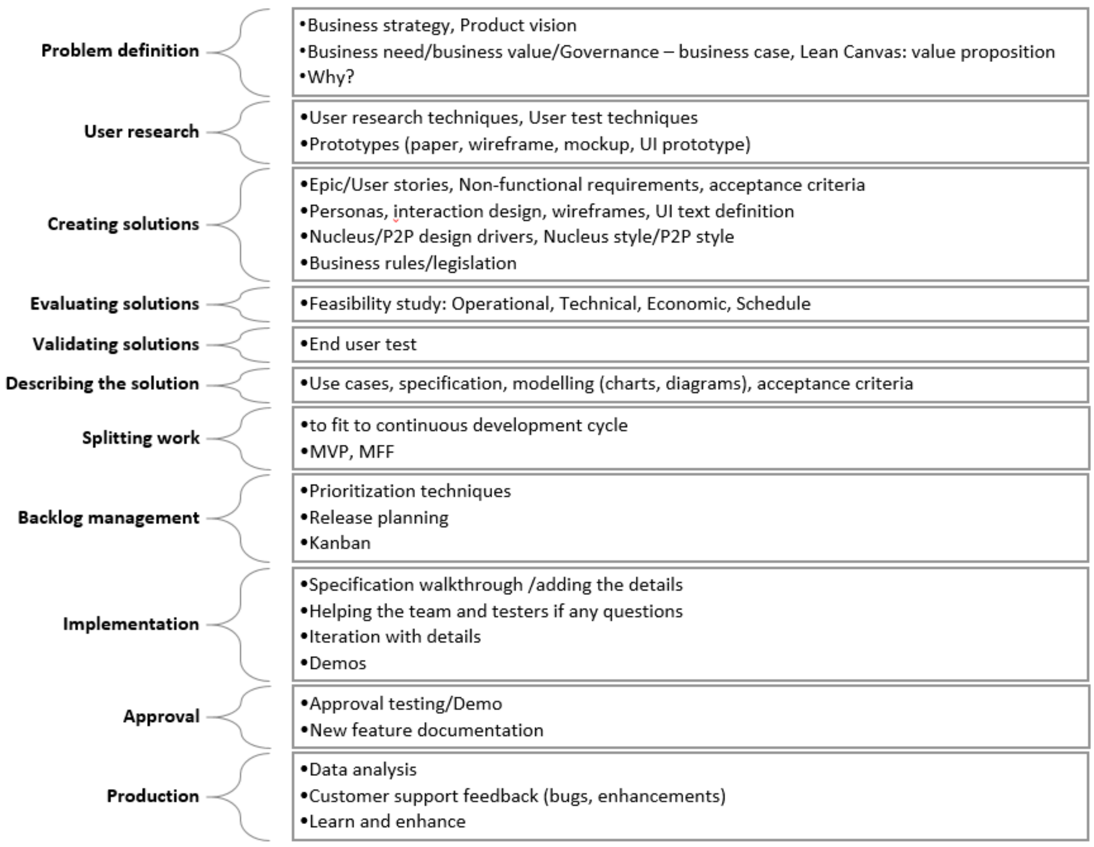
At the same go the selected solution should be described, acceptance criteria refined and work items split into the suitable size of work grouped together so that the output creates value for the users when released (MVP, MMF). Also risks can be evaluated at this phase.

In **validation phase** it should be verified that requirements are complete and testable. In this phase the developers and testers should agree about the acceptance criteria of the user story. This can be done with discussions, simulations and face-to-face meetings. (Murphy, 2010) In this phase the solution could be validated with end users to assure the quality of the solution.

Then it is time for **acceptance**, the decision has to be made that the solution is well enough validated and user stories are ready for implementation. Agile method for this gate decision that could be used is Definition of Ready (Agile Alliance, 2015a).

In agile development it is important to keep in mind that even if the requirement is validated and accepted in the requirements definition phase, the changes are welcome in the development phase too. The goal is to develop usable product, not according to the plan or specifications.

While drawing the process for the agile requirements definition and management, the list describing the most important guidelines, tools and methods for the persons doing the requirements definition and management was gathered to clarify the points of possible measurement (Figure 3-14).



Problem definition	•Business strategy, Product vision •Business need/business value/Governance – business case, Lean Canvas: value proposition •Why?
User research	•User research techniques, User test techniques •Prototypes (paper, wireframe, mockup, UI prototype)
Creating solutions	•Epic/User stories, Non-functional requirements, acceptance criteria •Personas, interaction design, wireframes, UI text definition •Nucleus/P2P design drivers, Nucleus style/P2P style •Business rules/legislation
Evaluating solutions	•Feasibility study: Operational, Technical, Economic, Schedule
Validating solutions	•End user test
Describing the solution	•Use cases, specification, modelling (charts, diagrams), acceptance criteria
Splitting work	•to fit to continuous development cycle •MVP, MFF
Backlog management	•Prioritization techniques •Release planning •Kanban
Implementation	•Specification walkthrough /adding the details •Helping the team and testers if any questions •Iteration with details •Demos
Approval	•Approval testing/Demo •New feature documentation
Production	•Data analysis •Customer support feedback (bugs, enhancements) •Learn and enhance

Figure 3-14 Tasks related to requirements definition and management

During the process and task definition, qualities like objectivity, facilitation, discussion and creativity were found as good qualities for people attending to requirements definition and management activities.

Separating Requirements cycle more clearly away from the Development cycle (Moccia, 2012) could clarify the daily work when shortening the backlog sizes. This could mean in practice keeping the requirements in the requirement backlog (e.g. with tag of Target=Future), out from the product backlog until the problem and targeted quality level has been defined. This would then need validation in practice whether it would bring any help or only make things more complicated. The requirement phase could still be done in Kanban mode without sprint as the rest of the backlog management.

Current KPI's

Current metrics measure mainly product and release quality and schedule and the feature development process. It was said in the interviews that requirements definition and management are not consciously measured, but when taking a closer look, the requirements definition and management is part of any measured area. Quality and accuracy of the requirements has straight effect to the amount of the bugs, contents of the releases, roadmap to follow the timetable and the velocity of the teams.

Existing KPI goals could be supported by setting the objectives against requirements definition and management. Suggested objectives are gathered into the Figure 3-15.

Area	**Way to improve**	**Metric/objective**
Quality/Amount of bugs	Paying attention to avoiding bugs in the first place, discussing the implementable stories more thoroughly through with the team	Feasibility study for feature or theme has been done on discovery phase, specification has been completed in a discussion with a programmer, demo has been given.
Quality/Amount of bugs	Being more precise with the acceptance criteria, writing measurable criteria, and challenge them well together with the team	Measurable acceptance criteria where the measurable targets are set
Quality/Amount of bugs	Being more strict with approvals – not approving the features to be merged with known bugs	Count of bugs per feature
Quality/Amount of bugs	Prioritizing the bugs to be fixed in the next release or closing them as 'not to be fixed' to gain the quality or stop bugs wasting time for prioritization	Do not let bugs stay open over 3-5 releases
Quality/Amount of bugs	Reviewing tests for automation or taking part to the planning could help to decrease the amount of bugs	Review has to be done before feature is accepted
Releases	Avoid pushing the feature into a release, if it is not mature	Count of bugs per feature – root cause analysis

	enough	
Roadmap	Try to keep constant pace with the work, adjust the resources to the roadmap, not the schedule	WIP
Velocity	Paying more attention to the contents and size of require-ments should help the team to keep the velocity up	Size of user stories

Figure 3-15 RDM objectives for the KPI's

According to both literature, management interviews and the workshop, measuring the productivity via ROI or business risk or created business value could be added to the current KPI metrics to stress the value of the business view. It is just not so easy to define the costs versus return or the value of output, especially when delivering agile software iterations to several customers with different needs. Sometimes you even may need intuition to define the possible value. It should be further validated whether value velocity, purpose alignment model, kano analysis, agility index or something else could be helpful tool for that. With defining the value, one should at least be careful that evaluating the value should not grow too big effort that it ends up as waste.

The first step closer to the value definition could be to define per feature what level of quality and market differentiator effect is wanted per feature and adjust the solutions to that level.

Metrics

Theory of the metrics guides to set the goal for the measurement and measure only what you want to achieve and also motivate the right behaviors with metrics. It guides to be aware of vanity metrics and recognize the possibility of gaming with certain kind of metrics. It tells to use the most important metrics until they are not valid anymore and then find new ones.

Driven from the business strategy the future goals are to achieve cloud revenue, simplify operations and improve productivity, by for example focusing on Customer Success by further improving customer satisfaction and experience and evolving our culture and way of working to focus more on performance.

In the interviews, the management mentioned both product quality and requirements quality as the most important parts of the requirements definition, cost-effectiveness and prioritization according to business need were also raised high.

In the workshop customer need, business justification, and vision were raised as the most important areas of requirements definition and management.

Figure 3-16 illustrates the similarities between the business strategy, management interviews and the workshop results.

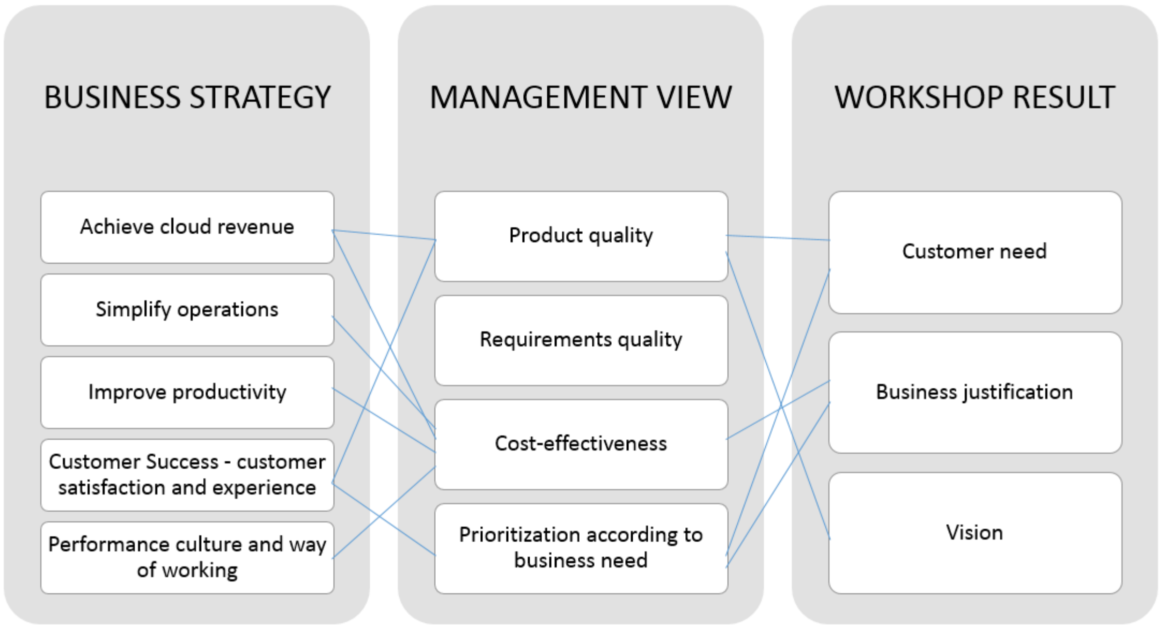


Figure 3-16 Important in business and requirements definition and management

In the interviews the management suggested cost-effectiveness, customer satisfaction, investment, quality of the service and quality of the requirements to be measured.

The suggested metrics gathered in the workshop were related to feature quality, feature value, prioritization, release value and feature usage.

Both results look at the same issues, but from the different angle (Figure 3-17). Management concentrates into higher level issues where the workshop results go to the more detailed level. Both of them emphasize the cost-effectiveness or creating value, service quality in general, in release or in feature level and prioritization and investment.

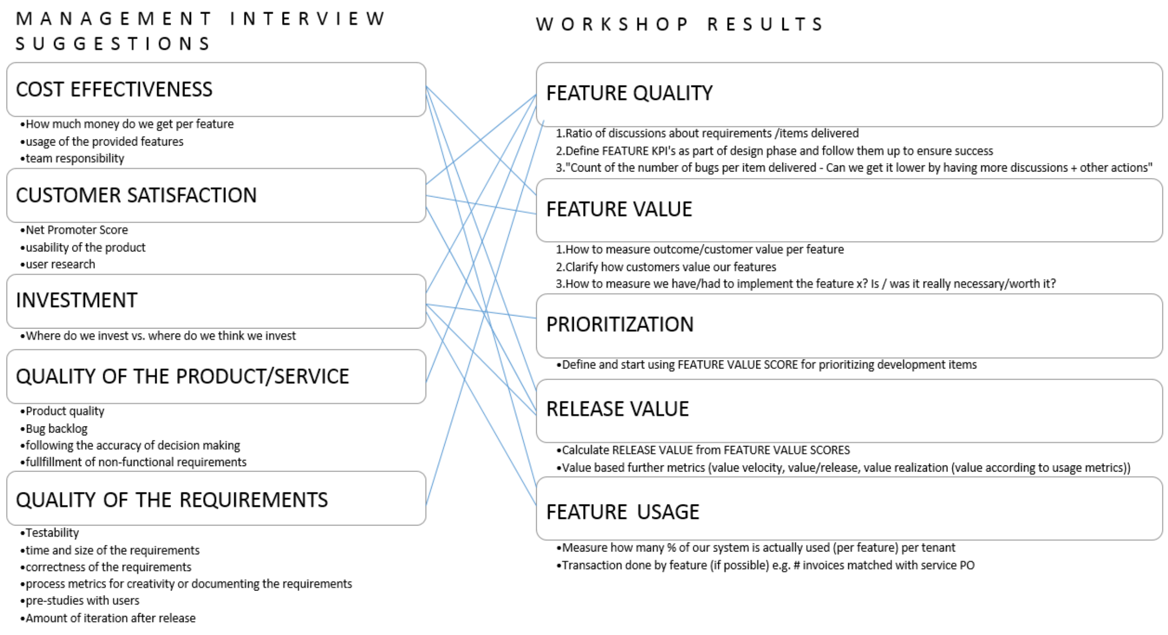

MANAGEMENT INTERVIEW SUGGESTIONS
COST EFFECTIVENESS
•How much money do we get per feature
•usage of the provided features
•team responsibility
CUSTOMER SATISFACTION
•Net Promoter Score
•usability of the product
•user research
INVESTMENT
•Where do we invest vs. where do we think we invest
QUALITY OF THE PRODUCT/SERVICE
•Product quality
•Bug backlog
•following the accuracy of decision making
•fullfillment of non-functional requirements
QUALITY OF THE REQUIREMENTS
•Testability
•time and size of the requirements
•correctness of the requirements
•process metrics for creativity or documenting the requirements
•pre-studies with users
•Amount of iteration after release
WORKSHOP RESULTS
FEATURE QUALITY
1.Ratio of discussions about requirements /items delivered
2.Define FEATURE KPI's as part of design phase and follow them up to ensure success
3."Count of the number of bugs per item delivered - Can we get it lower by having more discussions + other actions"
FEATURE VALUE
1.How to measure outcome/customer value per feature
2.Clarify how customers value our features
3.How to measure we have/had to implement the feature x? Is / was it really necessary/worth it?
PRIORITIZATION
•Define and start using FEATURE VALUE SCORE for prioritizing development items
RELEASE VALUE
•Calculate RELEASE VALUE from FEATURE VALUE SCORES
•Value based further metrics (value velocity, value/release, value realization (value according to usage metrics))
FEATURE USAGE
•Measure how many % of our system is actually used (per feature) per tenant
•Transaction done by feature (if possible) e.g. # invoices matched with service PO

Figure 3-17 Internal suggestions for the metrics

Cost-effectiveness and high level quality are not only requirement related metrics, but related to whole ALM. The goals for them should be defined in the organization level. But with both you should be careful what to count in and what to leave out. And to keep in mind the abstractness of the value. They could consist for example of the following things:

- Cost-effectiveness=value+quality-costs compared to usage
- Value=rationalization of the process and need for manual work compared to usage
- Quality=attractiveness+uptime+performance-bugs
- Costs= discovery effort+delivery effort+bugs+production cost (maintenance, release deployments, hardware/cloud investments) + support requests (recording, solving, prioritizing)

Both literature, interviews and workshop promotes the idea to follow the quality of the product by feature or theme. The quality related data could include the problem definition and the summary of rest of the phases performed during the discovery phase or explanations why they were not done, results of data analysis, amount and coverage of the unit tests, reported bugs and their status, open suggestions and enhancements and analytics over feature usage. Comparing the results of the product quality (amount of bugs and enhancements) to what happened in discovery phase, could help the organization to recognize the most efficient ways to push the features from the design to the production while providing the true value to the customers. Following all figures on the feature or theme level would allow the target organization to put the customer feedback into perspective with the level of theme or feature readiness and existing future plans.

Viewing all the bugs through the theme or feature could expose the quality of the product area more closely and help to analyze the them as larger entities.

From the requirements definition and management point of view, following the RDM process efficiently could be a key to improvement and raise both the quality of requirements, the quality of the feature and the quality of releases. Target organization has just clarified the internal process of the discovery phase. If target organization wants to enhance the quality of the requirements definition and management process and ensure that the process is followed, they could start measuring whether the most important steps are accomplished during the way or not. Or the opposite, which actions the organization wants to get rid of, they could be counted too with expecting 0 result. This should be easy measure through the Jira to add a check box to the feature level item to be filled before items flow to the implementation or at the acceptance phase latest. The check box is of course always easy to just mark without accomplishing the task, but the level of trust in the organization should be so high that there should not be any need for that kind of gaming. Lies are in this case easily tracked anyway.

Following table (Figure 3-18) lists the process steps that would be important to complete in way or another to achieve the feature quality through the RDM process.

Phase	**Step**
Problem definition	Business model canvas/Lean canvas
Problem definition	Personas
Problem definition	User research
Problem definition	Data analysis
Solution creation	Following design drivers
Solution creation	Level of innovation (compared to the set goal)
Solution creation	Use of prototype
Solution validation	User test
Solution validation	A/B testing
Solution validation	Feasibility study
Work planning	MMF
Work planning	Item sizes
Delivery	Acceptance criteria completed together with the team/programmer and tester, demos, retrospectives
Product quality	Amount and frequency of performed usability tests and/or solution evaluations

Product quality	Regular data analysis and monitoring
Product quality	Suggestions and bugs per feature or theme

Figure 3-18 RDM process quality steps

In problem definition phase it could be recorded whether business model canvas (Appendix 4.) or Lean canvas (appendix 5.) for the feature or theme exists. Existence of business model canvas draws the vision over e.g. value propositions, customer segments, cost structure and revenue streams and acts as the input to further phases. One sign about problem being defined could be the lean canvas.

To emphasize the usage of personas in requirements definition, we could record where personas are used.

To emphasize the importance of user research the level of user research performed could be recorded to the feature metrics.

One important thing to pay attention to is the data analysis. Data analysis should be improved and streamlined to better support the RDM. By dedicating time and resources to data analysis, to figure what is wanted out from the data and automating the reports as far as possible would give big benefit for the requirements management assuring that the analysis happen efficiently and making the data collection and grouping fast. To measure the amount and frequency of data analysis a simple metric would be to see whether it is analyzed or not, but more important achievement would be to see what the results of the analysis can tell and where they only raise more questions.

In solution creation, interesting things to follow would be whether the design drivers have been used in solution creation, what is the level of innovation of the feature or feature set or what kind of a prototype has been used for user testing.

In solution validation, it would be interesting to know has the user test been done, has a real user evaluated solution before implementation and was the user test done with A/B testing. Getting the fast feedback is an important part of agile requirements definition and management. To define a metric for that could be related to the fact that how easily the users can be reached for giving the feedback. This would require a streamlined process options for different level of feedback gathering. User groups, utilizing usertesting.com, few continuous connections to ask to could be options for the feedback loops.

Interesting thing from the quality point of view is to follow whether the feasibility study has been performed successfully, from both technical, economical, schedule and operational point of view. Perhaps something like current Feature Analysis that is in use, could be expanded to cover the other areas too.

If it only would be possible to measure already at solution selection phase, that the best, most feasible solution was selected, that meter would be the best to take in use. In creative iterative and time-boxed work the decisions are not always simple and easy to draw. Especially with the legacy enterprise software where dependencies go everywhere. At this stage the best measure is learning by doing. Recognize the decisions that worked and repeat those while trying to get even better.

When planning the work priorities and item sizes it is important to keep the concept of minimum marketable feature in mind and plan the released features so that whatever is released, it serves end users even if more features would be built on the top of the feature in the future. This can only be measured in collaboration with users, gathering feedback from the usability and value.

Something to keep in mind when prioritizing bugs, it may be hard to see the value of a small bug fix but with certain kind of small fixes it is the bigger mass that makes the difference if for example fixing the group of small UI bugs provides a polished façade that makes the service look professional. Customers will not be excited about that, but they sure will notice if the polished look is not there.

Prioritization and assigning the work according to the highest priorities and biggest risks first, building the software in small increments to get fast feedback and fit the work into the monthly releases cycle and the ability to adapt to the changed priorities are also important parts of work planning. These areas are in good shape in the target organization.

In the delivery process the most important part is that Product Owner and implementation team share the same vision and goal for the feature. Demo is a good tool to ensure the shared understanding and a great way for the both Product Owner and the team to look the service from the position of the user. That could be something to record and follow as a quantity too. Setting the amount of needed fixes after the demo should be as low as possible as a metric, could easily be gamed so that demo always ends up with status “no fixes needed” where the reason for the demo is to find and fix what is needed. Therefore measuring only whether the demo happened or not, could tell enough. Also there may be several demos during the development cycle, where the first one might contain only a rough version of the feature and therefore the quality should not be measured. Instead it would be a good goal for the first demo to find all or as many as possible missing acceptance criteria, but it is hard to imagine how to define a metric for that. There the shared responsibility with Product Owner and the developer should already do the work. In the last demo then the goal is to approve the feature. There the metric could be whether it was possible to approve the feature or not. And if not, what was it due to, the misunderstanding on requirements or a bug in implementation. Then the root cause could help to improve the work in the future. But here is a big chance that the analysis ends up as a vanity metric. Therefore quantity of demos during the way could be the best one to raise the discussion. Only testing this metric in action could tell whether it is worth of following.

Target organization is planning to measure customer satisfaction with NPS. In addition to that, it would be good to get more detailed lower level regular feedback for the improvements. This is done feature by feature in the development cycle, but it would be good to get the feedback independently away from the design and development to gain the view of fresh eyes. This could be gathered by independent usability tests e.g. during product quality process and in the beginning measured by the amount and frequency of performed usability tests and/or solution evaluations could be measured similar to the amount and frequency of performance tests run. Usability test results could then be gathered as feedback to the feature or theme.

In the other hand, Pixton and others (2014, chapter 9) suggested to use customer acceptance as the key measure instead of internal development metrics. They also state that many project failures arise from measuring the process rather than the results or the outcomes. In this light the only suggested metric would be whether the problem and selected solution are validated succesfully with real users before implementation.

And lean movement startups again measure value by validated learning about customers, instead of measuring the creation of value by our ability to produce tangible high-quality artifacts. (Ries. 2010) Measuring whether the problems and solutions are validated with users would fit here too.

For the future, it might be worth of looking at organizational learning and how to grow better by more efficient knowledge management and metrics for organizational learning.

4 Results and Discussion

The original research question was “Measuring the agile requirements definition and management in the enterprise software development – what to measure and why?”. This research has defined the context for agile requirements definition and management by describing agile software development, requirements definition and management and drawn a picture over the metrics.

The research both suggests the metrics to take into use with requirements definition and management, but also clarified the process in the target organization. In addition to the metrics and the process figure, the research has initiated interesting discussions in the target organization and kicked the knowledge off to be evolved in the target organization.

It was asked that why should we measure the agile requirements management. The very first answer to that question from a manager in the target organization was “You Can't Manage What You Don't Measure” (Origin unknown). The theory confirms that fact, but in addition advises to be careful with how to set the metrics against what you want to achieve avoiding the possibility for wrong results. Requirements definition and management is fundamental part of software development. By getting requirements wrong the software doesn’t provide benefit to the customers. By creating poor solutions or selecting the wrong solution may cause loss of benefit. By prioritizing or splitting the items wrong the benefit is lost again. Since the requirements definition and management is very essential, it should be done well and efficiently. Therefore it is wise to look at it with metrics also.

Another question was that what should we measure of the agile requirements management. The short answer to this question is that what ever we want to achieve. If we wanted to achieve productivity we should set the objectives so that they lead us there.

It was asked also that what answers can the measurements give. Measurements give us the answers that we ask when setting up the metrics. There one needs to be careful to take the qualities of the metrics into account, since e.g. quantitative metrics cannot give you qualitative answers and vice versa, lagging metrics can’t help you to change the direction on the go, if the results are gathered only after the project and a vanity metric can lead you to the wrong direction, so actionable metrics that provide information that can help you make informed decisions and take corresponding actions are the helpful ones.

It was asked that how do we analyze the results and why. This question goes to the same category as the previous. Analyzing the results should be planned when the metric is set. The possibilities for gaming or other misuse of the metric should be considered at the same time when defining the metric itself.

And how do the results end up into concrete actions for improvement? Only by nominating a responsible person to deploy the needed changes and follow the trends to figure has the change happened or not and encourage the Product owners to improve the ways of working further.

4.1 Conclusions

The literature guides to measure the most important things first. To validate the requirements, both the real problem and the good solution against that, validating solutions with users were found as the most important things to improve at the moment. It was suggested by Pixton and others (2014, chapter 9) that customer acceptance should be used as the key measure instead of internal development metrics. In addition the lean movement startups measure value by validated learning about customers (Ries. 2010). This can be measured with gathering the level and way of user validation done per feature. This can then be compared to the overall quality of the released feature and then evaluate the efficiency of the levels and ways of user validations compared to the outcome of the feature, amount of bugs, suggestions and enhancement requests for the feature. The big achievement from validating solutions with users should also be the team and Product Owner learning from the users, that is hard to measure in quantity.

To support the efficiency of defining and validating the solutions, the feature quality target could be set beforehand to define the level of desired level of quality, meaning the targets for the attractiveness and importance of the feature. Both the solution definition and technical quality could then be adjusted to the set level and measured whether the target was met or not.

Another important area of improvement is evaluating the MMF set, so that the released feature set answers to the user’s need and no important dimension should not be left out so that user experience or performing the needed action suffers. That could also be evaluated with the user test and via decent problem definition, recorded to the feature level and compared to the feedback about the feature.

In the target organization it would be important to deploy the new design process well in use. To monitor the success, completing the steps on feature level could be measured to view the trend of improvement and it's impact to the feature quality and efficiency. The phases to measure are introduced in the Figure 3-17.

Following feature quality and feature value were raised high. Through that measure it would be possible to not only follow the total quality of the feature, but also explore and find the lean way to do the discovery of the requirements via comparing the used RDM techniques and completed process phases to the quality of the outcome of the feature.

Enhancing the data analytics of the service production data would improve both the RDM process and the product quality and cost-efficiency. Automated reports and trends explaining the most important and the most current areas of service usage would both accelerate the requirements definition and management process and help to prioritize better. Dedicated resource to raise the level, accuracy and use of the data analytics could be recommendable. Pixton et al (2014, Chapter 1) recommended to base the data analytics by defining the questions where you want answers from the data.

Requirements definition and management is a seamless and important part of software development, therefore most metrics cover the whole software development, not only the RDM. Anyhow separate objectives for RDM are recommended to be set against the existing common KPIs. Figure 3-15 shows the recommended RDM objectives for the KPI's.

4.2 Development suggestions

The metrics defined in this research should be validated and figured whether they help to achieve the defined goals or not, whether they are vulnerable for gaming or other misuse and whether the cost for gathering and analyzing the results is feasible.

To measure feature quality, a decent way to collect all the data most efficiently by the feature should be defined. For example taking Epics in Jira in this feature use, would support this way of working and provide some of the metrics by default. Current development modes should only be slightly changed to follow the idea. Using Jira epics would support requirements definition and management in other senses too, since that way it would be easier to find an old item and view the feature as whole, checking the duplicate items and analyze the bugs and suggestions per feature.

More streamlined process options for different level of feedback gathering are needed to ensure getting the fast feedback for iterations. User groups, utilizing usertesting.com, few continuous connections to ask to could be options for the feedback loops.

The RDM process should be deployed efficiently to gain the just-in-time quality. It would be beneficial for the big picture if all Product Owners shared the same basic view about RDM process steps and especially goals and encourage them to figure together how to improve the work. Building a single service would need certain basic elements to be followed by everyone building the service to achieve service consistency. The final survey of the workshop also raised a concern that the common terminology is not used within the Product Owners, Product Managers and Project Managers. It would be beneficial to define the core vocabulary to ensure that people talk about same things when building the ways of working.

It could be beneficial to consider

- managing requirement backlog separately from product/team backlog to gain the benefit of not handling both ready and discovery phase items in the same pile. Consider also taking Definition of Ready in use
- giving Product owner responsibility over his own team backlog to increase efficiency and motivation
- moving to hypothesis-driven development to work the need first and ensure that the solution follows the problem and avoid going solution first.

Use metrics to motivate and encourage people to perform better. Let the teams define the metrics that would benefit them to improve. Product Owners should be encouraged to develop the RDM process and metrics further together with the Product Managers.

To emphasize the responsibility of the team, moving the solution definition responsibility closer to the development team could help to mitigate the quality issues and help with productivity. It could be beneficial if the target organization would use the implementation teams more in the solution creation phase too. More feasible and innovative solutions could be found when creating ideas together first. It could even be worth of trying to get people from the marketing and support organization or from the operations team to join the creative workshop for certain bigger themes to both get to know the people better, create the communication link and understand the challenges in the other side of the fence.

It might also be worth of considering to follow employee satisfaction in team level, by measuring leadership effectiveness, trust and ownership to enhance the empowerment and motivation could be considered too.

When the RDM process is well in use, it is important to take another round of facilitated workshop to define the next metrics for the RDM and keep improving!

4.3 Suggestions for additional research

To keep improving, the target organization could do additional research around the following subjects:

- Evaluate the proper way to estimate business value, cost-effectiveness and all the angles of the quality.
- Evaluate the SaFe, whether any useful patterns for scaled work could be utilized from that framework.
- Study the knowledge management and organizational learning further, and figure how to gain more advantage out of them.

4.4 Reliability and ethicalness

References are wide, target organization current state has been investigated thoroughly and wide audience of stakeholders were involved into the process of generating ideas for the future metrics.

The researcher has tried to be as objective as possible with the research, even if working in the target organization. Still the interests of the researcher have guided the path and most probably influenced to the research result so that the point of view covers the whole software development process, but concentrates to the importance of the discovery part.

This research is linked to the present time and therefore the results may be unique, since the ways of working develops all the time, phase of the lifecycle of the service changes, so does the methods for working and organizations learn and changes continuously and processes mature on the go. Knowledge evolves and therefore ties this research to the current time.

The results of this research may not fit for other organization units in Basware or other product development organizations, unless they use very similar interpretations of the same methodologies in the same scale and structure as the organization part under the research. The results may though give other organizations helpful ideas to utilize in their own environment.

The research has defined the suggested metrics for the target organization and therefore met its goal.

4.5 Evaluation of the final thesis process and own learning

The research question was very current, since the organization is aiming at improving productivity and the research shows how to strengthen the whole development cycle with strong requirements definition and management. Looking the requirements management from the metrics point of view added an interesting angle to the research and encouraged the target organization to discuss and be inspired of that angle too. The final thesis process is shown on Figure 4-1.

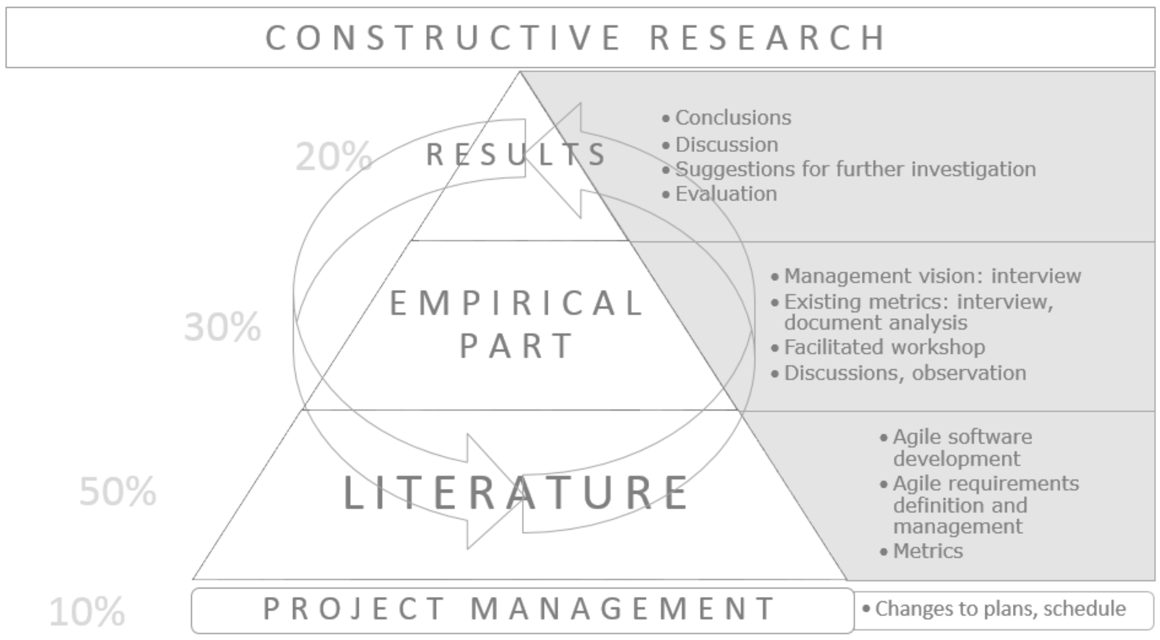

CONSTRUCTIVE RESEARCH
20%
RESULTS
• Conclusions
• Discussion
• Suggestions for further investigation
• Evaluation
30%
EMPIRICAL PART
• Management vision: interview
• Existing metrics: interview, document analysis
• Facilitated workshop
• Discussions, observation
50%
LITERATURE
• Agile software development
• Agile requirements definition and management
• Metrics
10%
PROJECT MANAGEMENT
• Changes to plans, schedule

Figure 4-1 Final thesis process

In addition to very basic theories some very interesting new sources of information were found from both books and articles. Practical knowledge was gained both trough the daily work and the interviews, document analysis and discussions in the target organization. It was interesting to prove the power of knowledge evolving through the discussions.

The question was also broad, which allowed to look the subject from several angles. The amount of the literature around this broad subject was huge. During the research, it was challenging to keep the focus and strike lots of interesting material out. Just when it felt that now everything is picked, always a new clue was found that led to an interesting article and/or book. This was a very challenging part. Especially when it felt that the wheel was continuous, read theory, write about the empirical part and/or have a discussion, get a new idea to be checked from the theory, write about empirical part… It felt that there is no end to the information flow.

Research met its' targets to found the answers to the questions, even if everything did not go as planned. First the approach was changed (Figure 4-2), since the workshop was found to serve the purpose better in the target organization than a survey.

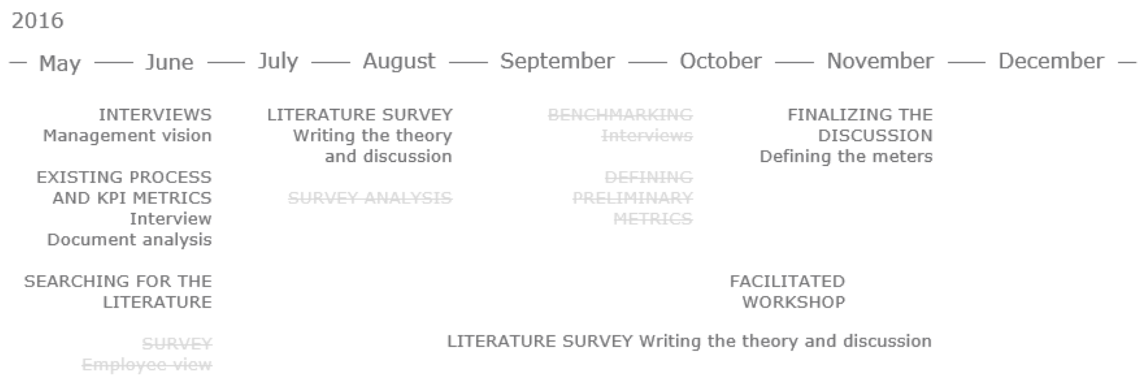

2016
May
June
July
August
September
October
November
December
INTERVIEWS Management vision
EXISTING PROCESS AND KPI METRICS Interview Document analysis
SEARCHING FOR THE LITERATURE
~~SURVEY Employee view~~
LITERATURE SURVEY Writing the theory and discussion
~~SURVEY ANALYSIS~~
~~BENCHMARKING Interviews~~
~~DEFINING PRELIMINARY METRICS~~
FINALIZING THE DISCUSSION Defining the meters
FACILITATED WORKSHOP
LITERATURE SURVEY Writing the theory and discussion

Figure 4-2 Changed research plan

With the workshop the creativity of the whole organization was taken in use and at the same go the information was deployed. The workshop could only be arranged quite late phase of the research and the luck was a little against with the workshop when an accident on local trains delayed the starting of the workshop. Despite all that the workshop encouraged the organization to discuss the subject openly and creatively and lots of new knowledge was generated.

Composing the solutions was challenging, since the RDM is a seamless part of the software development and there are no unambiguous measures available for iterative work that emphasizes even the late change over sticking to the plans. The business strategy, management interviews and the facilitated workshop gave good advice for composition.

In addition to the definition of the metrics, the RDM process picture for the target organization was drawn to make the process tangible and easier to share and describe and possible to set the metrics against to. It is delightful if the picture of Requirements definition and management in target organization (Figure3-12) will help people to develop the process further from here.

Testing and validating the metrics in action was scoped out due to limited schedule.

Theory knitted together this way may help other organizations to familiarize themselves with the subject and set their minds into the metrics and agile requirements definition and management. Other organizations may help the discussion over the RDM metrics helpful if considering the measurements themselves, although the metrics are only in the basic level and to keep in mind that they are not evaluated in action yet.

The research has taught the researcher a lot from both surveying the literature, exploring the target organization and the subjects themselves. Getting to understand the power of the document analysis has been very helpful during this journey. Learning how to run a facilitated workshop was also fascinating. It has also been a privilege to see the knowledge growing during the discussions and the workshop around the subject. Therefore the final conclusion is: read, discuss and share your thoughts to let them grow even better. Measure only to support your goals and do it to motivate and encourage for improvement.

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Appendices

Appendix 1. Summary of the key concepts

Actionable metrics	Provides information that can help you make informed decisions and take corresponding actions. (Croll and Yoskovitz, McDonald, 2015, Chapter 3)
Agile	Nurturing a mindset that enables us to constantly adapt to a rapidly evolving situation and look for more effective ways to solve a problem (Varma. 2015)
Agile Software Development	Agile software development describes a set of principles for software development under which requirements and solutions evolve through the collaborative effort of self-organizing cross-functional teams. (Wikipedia. 2016d.)
Application lifecycle management (ALM)	Application's lifecycle includes the entire time during which an organization is spending money on this asset, from the initial idea to the end of the application's life, even if it often is commonly equated with the software development lifecycle (SDLC). Chappell (2008)
Asset Efficiency Ratios	Gauges how effectively management is using the assets of the firm to drive revenues and profits. These measures are evaluated over time to assess improvement or deterioration in asset utilization. (Reh. 2016a)
DevOps	DevOps (a clipped compound of development and operations) is a culture, movement or practice that emphasizes the collaboration and communication of both software developers and other information-technology (IT) professionals while automating the process of software delivery and infrastructure changes. (Wikipedia. 2016e.)
Exploratory metrics	Helps you discover new insights to ensure that you are solving the right problem. (Croll and Yoskovitz, McDonald, 2015, Chapter 3)
Facilitation	Facilitation is any activity that makes tasks for others easy, or tasks that are assisted. In business and organizational settings facilitation is used to ensure the designing and running of successful meetings and workshops. (Wikipedia. 2016f.)
Financial Leverage Ratios	Help businesses understand the impact of debt on their

	overall financial structure. These ratios help shareholders and stakeholders assess financial risk. (Reh. 2016a)
Financial metrics	Are drawn from accounting measures help management, shareholders and key stakeholders assess an organization's overall financial health at a point in time as well as monitor the improvement or decline in health over a period of time. (Reh. 2016a)
Kanban	Technique for managing a software development process in a highly efficient way. Kanban underpins Toyota's "just-in-time" (JIT) production system. (Peterson. 2109-2015.)
Lagging metrics	Tells what happened in the past and gives you no or very little time to react. (Croll and Yoskovitz, McDonald, 2015, Chapter 3)
Leading metrics	Tries to predict the future and provide the information that you can act on. (Croll and Yoskovitz, McDonald, 2015, Chapter 3)
Lean	Maximizing customer value while minimizing waste. (Lean Enterprise Institute, Inc. 2000-2016.)
Liquidity Ratios	Help businesses monitor their ability to fund operations and pay bills. These metrics are watched closely to ensure the firm can meet its short-term obligations. (Reh. 2016a)
Metrics	A standard for measuring or evaluating something, especially one that uses figures or statistics: new metrics for gauging an organization’s diversity. (Dictionary.com. 2016)
MoSCoW Prioritization	A method to prioritize stories (or other elements) in incremental and iterative approaches. MoSCoW (must have, should have, could have, won’t have) provides a way to reach a common understanding on relative importance of delivering a story or other piece of value in the product. (IIBA, 2015)
Non-financial metrics	Focus on other process, service or quality measurements important to monitoring the organization's health and success. (Reh. 2016a)

Outcome	The change in the organization and changes in the behavior of stakeholders as a result of an IT project. You don’t know what the outcome of your IT project is until you deliver something—the output—and observe how that output impacts the organization and your stakeholders. (McDonald. 2015)
Output	Anything that your team delivers as part of your IT project. This includes software, documentation, processes, and other things that tend to be measured in order to gauge how the project is going. (McDonald. 2015)
Personas	Fictional characters or archetypes that exemplify the way that typical users interact with a product. (IIBA, 2015)
Profitability Ratios	Assess the effectiveness of management in driving earnings from the capital invested in the firm. These numbers are critically important to investors and shareholders. (Reh. 2016a.)
Qualitative metrics	Gives you understanding about your stakeholders and their needs and answers to the question ”What?”. (Croll and Yoskovitz, McDonald, 2015, Chapter 3)
Quantitative data	Is the numbers and statistics tracked and measured, hard numbers but not total insight. (Croll and Yoskovitz, McDonald, 2015, Chapter 3)
Reporting metrics	Are helpful when you know what questions to ask but don’t know the answers. An example of a reporting metric is velocity. (Croll and Yoskovitz, McDonald, 2015, Chapter 3)
Requirement	Requirements are what the software product, of hardware product, or service, or whatever you intend to build, is meant to do and to be. Requirements exist whether you discover them or not, and whether you write them down or not. (Robertson & Robertson 2013, p. 1)
Requirements definition	The process of eliciting, documenting, analyzing, prioritizing and agreeing on requirements. (Murphy. 2010.)
Requirements Management	Controlling, managing and overseeing changes and risk. (Murphy. 2010.)
Software development lifecycle (SDLC)	The systems development life cycle (SDLC) is a conceptual model used in project management that describes

	the stages involved in an information system development project, from an initial feasibility study through maintenance of the completed application. (Search Software Quality. 2009.)
Trust-Ownership model	A model that explores the interrelationship between the amount of trust that the Leader or organizational process has in the Team and the level of ownership and commitment that the Team has to the success of the project or business. (Pixton and others. 2014. Chapter 1.)
Vanity metrics	Are the ones that are easy to measure, easy to manipulate, and do not provide useful information for making decisions or taking actions. (Croll and Yoskovitz, McDonald, 2015, Chapter 3)

Appendix 2. Interview questions

Hi,
Here are the questions for the interview. My research question is 'Measuring the agile requirements management – what to measure and why?'

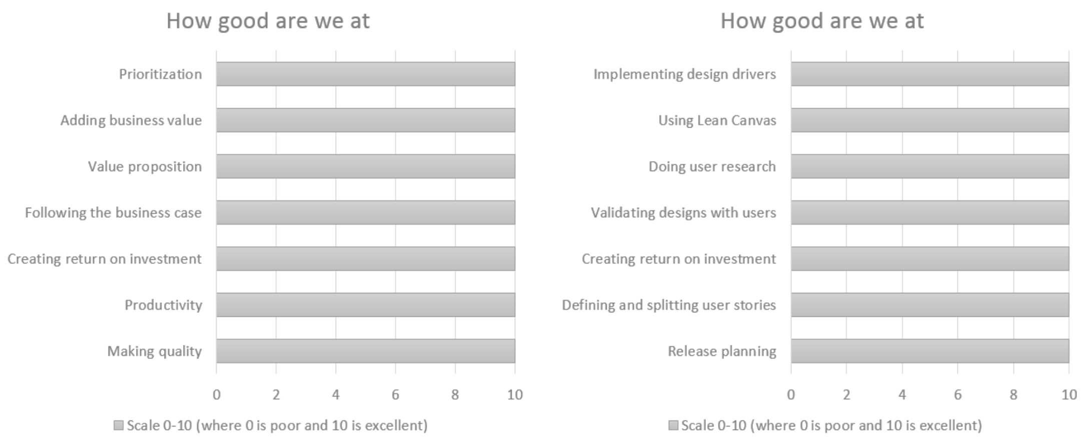
I would like to hear your point of view to these following questions:

1) From your point of view, what is most important in requirements management?
2) What would you want to be measured from requirements management and for what purpose would you use the results?
3) Which methods and/or frameworks should we follow in requirements management now or in the future?
4) Any other tips for me what else should I take into account in this research?

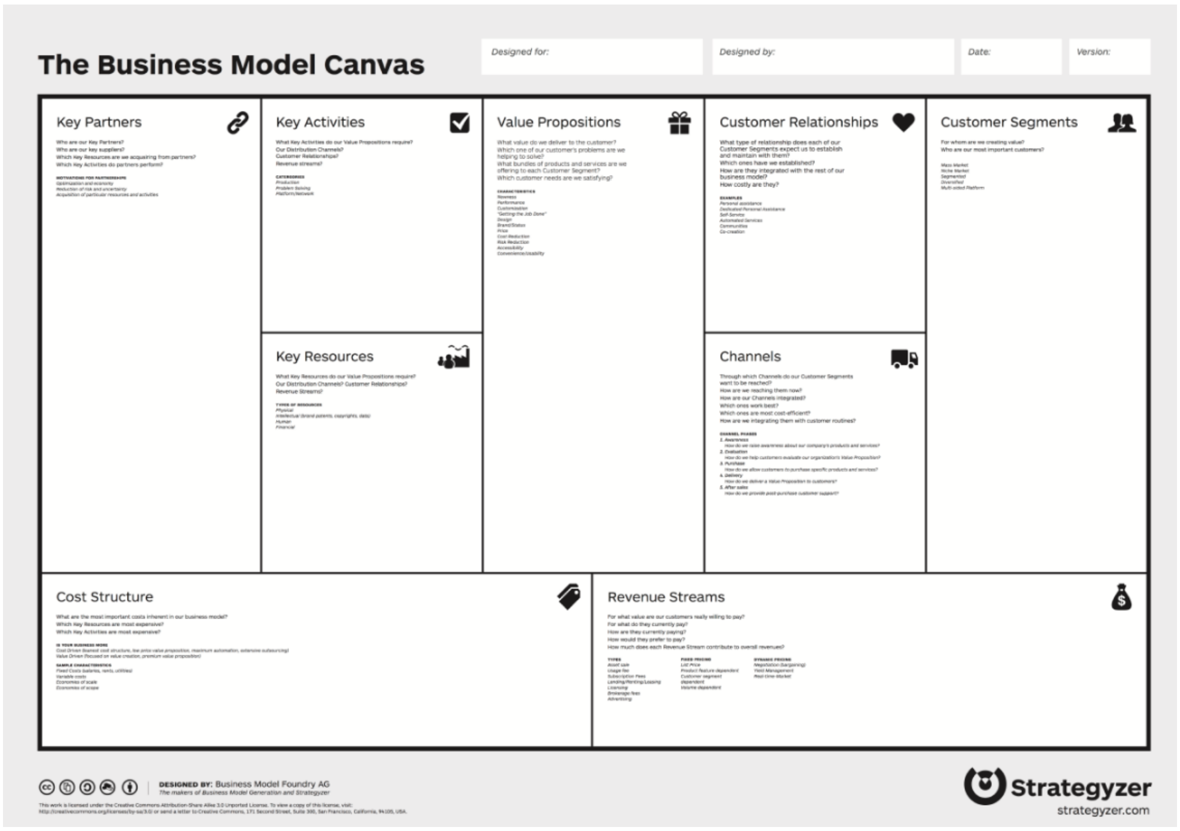
Best regards,
-nina

Appendix 3. Quick survey questions in the workshop

From Requirements Definition and Management point of view:



Appendix4: Business Model Canvas



The Business Model Canvas

Designed for:

Designed by:

Date:

Version:

Key Partners

Who are our Key Partners?
Who are our key suppliers?
Which Key Resources are we acquiring from partners?
Which Key Activities do partners perform?

MOTIVATIONS FOR PARTNERSHIPS
Optimization and economy
Reduction of risk and uncertainty
Acquisition of particular resources and activities

Key Activities

What Key Activities do our Value Propositions require?
Our Distribution Channels?
Customer Relationships?
Revenue streams?

CATEGORIES
Production
Problem Solving
Platform/Network

Key Resources

What Key Resources do our Value Propositions require?
Our Distribution Channels? Customer Relationships?
Revenue Streams?

TYPES OF RESOURCES
Physical
Intellectual (brand patents, copyrights, data)
Human
Financial

Value Propositions

What value do we deliver to the customer?
Which one of our customer's problems are we helping to solve?
What bundles of products and services are we offering to each Customer Segment?
Which customer needs are we satisfying?

CHARACTERISTICS
Newness
Performance
Customization
"Getting the Job Done"
Design
Brand/Status
Price
Cost Reduction
Risk Reduction
Accessibility
Convenience/Usability

Customer Relationships

What type of relationship does each of our Customer Segments expect us to establish and maintain with them?
Which ones have we established?
How are they integrated with the rest of our business model?
How costly are they?

EXAMPLES
Personal assistance
Dedicated Personal Assistance
Self-Service
Automated Services
Communities
Co-creation

Channels

Through which Channels do our Customer Segments want to be reached?
How are we reaching them now?
How are our Channels integrated?
Which ones work best?
Which ones are most cost-efficient?
How are we integrating them with customer routines?

CHANNEL PHASES
1. Awareness
How do we raise awareness about our company's products and services?
2. Evaluation
How do we help customers evaluate our organization's Value Proposition?
3. Purchase
How do we allow customers to purchase specific products and services?
4. Delivery
How do we deliver a Value Proposition to customers?
5. After sales
How do we provide post-purchase customer support?

Customer Segments

For whom are we creating value?
Who are our most important customers?

Mass Market
Niche Market
Segmented
Diversified
Multi-sided Platform

Cost Structure

What are the most important costs inherent in our business model?
Which Key Resources are most expensive?
Which Key Activities are most expensive?

IS YOUR BUSINESS MORE
Cost Driven (leanest cost structure, low price value proposition, maximum automation, extensive outsourcing)
Value Driven (focused on value creation, premium value proposition)

SAMPLE CHARACTERISTICS
Fixed Costs (salaries, rents, utilities)
Variable costs
Economies of scale
Economies of scope

Revenue Streams

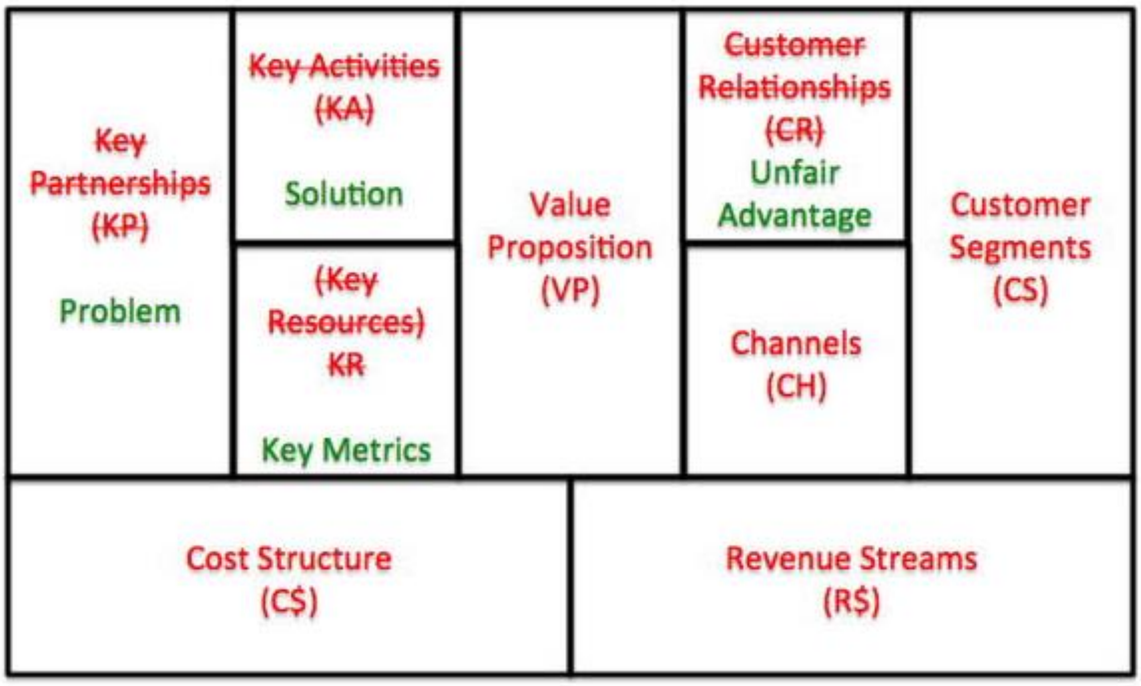
For what value are our customers really willing to pay?
For what do they currently pay?
How are they currently paying?
How would they prefer to pay?
How much does each Revenue Stream contribute to overall revenues?

TYPES	FIXED PRICING	DYNAMIC PRICING
Asset sale	*List Price*	*Negotiation (bargaining)*
Usage fee	*Product feature dependent*	*Yield Management*
Subscription Fees	*Customer segment dependent*	*Real-time-Market*
Lending/Renting/Leasing	*Volume dependent*	
Licensing		
Brokerage fees		
Advertising		

Strategyzer
strategyzer.com

(Wikipedia. 2016c.)

Appendix 5. Lean Canvas



Ash Maurya (Varma. 2015. Chapter3.)

Table of figures