

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE  
HIGHER EDUCATION ESTABLISHMENT  
“UKRAINIAN CATHOLIC UNIVERSITY”

Department of Social Sciences  
Chair of Management and Organizational Development

**Master’s thesis**

entitled: Improve development process in the given product development company

Performed by: 6th year student, group  
STM17/M  
speciality 073 “Management”  
Galushchak Oleh

Supervisor: Chekh Myroslava

Reviewer: Hankevych Andriy

Lviv 2019

## Table of Contents

<b>ABSTRACT</b> .....	<b>4</b>
<b>PROBLEM STATEMENT</b> .....	<b>5</b>
<b>1.1 Company description</b> .....	<b>5</b>
1.1.1 Organizational structure .....	6
1.1.2 Key stakeholders .....	6
1.1.3 SWOT analysis .....	7
1.1.4 Porter's Five Forces .....	8
1.1.5 Engineering processes .....	10
<b>1.2 Identified problems</b> .....	<b>11</b>
<b>1.3 Strategy and discovery</b> .....	<b>15</b>
1.3.1 Market analysis .....	15
1.3.2 Key players .....	20
1.3.3 Competitive analysis .....	21
<b>SUGGESTED SOLUTION</b> .....	<b>25</b>
<b>2.1 Overview</b> .....	<b>25</b>
<b>2.2 Methodology</b> .....	<b>25</b>
<b>2.3 Product development lifecycle and related processes</b> .....	<b>26</b>
<b>2.4 Technical description and tools used</b> .....	<b>29</b>
<b>2.5 Roles and responsibilities</b> .....	<b>31</b>
<b>2.6 Finance</b> .....	<b>32</b>
<b>2.7 Stakeholder management</b> .....	<b>34</b>
<b>2.8 Risks and constraints</b> .....	<b>35</b>
<b>2.9 Implementation strategy</b> .....	<b>36</b>

<b>2.10 Business model</b> .....	<b>38</b>
<b>CONCLUSIONS</b> .....	<b>41</b>
<b>3.1 Managerial conclusions</b> .....	<b>41</b>
3.1.1 Approach to offshore consulting.....	43
<b>3.3 Further steps</b> .....	<b>44</b>
<b>3.4 Learning conclusions</b> .....	<b>45</b>
<b>References</b> .....	<b>47</b>
<b>ADDENDUMS</b> .....	<b>50</b>
<b>Addendum 1 - Customer reported defects - running total and average cycle time</b> .....	<b>50</b>
<b>Addendum 2 - Example of the dashboard</b> .....	<b>51</b>
<b>Addendum 3 - Release statistics</b> .....	<b>52</b>
<b>Addendum 4 - Average release duration</b> .....	<b>53</b>
<b>Addendum 5 - Quality reports</b> .....	<b>54</b>

## **ABSTRACT**

This thesis paper summarizes the consultancy project that I am leading for the US product development company. As the part of the consultancy we have thoroughly analyzed the company and the market where it operates. Thesis describes how a host of process-related issues that led to gradual loss of customers and thus promoted company to act. Competitive analysis systematizes challenges of faced by competitors developed a list of common approaches to their resolution. Thesis describes suggested solution and unfolds various aspects of project implementation including suggested changes, financial data, risks and many others.

The described project led to significant changes in the company and already brought the first results. The last section describes those outcomes of the project and conclusions made in the process of consultancy.

# **SECTION 1**

## **PROBLEM STATEMENT**

### **1.1 Company description**

This project is done for US-based software development company. Due to strict NDA and company policies it is not possible to disclose the company name, so further in this work it will be called just “company” or “consulted company”.

Company has been founded a decade ago and operates on video conferencing market from the moment of its foundation. It is still privately owned and funded by venture capital. At the moment there are no plans to go for initial public offering (IPO). Being one of the pioneers in the industry company had a significant influence on video conferencing.

The company focuses on selling to enterprise customers, especially those that are operating in the financial and healthcare industries. Such focus is reasoned by the fact that enterprise customers are oriented towards long-term usage of selected software due to high costs of introduction of the software and high costs of employees training. This is especially true for financial and healthcare industries where adoption of new software can cost 10x in comparing to software cost. Speaking about the geography of sales we can clearly see that the company is a global player, which sells to customers all over the globe.

At the current moment company employees around 300 employees located in multiple countries with major centers in US and eastern Europe. Among them there are around 100 employees working in Engineering, who are responsible for the development and engineering support of all products.

Attitude towards distributed teams and remote work vary significantly from department to department. For example, Engineering is centered around one location in US and one location in Ukraine. At the same time, customer support is widely distributed between multiple locations.

Over the course of its existence, the company accumulated a very significant amount of intellectual property (IP) and patents, which are one of the competitive

advantages comparing to other players. So some employees who own the knowledge are themselves the key asset of the company.

Let's analyze the company from various perspectives in the next sections.

### 1.1.1 Organizational structure

The organizational structure is a typical for such companies, it is hierarchical with employees divided by departments.

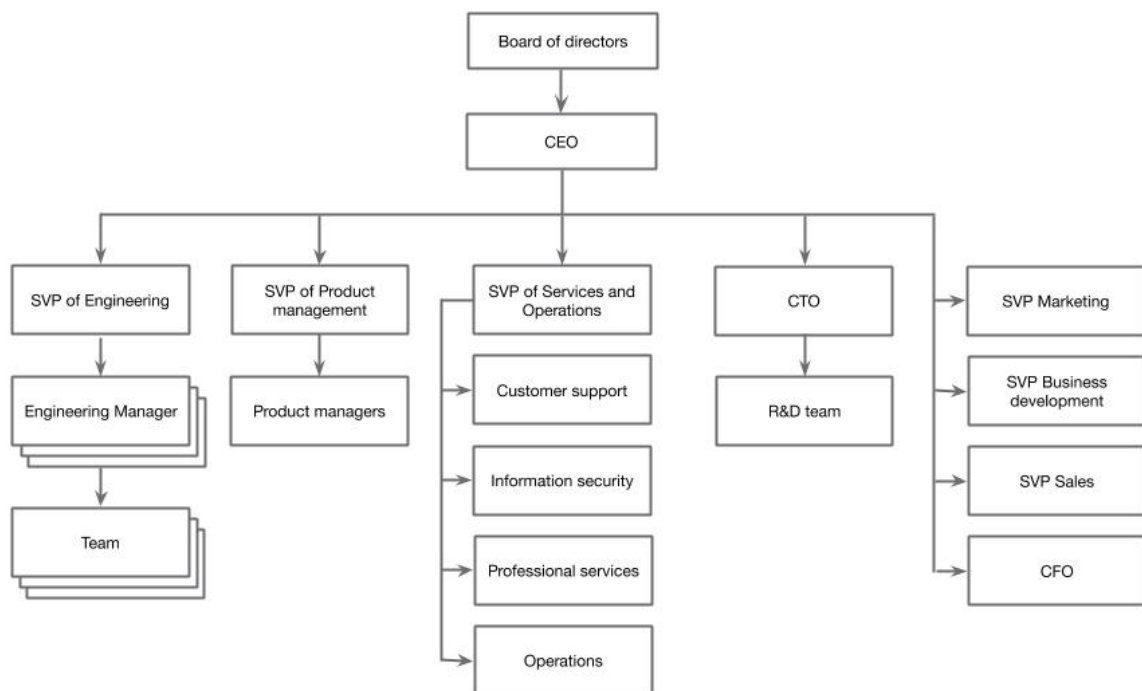


Image 1.1 - Company organizational structure

Engineering, in turn, is divided into project teams. Each team is responsible for development and support of one or more products.

### 1.1.2 Key stakeholders

Before the transformation initiative started, we had built a stakeholder register, which is partially shown in the table below. The stakeholder register helped us to find an approach to different stakeholders and thus to increase the chance of overall success. In Solution section there are described approaches that we selected to manage those stakeholders.

<b>Position</b>	<b>Role</b>	<b>Interest</b>	<b>Power</b>
CEO	Approver	High	High
CTO	Informed	Medium	Medium
CFO	Informed	Low	High
SVP of Engineering	Accountable	High	High
SVP of Sales, SVP of Bis Dev, SVP of Marketing	Consulted	Medium	Low
SVP of Services and Operations	Consulted	Low	Low
Engineering managers and Product Managers	Consulted	Low	Low

Table 1.1 Stakeholder register

### **1.1.3 SWOT analysis**

Based on the information provided in previous sections and on findings made during the course of cooperation with the company we performed a SWOT analysis.

<b>Strengths</b>	<b>Opportunities</b>
<ul style="list-style-type: none"> <li>● Significant amount of IP and patents accumulated</li> <li>● IP enables top quality, reliability and load handling</li> <li>● Customers have a high cost of switching to a competitor</li> <li>● The high lifetime cost of each customer</li> </ul>	<ul style="list-style-type: none"> <li>● Recognizable brand</li> <li>● Deep industry expertise</li> </ul>
<b>Weaknesses</b>	<b>Threads</b>
<ul style="list-style-type: none"> <li>● Multiple products leading to a loss of focus</li> <li>● Partially outdated stack of technologies</li> <li>● Engineering management is focused more on tech aspects, but not on strategic aspects or process improvements</li> </ul>	<ul style="list-style-type: none"> <li>● Competition from open source</li> <li>● Competitors focusing on specific audiences and use cases</li> <li>● Future shifts in customer expectations</li> </ul>

Table 1.2 SWOT analysis

#### 1.1.4 Porter's Five Forces

Let's review another aspect - the competitiveness of the business through Porter's Five Forces analysis. This analysis supplemented the overview of the company and summarized information important for described consulting initiative.



	<p><b>Treat of new entry - low:</b></p> <ul style="list-style-type: none"> <li>- requires significant investment and domain knowledge</li> <li>- treat from open source</li> </ul>	
<p><b>Supplier power - medium:</b></p> <ul style="list-style-type: none"> <li>- small number of suppliers</li> <li>- suppliers are replaceable</li> </ul>	<p><b>Competitive Rivalry - high:</b></p> <ul style="list-style-type: none"> <li>- significant competition</li> <li>- multiple top tech companies compete on this market</li> </ul>	<p><b>Buyer Power - high:</b></p> <ul style="list-style-type: none"> <li>- low brand loyalty</li> <li>- ability to pick between multiple brands with similar functionality</li> <li>- low chance of switch of existing customer due to complicated technical and training processes</li> </ul>
	<p><b>Threat of Substitution - high:</b></p> <ul style="list-style-type: none"> <li>- there are multiple other products with similar functionality or even better feature sets</li> <li>- high cost of switching</li> <li>- high quality and reliability of company's solution</li> </ul>	

Image 1.6 Porter's Five Forces for video conferencing market

We may clearly see that Competitive Rivalry is high on the market. This is an important factor that contributes to challenges described in the section “Identified problems”. Competitive Rivalry is high since there are multiple offering that propose everything from ready to use applications to powerful communication platforms. The competition is worthen since there are multiple top tech companies competing for video conferencing market. Those companies may allocate significant costs to develop their products. This situation is directly linked to the high threat of substitution, since on the

market there are multiple products with similar functionality. This thread is somewhat counterbalanced by the high switching cost, especially in targeted verticals of healthcare and finance, and by reliability of products developed by consulted company.

On the other 'dimension' there are supplier power and buyer power. We see that supplier power varies depending on supplier type with engineering suppliers having bigger influence and negotiation power. This is since they are tightly involvement into product development thus much harder to replace. On the other hand no core process is outsourced, so with certain amount of costs each supplier may be replaced.

Buyer Power is one more key factor that leads to challenges of involvement of new customers as outlined in further sections. It is especially high during the first purchase, which results in reduced profit margins. Multiple vendors offer similar services and sets of functionalities, thus providing at least few suitable options for even the most demanding customer. However, buyer power is getting smaller as it goes in the cooperation with selected vendor due to high cost of switching, especially in verticals of healthcare and finance where consulted company is focused. Thanks to this fact consulted company manages to retain most of existing customer base.

### **1.1.5 Engineering processes**

In order to discuss Engineering processes changed during described consultancy it is necessary to describe how did they emerge.

Until 2017 engineering has been following quite loose set of practices, which greatly varied between teams and lead to almost guaranteed misses of release dates or compromises around scope. This clearly visible in Addendum #3 looking on the statistics for 2017. In order to address the issue company invited set of consultants and instituted a new role - Process manager, who have been responsible for ensuring compliance with the new process and for improvement of it based on emerging needs. As the result in late 2017 have been introduced quite rigid processes with waterfall-like product development lifecycle (PDLC) and software development life cycle (SDLC). The key aspect has been establishment of the practice that team prepared

detailed project plan and then was responsible for its execution. Such change had rather positive outcomes leading to more visibility and increase of percentage of releases delivered on time.

The most notable downside of the process was significant amount of time that have been spent to prepare artifacts. This resulted in the problem - teams had downtime between delivery of the one release and start of the development of the next one. This time was spent to plan the upcoming release, while majority of the team has been idle. All efforts to parallel development of the one release and planning of the next one failed. Major reason behind failure was the sheer size of releases - both final stabilization and planning were too big to coexist. However, teams significantly matured by following rigid PDLC during 2018, thus were considered to ready for more flexible approaches.

## 1.2 Identified problems

Around summer 2018 it was becoming clear that there is a need for significant changes in the way how company operates. We received ‘signals’ and direct calls for improvement from various sources: customers, Sales and Bis. Dev, Engineering members.

The major signal was dynamics of paid user accounts in 2018. Around mid-summer it was clear that total amount of paid accounts will drop by 4-5% during the year. Below is the table that shows dynamics for past 5 years.

Financial year	Paid user account
2014	+9%
2015	+7%
2016	+3%
2017	-1%
2018	-5%

Table 1.3 Dynamics of paid user account

Statistics and forecast pushed CEO, SVP Sales, and SVP of Bis Dev to initiate a discussion that there is a challenge with customers leaving for competitors and not enough new customer joining.

To analyze what is important for customers we together with Product management team discussed customer preferences and analyzed available feedbacks of customers who left for competitors. Here is a summary of reasons why customers were leaving:

- Cost - 40%
- Feature set / user experience - 50%
- Other reasons - 10%

As the result we clearly saw a need to build more effective processes to reduce cost and a correlation between features available and retention of customers.

In order to double check on the importance of feature set we analyzed behavior and attitude of existing customers. Based on available statistical data we found the following distribution of attitude towards new features:

- Reluctant to upgrade - 10-20%.
- Waiting for a specific feature - 70-85%.
- Willing to upgrade ASAP - 5-10%.

There are multiple complex factors behind each such decision that include industry and installation type, cloud or on-prem, etc., but gathered figures still provided a valuable insight in the attitude of the majority of customers.

So, Engineering stepped in to propose improvements. This has led to an effort to structure available information and collect missing pieces about major challenges which were influencing product development branch of the company and related departments.

Engineering already had a collection of requests for process improvement - Engineering process improvement backlog. It has been maintained since Engineering management and Process management group had a practice of collection of the information to continuously tailor processes according to business needs. All suggested changes were collected and stored in the common backlog. They were reviewed on

weekly Engineering leadership meetings and periodically some of them led to initiatives to change certain tools and processes. Based on this backlog in the second half of 2018 it was clear that there is a need for more systematic changes.

To supplement available information and verify necessity to improve Engineering management practices we checked the following:

- Quality metrics of measured both during projects execution and upon completion for active projects at that moment
- Historical data about quality and schedule performances
- Customer reported issues
- Customers’ feedbacks about both beta and release versions

Findings were supplemented by the results of the Employee Engagement survey, which we conducted among all members of Engineering teams in October 2018. The survey focused on 5 areas: engagement, role, processes, management & team, and company. There were both open questions and closed questions. Open questions were aimed to determine motivation and improvement areas. Closed questions provided a choice of experiencing levels of agreement or disagreement with each of them.

The result of the Engagement Survey has been very positive showing overall satisfaction of 90%, which is shown in the table below.

<b>Section</b>	<b>Average Score</b>
Role	97%
Processes	70%
Management and Team	99%
Company	95%
<b>Total</b>	<b>90%</b>

Table 1.4 Employees Engagement Survey results

There is a notable gap in the “Processes” section. We analyzed related information available in the survey including comments and accounted it while collecting further feedback and developing the plan of actions.

Findings discovered via means described above were kept in writing using Confluence knowledge management system and Google docs. We performed the root cause analysis [1] and “5 Whys” [2] to make that we are addressing the real root cause and that solution will fix problem not symptoms. Also, for each issue we asked ourselves “will this issue be important in the long term?”, this helped us to focus on topics important for the future, rather than on fire fighting. Based on gathered information and discussions with key decision makers similar issues were merged and the list has been prioritized. Table below shows the most important issues which were selected to be addressed.

<b>Group</b>	<b>Issue</b>	<b>Source</b>	<b>Import ance</b>
Related to value delivered	Long time to wait for the next release	Feedback from Sales, Bis. Dev, C-level	High
	The business expects that more features will be delivered each year	Feedback from Sales, Bis. Dev, C-level	High
	Not enough predictability of when a certain feature will be released	Feedback from Product Management and Sales	Medium
Related to Engineering management practices	Quality of some releases does not meet defined standards	Engineering metrics, customer-reported defects, customers’ feedback	High
	Project management	Engineering metrics,	Medium

	practices are not aligned between teams	observations, Engagement survey, process improvement survey	
	The release schedule is not aligned between related system parts	Observations and historical data	Low

Table 1.5 List of identified challenges as suggested by customers, business leaders and employees

### 1.3 Strategy and discovery

#### 1.3.1 Market analysis

We, humans, are extremely visual in our nature. We need visual communication to establishing rapport and trust. Our learning is greatly influenced by images. As the result, video communication tools have a long history. But only now, due to improvements in those solutions become more and more reliable and affordable.

The video conferencing market is propelled by the rise in globalization [3]. Globalization leads to closer relations between the countries, so companies are expanding to tap into foreign markets. At the same time, corporations are relocating their workplaces to offshore locations to take advantage of the availability of necessary resources and lower wages. All of this leads to a need in a collaborative communication approach [4].

As established by Gartner research [5] “Global survey of 333 executives found that a full 92% of them believe that expanded use of video conferencing has a positive impact on their performance. The impact is so strong that 80% of executives now say that relative to audio conferencing, video conferencing is fast becoming the norm for internal teams – with 84% saying the same for collaboration with external stakeholders.”

According to mentioned Gartner research [5] respondents say video conferencing improves outcomes across a range of productivity-enhancing measures, which may be seen on the image below.

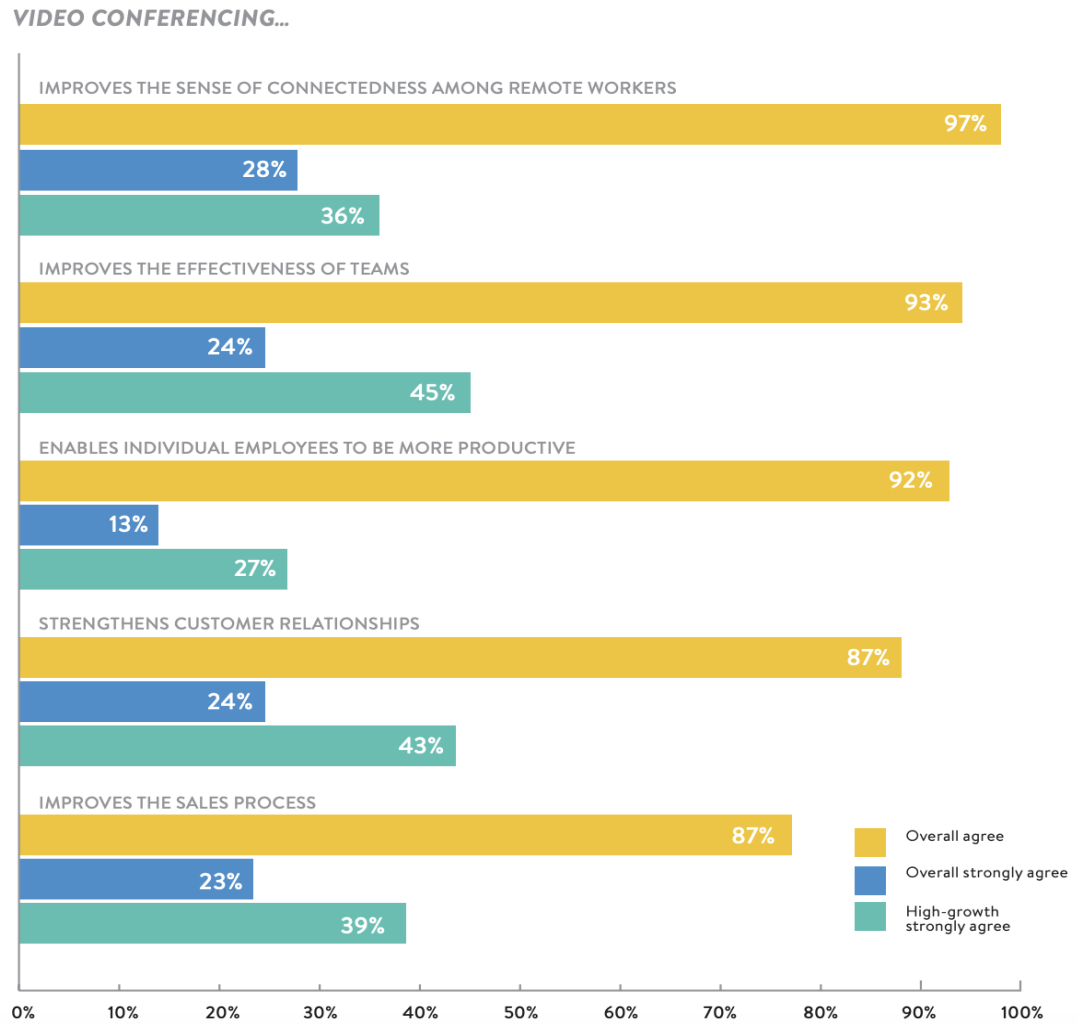


Image 1.4. Video conferencing drives productivity, from Gartner research [5]

The important aspect is an opportunity to build communications lines between multiple offices without incurring a huge capital expenditure [6]. Over the last decade price of the video conferencing products continuously reduced, thus driving the growth in the conferencing market [3]. In turn lower cost is a major factor promoting the adoption of the video conferencing solutions. Maintenance of traditional communications solutions and infrastructure are becoming very complex and costly in the current world of rapidly changing market conditions. So, companies are rapidly adopting cloud solutions to handle their communication needs in a cost-effective



manner. Such cloud solutions significantly reduce the upfront expenses since they are now transferred to service providers.

Most reports are predicting similar dynamics that expected CAGR around 10% and that Video Conferencing Market size is set to exceed USD 20 billion by 2024 [3] [6] [7].

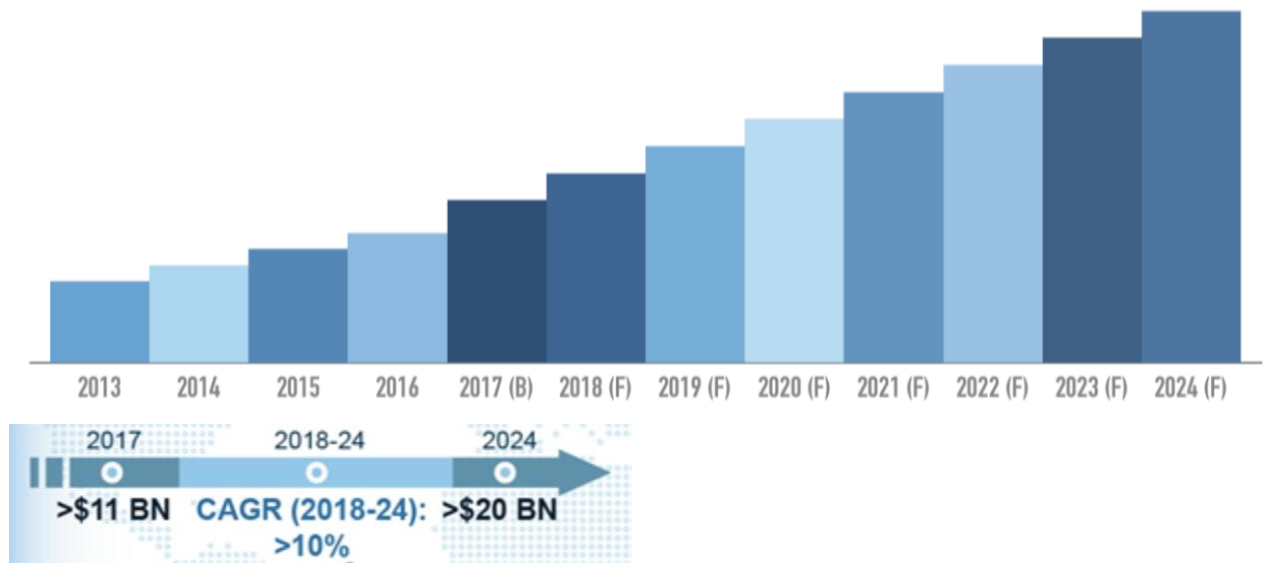


Image 1.3 Predicted growth of video conferencing market (graph is taken from the report [3])

There are 3 major components of the market: software, hardware and services. All of them are predicted to grow significantly in the next 5 years, where the software has the highest predicted CAGR of more than 14% [8]. The consulted company has the majority of products in the software segment, so this is definitely a positive sign.

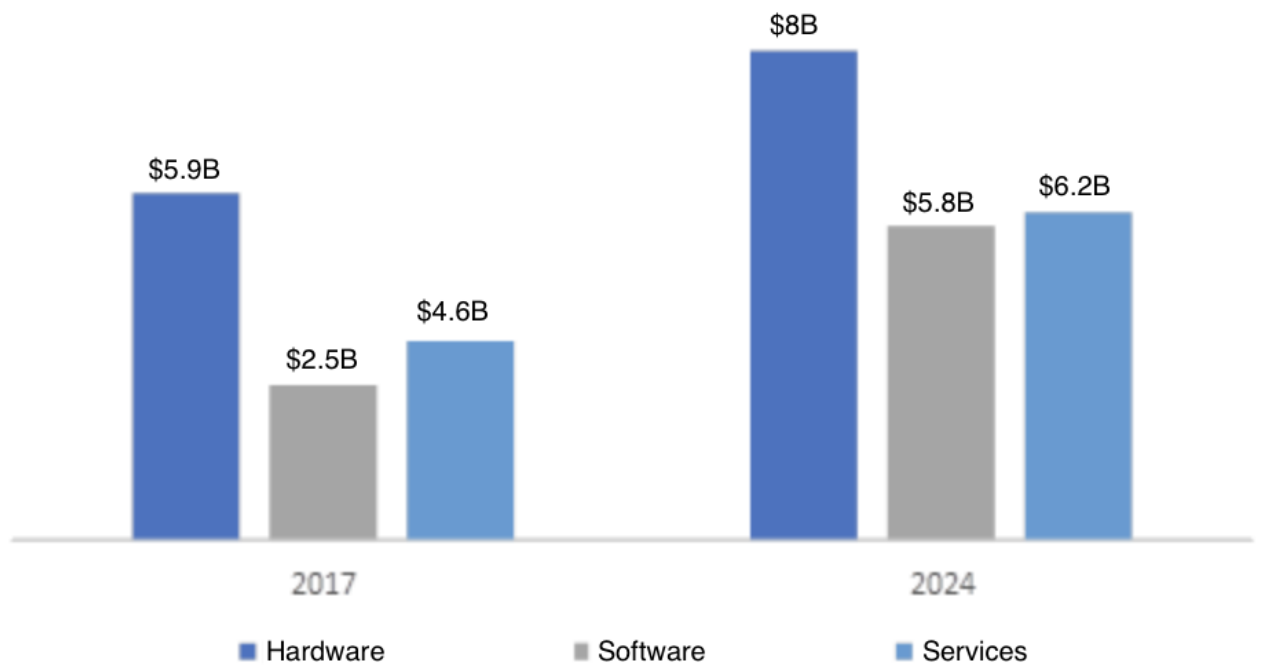


Image 1.4 U.S. Video Conferencing Market Revenue by Component, 2017 & 2024, (USD Million), (graph is taken from the report [3])

The other interesting point of view on the market is Impact forces analysis which is depicted on the image below.

The major factor is the growing demand for unified communication solutions among the industry verticals. Since more and more organizations become global, establishment and maintenance of communication channels become exponentially more challenging, which require huge budgets to purchase and maintain hardware and network equipment.

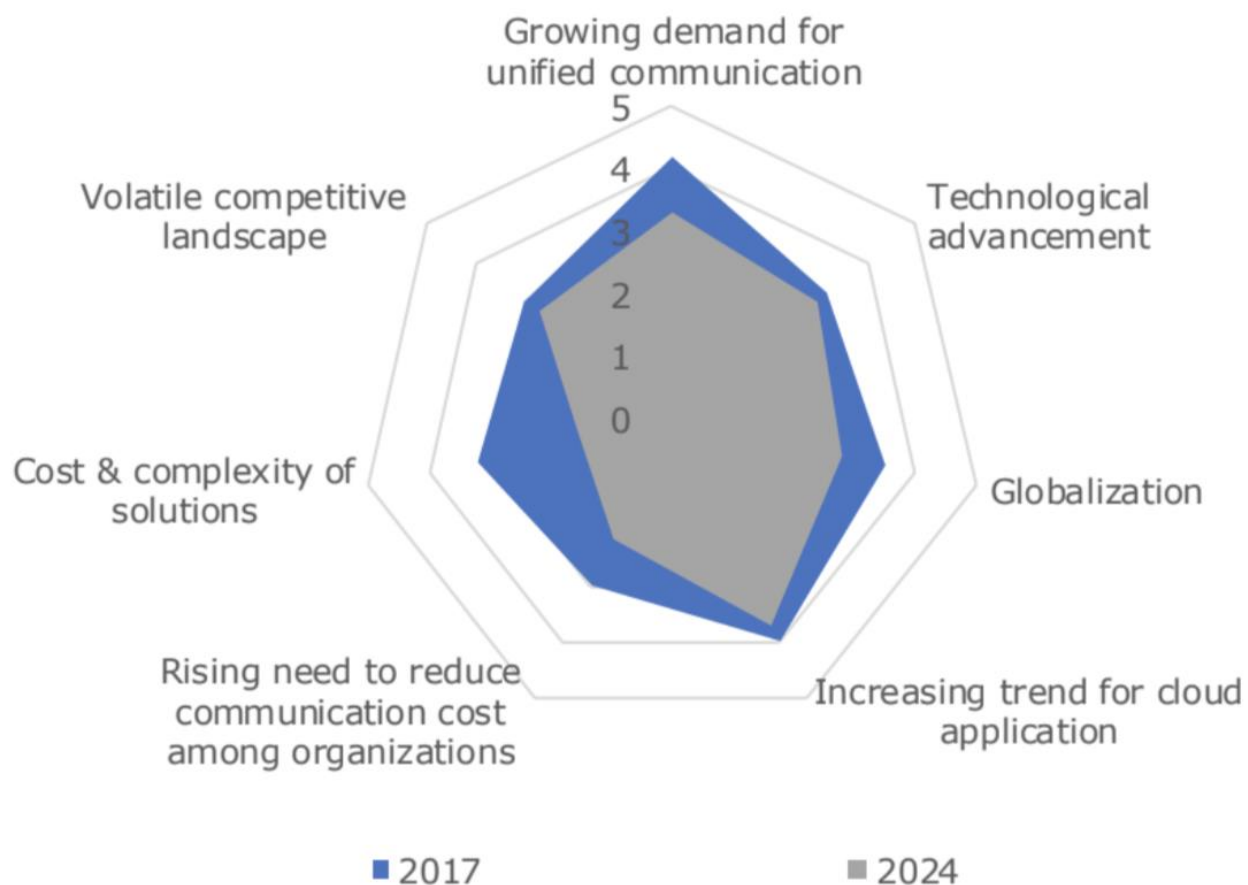


Image 1.5 Impact forces analysis

What is more there is a need to assign engineers responsible for each specific media and tool used in each company location. At the same time unified communication solutions are configured and controlled centrally. So, such implementations lead to significant cost savings.

Rising need to reduce communication costs is also a major reason to implement video conferencing, since it is much more cost-effective option comparing to traditional means of communication. This in turn is boosted by adoption of cloud to further reduce costs. Cloud is an attractive option since it significantly reduces upfront costs and distributes costs over long period of time.

At the same time based on Impact forces analysis we may see that complexity of solutions is expected to much less a challenge with the evolution of cloud and hardware.

Speaking about users of video conferencing we should note that it is widely used by corporate enterprises, educational institutions, government establishments, and

healthcare organizations. As noted earlier the consulted company focuses on healthcare and financial domains. Video conferencing in financial services is expected to have a growth rate equal to industry average, where the healthcare market has expected CAGR of 15% over the next 5 years thanks to the wide adoption of mHealth and Telemedicine across the globe [3].

Overall market growth prediction looks very positive for the consulted company.

### 1.3.2 Key players

The video conferencing market is fragmented and volatile due to the presence of a large number of players. According to reports [8] [9] major players of the market are listed in the table below. For many companies in the list it is not possible to determine revenue they receive from video conferencing market, so table contains total company revenue for 2018 financial year, however list is sorted by perceived market share according to multiple reports including [8] [9].

Company	Company revenue
Cisco Corporation	\$50.8B
Polycom Inc.	\$1.2B
Huawei Technologies Co. Ltd.	\$100B
Microsoft Corporation	\$122B
Avaya Inc.	\$3.2B
Zoom Video Communication Inc.	\$269.5M
Adobe Systems Inc.	\$9B
BlueJeans Network	\$100M
Google Inc.	\$136.2B
Vidyo Inc.	\$25M

Logitech International	\$3B
LogMeIn Inc.	\$1.2B
Amazon.com, Inc.	\$1.2B

Table 1.6 - Major player of video conferencing market.

### 1.3.3 Competitive analysis

Further analysis has been conducted to find what issues are faced by major players of the industry.

We started with studies characterizing general telecom challenges. According to Ernst & Young’s “Digital transformation for 2020 and beyond, a global telecommunications study” [10] and Bain & Company’s “Simplify to Grow in Telecommunications” [11] studies the list of industry challenges is topped by the following:

- Process:
  - Rigid governance and organization
  - Complex manual processes
- Competition:
  - Disruptive competition
  - Changing customer needs and attitudes
  - Complex product offering
- Tech:
  - Shortening technology cycles
  - Presence of legacy technologies

According to mentioned studies those challenges led to the following strategic priorities:

- Improvement of customer experience
- Adoption of digital business models and services
- Increase of business efficiencies
- Improvement of systems and processes

- Increase of organizational agility
- Product simplification

We could clearly see that challenges related to processes correlate with challenges faced by consulted company, which are described in the section “Identified problems”. What is more, by improving processes Engineering could influence other two groups: competition and tech. As stated in Ernst & Young’s research [10] all those areas are tightly connected: “Overall, what comes across loud and clear is a symbiotic relationship among digital business models, customer experience, and efficiency and agility gains. Only by harnessing these related objectives as part of a common purpose do operators see themselves unlocking the full benefits of their transformation agenda.”

Then we analyzed whether major market players were facing same process-related issues and how did their engineering branches address them. This has been done through research of open sources and publications as well as by reaching directly to company representatives. Below are few highlights of what has been discovered.

The leader of the market Cisco used to follow the waterfall but started to look for a new approach. Here what an SVP of Cisco said “Waterfall worked reasonably well, but had some drawbacks. With a big, long development cycle and a big, long testing cycle it wasn’t very efficient. If we found something late in the test cycle it was hard to go back to the start and make changes.” [12]. So, Cisco decided to try an Agile. They started it with one team, then gradually expanded to the entire Cisco’s Development Organization. Further steps included the adoption of Scaled Agile Framework (SAFE) [13]. SAFE led to significant improvements including:

- 40% decrease in critical and major defects
- Improved employee satisfaction by eliminating the need for after-hours work and reducing meetings/calls
- 25% fewer quality assurance defects

Another big player, Adobe, also felt disadvantages of waterfall model including spikes in bug creation close to release, high cost of fixing each bug, need of overtimes. By applying the Agile Scrum Adobe addressed all those issues [14].

Companies fully focused on the video conferencing market also went through similar transformations. There is a great story how Zoom transferred to streamlined and agile processes which helped to reach unprecedented customer satisfaction scores [24]. Another important player of video conferencing market - Avaya maximized business value by using Scrum according to article [25].

In the table below, there is a summary of findings of software development methodologies used by all mentioned major players of video conferencing market.

<b>Company</b>	<b>Software development methodology</b>
Cisco Corporation	Agile
Polycom Inc.	Agile: Scrum
Huawei Technologies Co. Ltd.	Agile: LESS
Microsoft Corporation	Agile
Avaya Inc.	Agile: Scrum
Zoom Video Communication Inc.	N/A
Adobe Systems Inc.	Agile: Scrum, SAFE
BlueJeans Network	N/A
Google Inc.	Agile
Vidyo Inc.	Agile: Scrum
Logitech International	Agile
LogMeIn Inc.	Agile
Amazon.com, Inc.	Agile

Table 1.7 - Software development methodology used by companies on the video conferencing market.

We can see overwhelming presence of Agile and clear lead of Scrum among Agile frameworks. Based on our findings we concluded that there is a strong

correlation between adoption of Agile and improvement of in the company performance in the modern times.



## **SECTION 2**

### **SUGGESTED SOLUTION**

#### **2.1 Overview**

Based on all collected data we crafted a suggested solution, which consisted of four major areas:

1. Software development methodology - adoption of Agile.
2. Processes - redevelopment based on Agile principles. This includes:
  - a. significant modification of processes followed by Product teams;
  - b. partial modification of processes of related departments (Operations, Support, etc.);
  - c. streamlining of existing reporting and tracking approaches.
3. Tools:
  - a. focus on unification and integration of existing tools;
  - b. introduction of new tools where necessary.
4. Roles and responsibilities - review and partial modification to match new Software development life cycle (SDLC)

In sections below there are details and reasoning behind proposed changes.

#### **2.2 Methodology**

The first important step was to decide whether identified challenges may be overcome with existing waterfall-based processes (described in Section “Engineering processes”). Based on interviews of multiple key employees it became quickly obvious that existing processes were not able to fulfill new needs. The most common feedbacks included:

- Development of each version lasted from three to six months and it was almost impossible to shorten it. Major reasons were complex planning process and lengthy testing process. Both factors encouraged and rewarded planning for longer periods.
- There was a need in lengthy planning process of each new version development that often took few weeks to complete. This has happened

mostly due to multiple approvals, artifacts and documents necessary to obtain permission to start.

- Not sufficient quality of some releases.
- Schedule misses caused by uncertainty summing up over long development periods.

The most disturbing fact was that those factors amplified each other.

Another proof that waterfall processes were not suitable for company purposes is the result of analysis of experience of other companies in the industry which is described in the section “Competitive analysis”. The same analysis clearly suggested Agile methods and Scrum in particular as a proper methodology for software development industry and in particular for video conferencing. So we selected the Scrum [15] as foundation of our software development methodology.

### **2.3 Product development lifecycle and related processes**

Using our experience, we clearly understood that selecting a proper methodology is just the first step to solve our challenges. In order to deliver proper change, we needed to update product development lifecycle (PDLC) too to make sure that all stages from ideation to product support are tuned to fit new vision.

We carefully reviewed existing scaled Agile frameworks including Large Scale Scrum (LeSS) [16], Scaled Agile Framework (SAFE) [17] and Nexus Framework [18]. Going with existing framework definitely has its benefits since those frameworks are well established and well-tried. On the other hand, any of them is too general, it will have unnecessary parts and will miss to cover something important. After analysis and discussions with key stakeholders it was decided to develop a custom PDLC borrowing some concepts from SAFE.

We split our PDLC and related processes and tools into 4 layers:

- Roadmap layer - for planning for the long term.
- Requirements layer - detailed elaboration of what should be done.
- Development layer - implementation of software product.

- Production layer - everything needed to deliver implemented functionality to customers and to keep it operational.

Image 2.1 displays key processes, responsibilities and metrics for each layer of PDLC.

<b>Roadmap Layer</b>	<b>Responsible:</b> Product Manager <b>Participants:</b> Sales, PMs, Eng. Manager	<div style="background-color: #f4b084; padding: 10px; border: 1px solid black; margin: 0 auto; width: 80%;">           Definition, Impact Assessment, Prioritization         </div>	<b>Key metrics:</b> <ul style="list-style-type: none"> <li>● # of incoming and processed requests, their correlation</li> <li>● Median Time-to-Process</li> </ul>
<b>Requirements Layer</b>	<b>Responsible:</b> Product Manager <b>Participants:</b> PM, Eng. Manager, UX team, Dev team	<div style="background-color: #90c17e; padding: 10px; border: 1px solid black; margin: 0 auto; width: 80%;">           FRD &amp; UX, Feature design, Test design, Estimation         </div>	<b>Key metrics:</b> <ul style="list-style-type: none"> <li>● # of incoming and processed requests, their correlation</li> <li>● Median Time-to-Ready</li> </ul>
<b>Development Layer</b>	<b>Responsible:</b> Eng. Manager <b>Participants:</b> Dev Team, Eng. Manager, UX team	<div style="background-color: #4a90e2; padding: 10px; border: 1px solid black; margin: 0 auto; width: 80%;">           Development and testing         </div>	<b>Key metrics:</b> <ul style="list-style-type: none"> <li>● Velocity</li> <li>● Features delivered vs features committed</li> <li>● Quality metrics</li> </ul>
<b>Production Layer</b>	<b>Responsible &amp; Participants:</b> Operations, Professional Services, Customer Support, Dev Team, Eng. Manager,	<div style="background-color: #34495e; padding: 10px; border: 1px solid black; margin: 0 auto; width: 80%;">           Pen Testing, Deployment, Branding, Customers Support         </div>	<b>Key metrics:</b> <ul style="list-style-type: none"> <li>● # of incoming CFDs</li> <li>● Open vs resolved CFDs</li> </ul>

Image 2.1 Four layers of developed PDLC

The next important concept was selection of cadence. In this case cadence means “the use of a regular, predictive development rhythm, while synchronization causes multiple, potentially dependent events to happen at the same time” [17]. Based on the different nature of each product we decided to allow different length of the cadence from one month to three months with an important stipulation - each had to be aliquot to one month. For this purpose, we predefined date at the end of each month at which team could push developed new version of the product to be released.

In order for cadence to properly function we had to make sure that all stakeholders on all steps of PDLC are aligned. For this purpose, we developed a set of

meetings with dial purpose: fasten transition of business requirements through PDLC and act as synchronization points. Image 2.2 depicts key meetings:

- Feature planning - review roadmap, update priorities and consider dependencies.
- Stories Grooming - review defined requirements and mock-ups of user interface, clarify questions and share feedback between product owner and team.
- Commitment - lock of the scope and resources for the cadence to deliver new software version.
- Final Acceptance - confirmation that team has reached committed goals.
- Delivery - push of the new version to production.

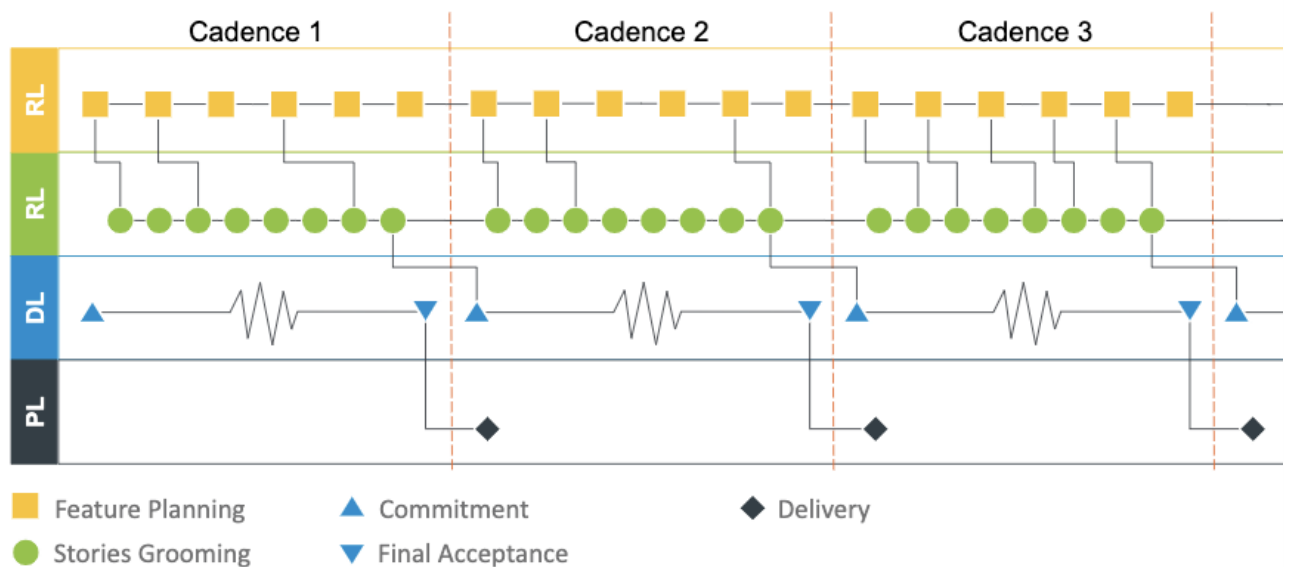


Image 2.2 Key meetings of PDLC

On the Development Layer the cadence encompasses all typical Scrum processes as well as processes specific for our custom-build process (image 2.3).

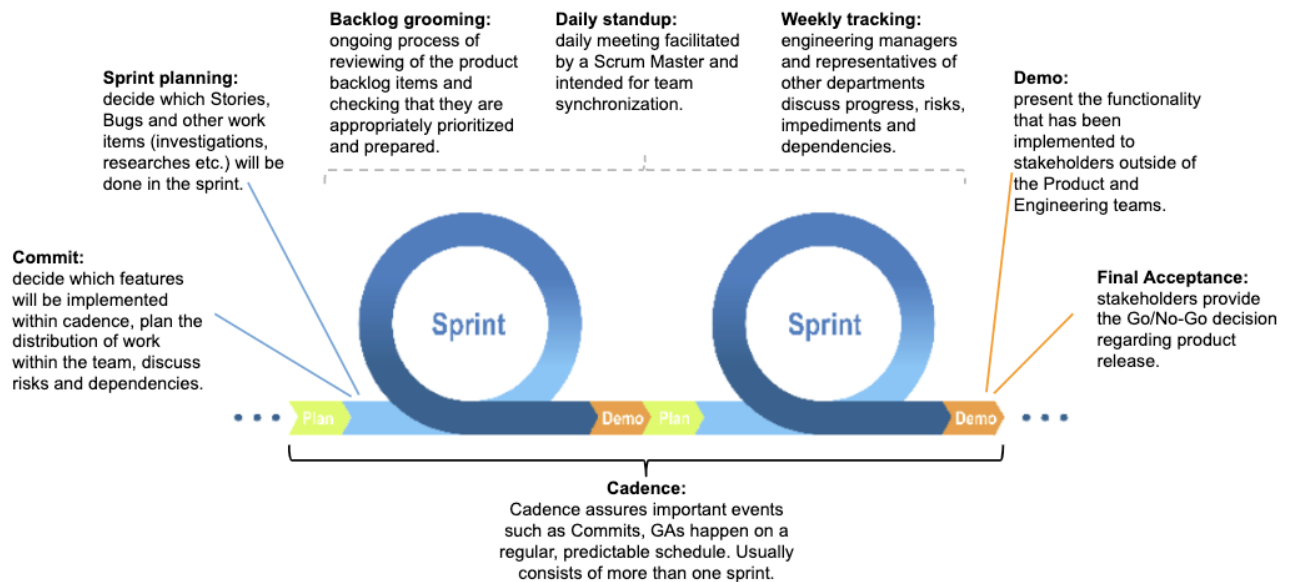


Image 2.3 Cadence process on Development layer

## 2.4 Technical description and tools used

The crucial part of consulting project has been selection of proper tools to organize information and manage products development on all stages of PDLC.

When we started described transformation consulted company has been using the following tools:

- Jira for tracking of tasks and bugs.
- Testrail for management of test cases and planning of QA activities.
- Bamboo for continuous integration.
- Confluence as knowledge management system.
- Zendesk as customer support tickets tracking system.

According to feedback obtained from employees and observations we identified weak areas:

- There was almost no integration between used tools.
- Some teams used available tools in the distinct way which contradicted to practices of other teams.
- Some tools necessary for implementation of Scrum and PDLC were missing.

We started with unification of approaches. Important unification effort has been upgraded of Jira workflows. We received a significant boost from the previous

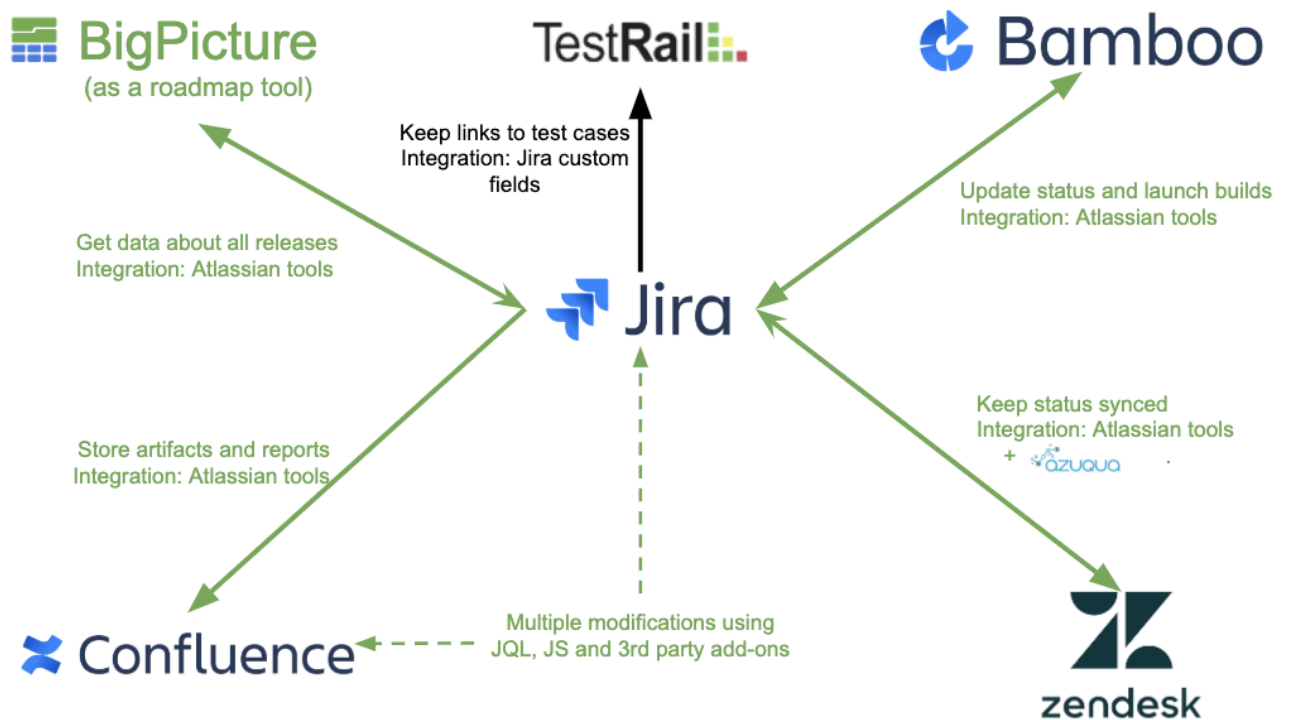
initiative to unify Jira workflows and reports, which started prior to described consulting project. Now we just had to continue building on top of unified Jira workflows. We heavily used add-ons such as “Jira Misc Workflow Extensions”, “Automation for Jira” and “Adaptavist ScriptRunner for JIRA” to automate multiple steps in workflows of Jira usage. Purposes of automation were to remove a need in multiple routine tasks as well as to push information to various consumers in Jira.

Then we launched multiple initiatives to integrate available tools together. We selected Jira as a key hub of information because of two reasons:

- This system is already heavily used by software development teams all over the industry
- Jira is well known for its versatility. It is used to automate all kinds of workflows and scenarios from automation of routine tasks of office managers to supplementing senior managers with their duties [19].

Then we started to add new integrations that are depicted on the image 2.4 as green arrows. For most integrations we relied on available APIs and add-ons developed by manufacturers of those tools. Such approach saved a lot of time and effort.

APIs developed by manufacturers of tools were not sufficient in case of Jira to Zendesk integration, so we utilized Azuqua to significantly extend available set of functionality.



All parts in green are added as a part of current transformation

Image 2.4 Tools used for management of all aspects of PDLC

The last important step was selection of the tool to act as a roadmap for entire company. We analyzed an idea to develop a custom tool, available 3rd party tools and suitable Jira add-ons. We decided to go with BigPicture Jira add-on as the best option. It was cost effective, already integrated with Jira and had a set of features that we were looking for.

## 2.5 Roles and responsibilities

During upgrade of processes and tools new duties and responsibilities arosed. So we had to update of roles and responsibilities to account for those changes .

Multiple roles in Engineering and some other roles were modified. Let's review few notable changes.

One of the key changes has been distinction between Product manager and Product Owner. Product manager is now defined as the person responsible for the high-level vision of product and for communication of this vision both internally and to the market. His goal is to ensure that the markets (customers) requirements are represented

in the product development plan in the most profitable way. As part of this role, product management is responsible for customer documentation and coordinating go-to-market strategy with Marketing, Operations and Sales.

Product owner in turn is the person responsible for providing the clear and implementable requirements to the development team. The ultimate goal is to ensure that the product development plan represented in the product backlog is clear, is in an implementable form, and it can be delivered on time.

Another highly anticipated change is clear definition of the role of engineering manager. Engineering manager is defined as the person responsible for the architecture, preparation of technical design documents and the representative of engineering that may be involved into communications with customers.

In true spirit of Agile we added a new role of Scrum Master. It is the person accountable for removing impediments so team is able to deliver the product goals and deliverables. It is clearly defined that the scrum master is not a traditional team lead or project manager but acts as a buffer between the team and any distracting influences. Thus, the role scrum master ensures that the Scrum framework is followed.

## **2.6 Finance**

For financial calculations we selected a state without suggested changes as a baseline, as if the consulted project was not implemented. Thus all further calculations were made for the delta between this baseline and expected state after the change. This has been caused by limited access to full financial data of the company, but brought additional benefit by streamlining calculations, thus leaving less room for errors.

Another assumption has been made that the first results should be noticeable in June 2019, since in May we expect first releases developed under the new approach. Thus, expenses from the start of the consulting project until May 2019 are initial expenses. Since in the consulted company financial year starts in February we forecasted further financial metrics for four quarters starting from the mentioned May 2019.



We started with the cash flow. Both financial and investment flows are equal to zero. Financial flow is zero since we did not involve any additional investments for this project. Investment flow did not change since project did not make any long-term investments and capital expenditures.

For operational cash flow we accounted multiple factors:

- Initial expenses
  - Efforts spent from the start of the current change project until May 2019.
  - Cost of acquisition and set-up of necessary software.
- Expenses for ongoing support of the process:
  - Cost spent on process manager role.
  - Cost of the time of other episodically involved stakeholders.
  - Support of the new software.
- Revenue increase from the increase in customer base.

For the last one we conducted sessions with experts form Product management office and concluded that 3% increase of the number of active customers is a most plausible assumption. Important note is that we expect gradual effect over the year, so user base should increase by  $3\%/12$  each month and reach +3% only in 3 months.

In order to verify different options, we brainstormed about positive and negative scenarios. To fairly reflect all options, we calculated 3 scenarios with the most pessimistic being that changes will hurt the customer base and in the most positive will give a nice boost. In the result we agreed on both figures and probabilities of all 3 scenarios as shown in the header of the table 2.1.

	Do not implement the project	Implement project		
		Pessimistic (10% chance)	Realistic (70% chance)	Optimistic (20% chance)
		-2% active customers annually	+3% active customers annually	+10% active customers annually
Cash flow	Annual Delta			
Operational		\$ (289,840)	\$ 299,760	\$ 1,125,200
Investment		\$ -	\$ -	\$ -
Financial	\$ -	\$ -	\$ -	\$ -
<b>NPV</b>		<b>\$ (269,996)</b>	<b>\$ 275,712</b>	<b>\$ 1,039,704</b>
<b>IRR</b>		<b>N/A</b>	<b>37%</b>	<b>68%</b>

Table 2.1 Financial forecast

According to discussion with CFO the company uses discount rate of 8%. Based on discount rate we calculated NPV and ERR for all three scenarios as shown in the table 2.1. Calculations clearly demonstrate that project is feasible. Let me note that weighted total of all three scenarios is \$ 373,939.

## 2.7 Stakeholder management

Important aspect of our change plan was stakeholder management approach [28]. We analyzed the stakeholder register that we already had. It was clear that some of them had ability to block the project or significantly impede it, others had power to boost its success. On the other 'dimension' some of them were deeply interested in what we were doing, others did not care. By understanding this power and attitude combination we identified strategies suitable for engagement of each of them.

<b>Position</b>	<b>Role</b>	<b>Interest</b>	<b>Power</b>	<b>Approach</b>
CEO	Approver	High	High	Keep informed about key decisions, share status and key KPIs weekly
CTO	Informed	Medium	Medium	Consult
CFO	Informed	Low	High	Consult
SVP of Engineering	Account.	High	High	Closely cooperate
SVP of Sales, SVP of Bis Dev, SVP of Marketing	Consulte d	Medium	Low	Keep informed
SVP of Services and Operations	Consulte d	Low	Low	Involve into areas related to his responsibility
Engineering managers and Product Managers	Consulte d	Low	Low	Involve into process definition

Table 2.2 Stakeholder management approach

## 2.8 Risks and constraints

During the preparation and implementation of current consultancy project we have maintained a risk register with known risks. We actively reviewed the list, developed response strategies and acted based on them. As the result we significantly

reduced probability of some risks. In the table 2.2 there is a risk register at his current state.

<b>Risk</b>	<b>Probability &amp; Impact</b>	<b>Trigger &amp; Response</b>
We made a wrong assumption that improvement of TTM will improve customer retention and acquisition	Probability: Low (10%) Impact: High (pessimistic fin. scenario)	Trigger: No positive trend after first three months Response: Analyze feedback and improve process. If trend does not improve for the next 3 months - kill this initiative
Proposed changes will harm delivery efficiency	Probability: Low (10%) Impact: Impact: High (pessimistic fin. scenario)	Trigger: More than 25% releases are missed over a quarter Response: Analyze and improve the process. f trend does not improve for the next 6 months - kill this initiative
Competitors coming with disrupting product	Probability: Low Impact: High	Response: accept
Changes will not be accepted and supported by critical mass of company employees	Probability: Low (20%) Impact: Med	Trigger: Systematic avoidance of new processes in more than 25% of teams Response: Involve initiative groups to further development efforts
Change in company strategy during 2019 FY	Probability: Low (10%) Impact: Low	Trigger: New company strategy is developed and approved. Response: Analyze and either adapt current initiative or start a new one.

Table 2.3 Risk register

## 2.9 Implementation strategy

There is a well-known approach to introduce change in the organization - Kotter's 8 step Model [27]. We used it to follow essential steps of change process.

According to Kotter the first step is to establish the sense of urgency. Most members of the company have been pretty aware about the situation that users are gradually leaving, so we just had to make sure that this information is universally known.

Then we continued the change by setting-up a team and resources for the change project. It was decided that this change will be spearheaded by Process management group. This group consisted of me as a process manager and a release manager with SVP of Engineering as a ‘customer’ and final decision maker when necessary. This was a usual format that we used to make changes to the processes and track compliance.

We also considered involvement of external consultants, but we rejected this idea. There reason is that based on our combined experience from previous similar endeavors consultants will not fully dive into the context, so we will have to pay for something that later we will have to modify ourselves. Thus, from time and cost perspectives we went we just internal resources participating in major process design efforts. Nevertheless, we benefited from involving external subject matter experts to consult about latest trends and best practices.

Another important aspect of our approach was involvement of multiple stakeholder on all levels to the development of change management plan. We built a initiative group which consisted of the most active and vocal representatives of key roles and departments. We met few times a week and together reviewed and significantly modified new changes developed by process management group. This effort helped with a buy-in across a company and significantly contributed to the quality of proposed solution.

Development of the change plan we have started with identified challenges that are described in section 1.2. Then we interviewed key stakeholders among to management and made sure that resolution of uncovered issues will contribute to implementation of the overall company strategy.

Together we have built a roadmap of the planned change initiative:

- Gather inputs and prepare initial suggestions - 31st Dec 2018
- Develop draft version of new approach - 15 Jan 2019

- Finalize and agree new approach - 28th Feb 2019
- Finish trainings and kick off the new approach - 15 Mar 2019
- Analysis of the process based on the results of first releases that are following the new process - 30 May 2019

Another aspect where Kotter's model has been very helpful was idea of short-term wins. For example, we found big pain points that were easy to resolve, like cumbersome artifact used as a project plan. Instead of it we developed a one-page template with heavy usage of automated reports, thus saved up to one man-day per release planning for manager and team lead.

The hardest part that awaits us ahead will be “make changes stick”.

## **2.10 Business model**

In this section I would like to describe key aspects of my consulting practice.

In parallel to working as a project and program manager in software development industry I periodically help to set up management processes and tools at various IT companies. In some cases that is a side project for my current employer and in some cases consulting of another company.

Let's explore various key characteristics of my consulting practice overall and current consulting project in particular.

**The need.** In the modern world business conditions are changing rapidly, so there is an ever-present need for each company to adapt to new realities. Additional factor is the rapid growth of most Ukrainian software development companies and IT overall. In both 2017 and 2018 industry have grown of headcount of IT professional by almost 30% annually [21]. As the result many companies are forced to build more complex management practices and Project management offices (PMO) to cope with their increased size and complexity.

**Mission.** In the process of consulting I usually introduce changes to processes and tools used by an IT company and help their project management expertise to grow. The last part is my key goal - involve and educate employees of the consulted company,

so they will not only learn to use what is suggested, but will be able and willing to adapt it to any future needs without any external consultant.

**Market.** In Lviv alone there are more than 300 IT companies which in total receive more than \$600 millions in revenue per year and total revenue grows annually by more than 20% [22]. This itself is a lucrative place to work and consult. Mentioned Ukrainian market [21] brings even more opportunities for growth.

Out of all those companies my target market are companies employing between 50 and 200 engineers and with 20%+ annual growth rate in headcount. Such companies proved to be of right scale and pace to need a consultant and at the same time scope is manageable for a single consultant.

**Unique value proposition.** There are a lot of professional managers in Ukrainian IT. Among them there are many professionals willing to teach and consult others. On the one hand side they are a significant competition to my consulting practice, but on the other they usually have very limited and one-sided experience. In the contrast I have a more diverse experience in IT and significant practice of process management alongside my full-time employment, for example I acted as an active member of PMO, as a head of Agile Practice and as a Process Manager. In addition to my full-time employments I consulted few Ukrainian IT companies on how to set up and develop their project management capabilities. Thanks to such versatile professional experience I have a track record of successful transformations. Such experience favorably tells me apart from most competition.

**Approach.** My usual approach is face based. Current consulting project consists of discovery phase where we built ground rules, and two major ‘waves’ of changes: the clearly defined “version 1” of the new process that is being finished and future “version 2”. Phased approach allows to have measurable progress and clear goals even though we do not have a vision of the final picture through majority of consulting.

**Finance.** In case of process management activities at my current employment time spent is usually covered by regular salary, where in case of consulting of another

company my usual approach is to charge an hourly rate for the time spent. In both cases there are usually pre-agreed bonuses for achieving certain targets.

In the presented case I am receiving an agreed compensation from my current employer and also have a defined bonus for achieving of key targets including:

- All teams are transferred to the new methodology.
- Average release cycle is cut in half.



## CONCLUSIONS

### 3.1 Managerial conclusions

Current project has been a very interesting experience. It is the biggest transformation project that I have led and it influenced few hundred employees of the consulted company and countless end customers. The project took a significant time and effort investment but was definitely worth it.

At the current moment all changes planned for consulted project were implemented. We are collecting established metrics are waiting for the first results. In parallel we are collecting feedback for future refinement and improvements.

During the course of current consulting endeavor we planned and implemented multiple big-scale changes in the company and now we can see both success cases and things that should be changed in future.

The first bunch of positive outcomes has been received due to standardization of tools and workflows across all teams. Some elements of standardization started even before transformation described in this thesis, but had a far-reaching consequence and laid a foundation for multiple changes introduced later. For example, the application of unified Jira workflows had a outcome beyond what we expected. It enabled projects to share, move and collectively process Jira records. Integration between tools, which are latest additions to standard tool set, boosted cooperation even further. This increased amount of information exchanged, while keeping it properly stored as comments and history records in the system. Ticket resolution time has dropped significantly as well as amount of unresolved tickets. In the addendum 1 there is a chart that shows both running total of open customer reported defects as well as time from the moment of creation till resolution. It is clear that after mentioned standardization in early 2018 significantly changed dynamics of the resolution of customer reported defects.

The next successful aspect of the change-process is availability of data through easy to use automatic reports. There is a famous saying “You cannot control, what you cannot measure” and during the course of the project we had multiple occasions to

witness its truth. In Addendum 2 there is an example of the automatic dashboard used by management to measure overall health of engineering projects at the moment. Thanks to developed reports and dashboards both team members and management have access to objective data that is used to oversee the project status at any moment. Thus, team in advance knows what are the criteria which are used by management to assess project status both on weekly basis as well as during project final acceptance. Management in turn have an ability to spot issues early. Countless root cause analysis and corrective plans have been launched due cases spotted by such reporting tools.

Another important conclusion is advantage of using the standard and unified processes. As stated earlier the first iteration of standard and rigid PDLC and SDLC process came into power around early 2018 and lead to significant improvements as much more teams met their commitments. The Addendum 3 shows amount of releases delivered on time and missed per quarter and clearly demonstrates benefit of process standardization. Addendum 4 demonstrates that standard processes significantly improved average duration of the release too.

However, our latest conclusion is that rigid PDLC and SDLC has its limits - most teams in the company are unable to reduce release duration to less than two months. There are two major areas influencing further reduction of release duration: managerial and technical.

Managerial aspect that influences duration is that we faced the limitation of the current approach - for some products it is impossible to do all necessary steps and prepare all necessary artifacts faster than in two months. Also based on the feedback from teams and objective measurements we see that rigid planning for a few months in advance impedes following some such Agile principles as quick response to customer feedback and quick adaptation to changing conditions. As the result we plan to proceed with even more radical simplification of process in the next phase of consulting. The key goal will be to convince top management to accept that commitments will be no longer then one sprint.

Technical factors that proved the most important for reduction of release duration are automation of testing process, technical debt and continuous integration / continuous delivery systems (CI/CD).

Automated testing is invaluable to reach shorter releases. Thanks due to implementation of thousands of automated tests company already saves man-months of testers' efforts per release and some teams already have 30%-50% of features covered by automates tests. However, to reach release duration of 1 month or less we will need to cover 80%+ of features according to our calculations. So this goal is the target for major products for 2019.

Technical debt is the additional rework caused by choosing a limited solution instead of using a proper approach that would take longer [26]. We periodically witnessed that teams had to waist efforts to work around pure design decisions made in the past. Thus we had to take a deliberate steps to reduce technical debt by including improvement tasks into each release. Reduction of technical debt as well as other engineering improvements led to significant boost of quality (see addendum 5 for related quality reports).

As for CI/CD - our teams are using Jenkins and Bamboo in this role, which allow them to have latest changes built into the product and deployed to test environments as soon as they are complete by developers.

### **3.1.1 Approach to offshore consulting**

Another set of conclusions that I have made are around consulting and change management.

At the beginning of current consulting endeavors multiple key stakeholders were skeptical because of my location offshore and thus far away from most decision makers. However, the very video communication technology developed by consulted company helped to overcome obstacles of remove communication. We conduct all meetings with cameras turned on and in most cases participants attend from their work places each sitting in from of the camera. This gives unprecedented feeling of live face to face communication, since we clearly here each other and see all clues of nonverbal

communication. As the result we have built a great rapport with all offshore team members. Such communication and connection approach played a vital role in gathering feedbacks and propagating developed ideas.

Current consulting project proved that the key to successful change of business unit or organization is presence of a champion. A champion in this case is a stakeholder who is interested in the project success and has enough influence to promote and protect it. We had an SVP of Engineering as such champion and I am sure that without such support this project would fail.

The critical aspect to successful change proved to be the involvement of stakeholders into designing of change process. We reached this by inviting key stakeholders, influencers and active team members to regular sessions where we discussed and tailored new processes. They had a ground to propose ideas and challenge what seemed wrong for them. Involvement gave those stakeholders the feeling of participation in their decision making and thus of ownership over suggested changes, thus made them promoters of new approaches.

### **3.3 Further steps**

There are two major vectors of expected improvement:

- Further process automation.
- Further process simplification.

The next heavily requested step in the process automation is full automation of PDLC tracking for each version of each product. This will include keeping all data about various project aspects including artifacts, action items and status reports in the same system. Most likely we will use Jira for this purpose. Such automation should save additional time for stakeholders who may be potential bottlenecks - product managers, engineering managers and team leads. It will also give management easy reach status reports and even earlier detection of problems.

For the process simplification the most disputable point is whether we should keep rigid elements of planning which force teams to commit to deliver scope for few months in advance or to fully embrace Agile and commit for one sprint only. As I

mentioned above this change will require further modification of managerial and technical approaches, but looks well worth implementing. So, I envision the discussion around this aspect as the most pivotal for the next iteration of changes.

### **3.4 Learning conclusions**

Modules of the MSTM program significantly contributed to the success of current consulting project.

“Management Decision Making Toolbox” taught by Mychailo Wynnycky gave as a toolset that I apply during my work. Some of them helped to investigate and describe aspects of discussed consultancy project as well as became parts of the current thesis. For example, I used Business model canvas to capture and display key aspects about the company. In turn Porter's five forces supplemented market analysis and made a foundation of competitive analysis.

Joe Pons during his “Strategic Marketing” course demonstrated that there is always more than one point of view on each problem. He taught us to carefully check available data since chances are there are hits among tons of gathered inputs.

“IT strategy” course taught by Alex Shegda helped me to see connection between company strategy and all other levels and aspects of the company. Another key takeaway for me were systems for setting and synchronizing goals across the company.

“Financial Decision Making” by Yuri Zayarny and “Corporate finance” by Mark Shuper greatly expanded my understanding of various aspects of finance management. This knowledge played an important role in calculations of financial prospects of described endeavor.

On personal level I received an invaluable boost during the module “7 Habits of highly effective people”. Module happened when I started my involvement as a Process manager and coincided with the moment of heavy workload and stress that I felt. Anastasia Markuts reminded me how to properly react to stress and completely changed my attitude to challenges that I have been dealing with.

I use obtained skills in my daily work and transfer them to those whom I mentor and help to grow.

## References

1. Duke Okes, Root Cause Analysis: The Core of Problem Solving and Corrective Action, Quality Press (2009)
2. “Determine the root cause: 5 whys”, isixsigma.com,  
<https://www.isixsigma.com/tools-templates/cause-effect/determine-root-cause-5-whys/>
3. “Video Conferencing Market Size”, gminsights.com,  
<https://www.gminsights.com/pressrelease/video-conferencing-market>
4. “Why all work meetings should be video meetings, even the in-person ones”, qz.com,  
<https://qz.com/work/1421523/why-all-work-meetings-should-be-via-video-call/>
5. “THE CONNECTED CULTURE: Unleashing the Power of Video in Everyday Collaboration” by Forbes, forbesimg.com,  
[https://i.forbesimg.com/forbesinsights/zoom/The\\_Connected\\_Culture.pdf](https://i.forbesimg.com/forbesinsights/zoom/The_Connected_Culture.pdf)
6. “At 10% CAGR, Video Conferencing Market will reach 20 billion USD by 2024”, marketwatch.com,  
<https://www.marketwatch.com/press-release/at-10-cagr-video-conferencing-market-will-reach-20-billion-usd-by-2024-2019-01-30>
7. “Enterprise Video Market by Component”, marketsandmarkets.com,  
<https://www.marketsandmarkets.com/Market-Reports/enterprise-video-market-1182.html>
8. “Video Conferencing Market Size By Component, By Type, By Application, Regional Outlook”, gminsights.com,  
<https://www.gminsights.com/industry-analysis/video-conferencing-market>
9. “Zoom Scoops Customers From Cisco In \$16 Billion Video Conferencing Market”, forbes.com,  
<https://www.forbes.com/sites/petercohan/2017/10/03/zoom-scoops-customers-from-cisco-in-16-billion-videoconferencing-market/#5b6859067979>

10. “Digital transformation for 2020 and beyond, a global telecommunications study”, ey.com, [https://www.ey.com/Publication/vwLUAssets/ey-digital-transformation-for-2020-and-beyond/\\$FILE/ey-digital-transformation-for-2020-and-beyond.pdf](https://www.ey.com/Publication/vwLUAssets/ey-digital-transformation-for-2020-and-beyond/$FILE/ey-digital-transformation-for-2020-and-beyond.pdf)
11. “Simplify to Grow in Telecommunications”, bain.com, <https://www.bain.com/insights/simplify-to-grow-in-telecommunications/>
12. “Agile Product Development at Cisco: Collaborative, Customer-Centered Software Development”, cisco.com, [https://www.cisco.com/c/dam/global/en\\_hk/solutions/collaboration/files/agile\\_product\\_development.pdf](https://www.cisco.com/c/dam/global/en_hk/solutions/collaboration/files/agile_product_development.pdf)
13. “CASE STUDY: Cisco”, scaledagileframework.com, <https://www.scaledagileframework.com/cisco-case-study/>
14. “Early Agile Scaling at Adobe”, agileforall.com, <https://agileforall.com/early-agile-scaling-at-adobe/>
15. “The Scrum Guide”, scrumguides.org, <https://www.scrumguides.org/docs/scrumguide/v2017/2017-Scrum-Guide-US.pdf>
16. “Large Scale Scrum (LeSS)”, <https://less.works/>
17. “Scaled Agile Framework”, <https://www.scaledagileframework.com/>
18. “The Nexus Guide”, <https://www.scrum.org/resources/nexus-guide>
19. “Jira Software : How can a non-software team use Jira Software?”, atlassian.com, <https://confluence.atlassian.com/confeval/jira-software-evaluator-resources/jira-software-how-can-a-non-software-team-use-jira-software>
20. Report “Video Conferencing Market Size By Component, By Type, By Application, Regional Outlook, Growth Potential, Competitive Market Share & Forecast, 2018 – 2024”, Global Market Insights
21. “Ринок праці 2018: рекордні темпи росту і 160 тисяч спеціалістів”, dou.ua, <https://dou.ua/lenta/articles/jobs-and-trends-2018/>

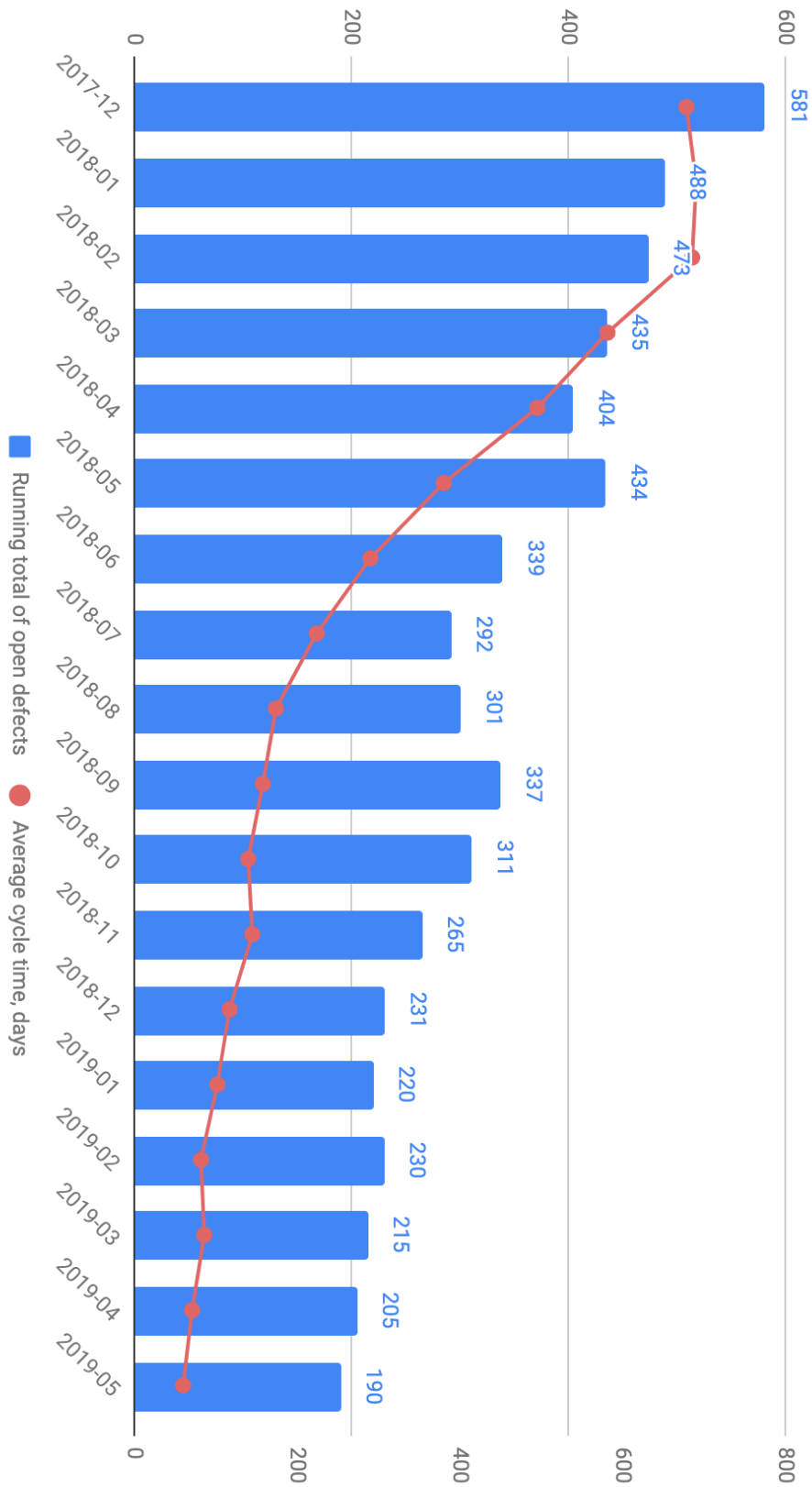


22. “IT Research 3.0”, itcluster.lviv.ua,  
<https://itcluster.lviv.ua/en/projects/it-research/>
24. “How Zoom achieves exceptional NPS scores”, blog.zoomint.com,  
<https://blog.zoomint.com/blog/zoom-82-nps>
25. “Creating Lean Mobile Applications Through Modern Agile”,  
avaya.com, <https://www.avaya.com/blogs/archives/2017/03/creating-lean-mobile-applications-through-modern-agile.html>
26. “Technical debt”, en.wikipedia.org,  
[https://en.wikipedia.org/wiki/Technical\\_debt](https://en.wikipedia.org/wiki/Technical_debt)
27. Kotter, J.P., Leading Change, November 2012, Harvard Business School Press
28. TOGAF Version 9.1, first edition (December 2011), Van Haren Publishing

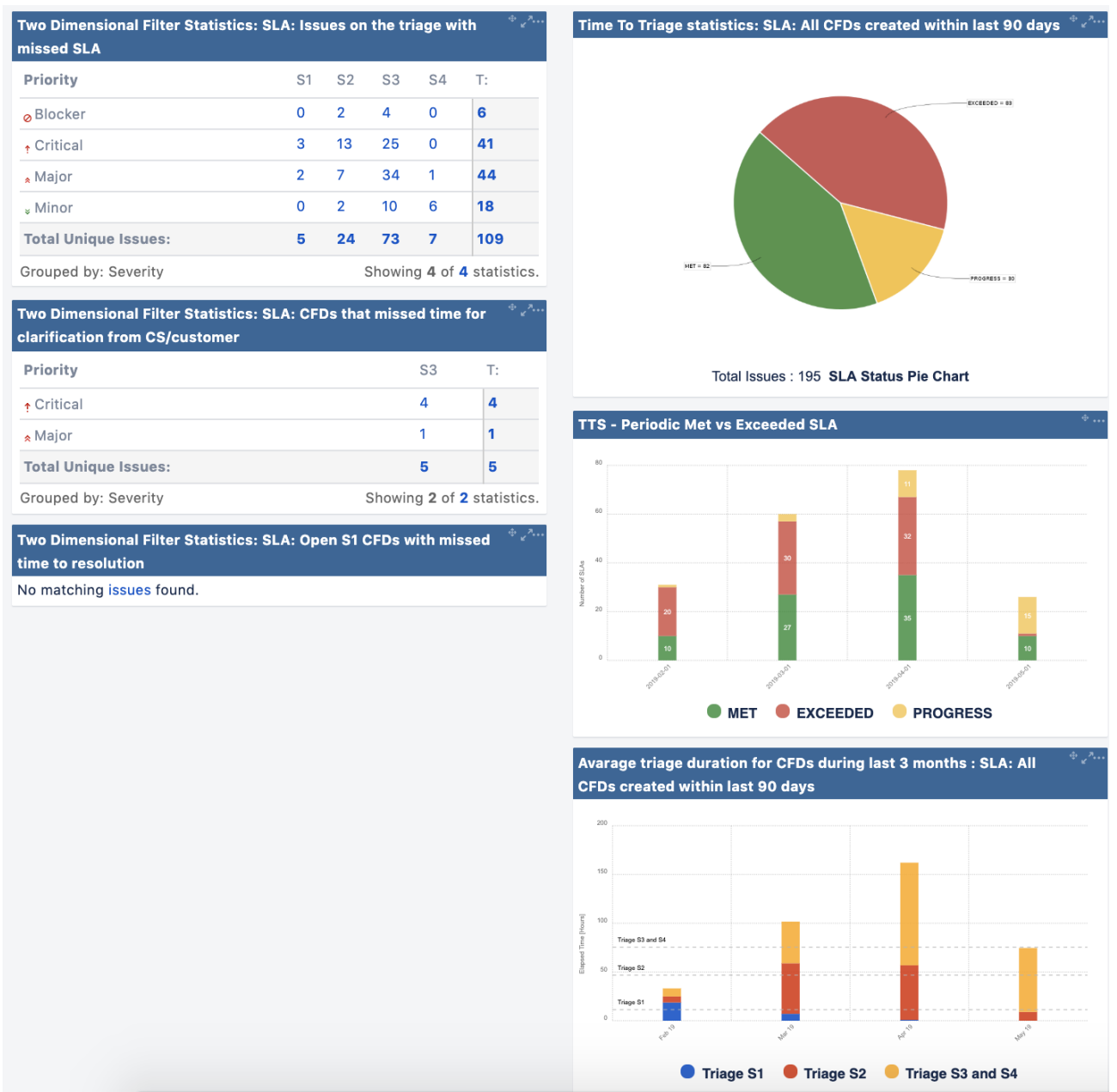
# ADDENDUMS

## Addendum 1 - Customer reported defects - running total and average cycle

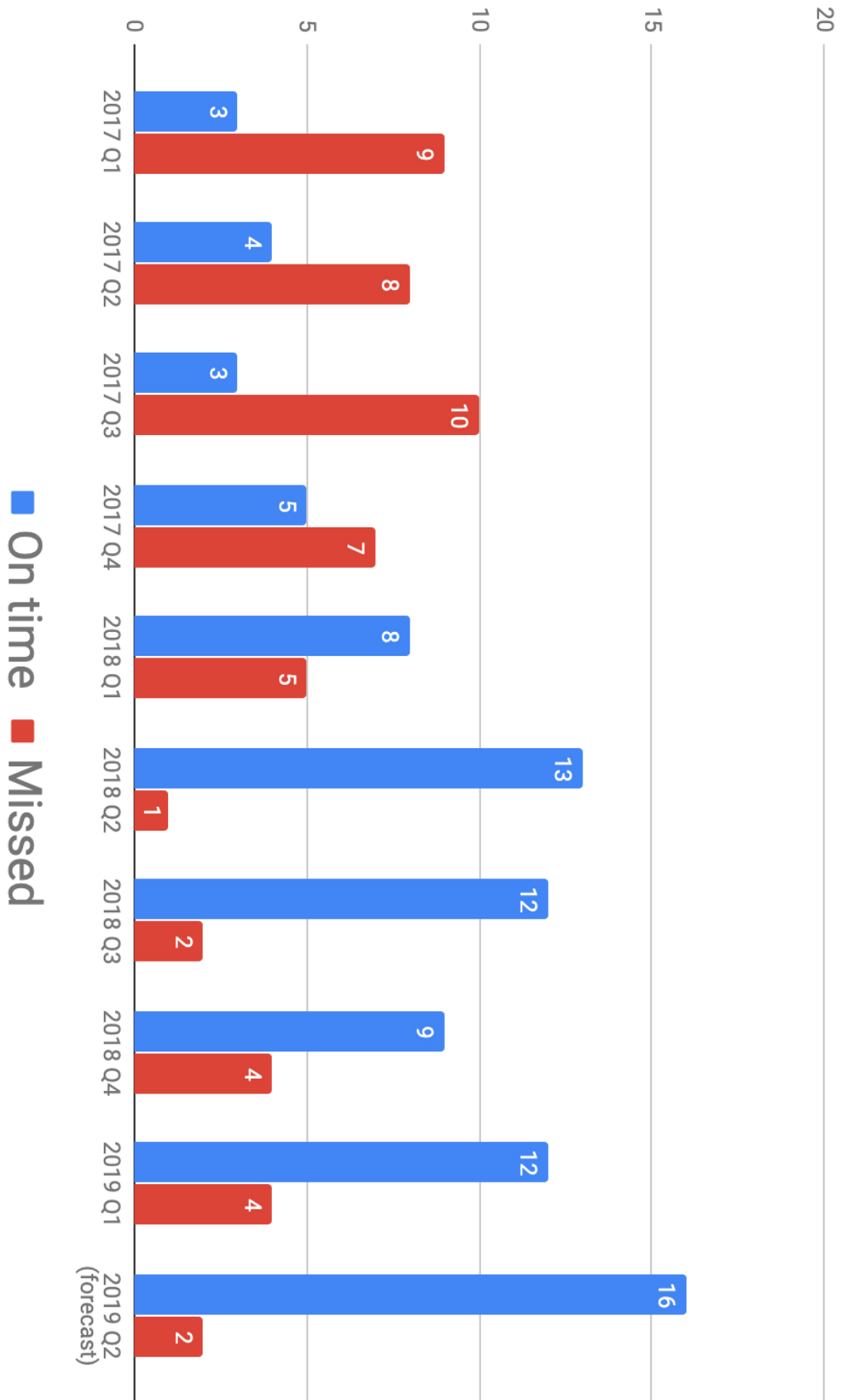
time



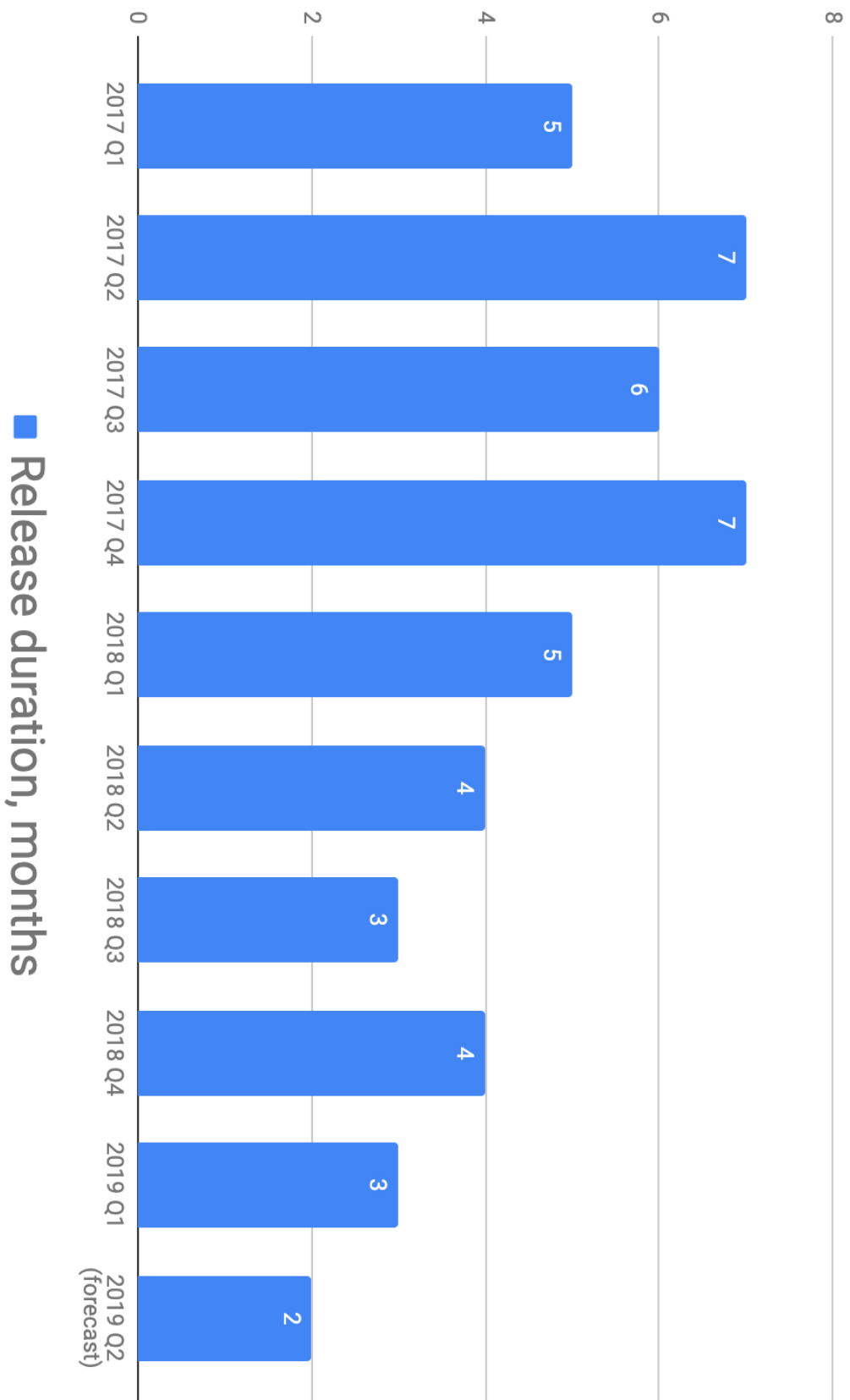
## Addendum 2 - Example of the dashboard



### Addendum 3 - Release statistics

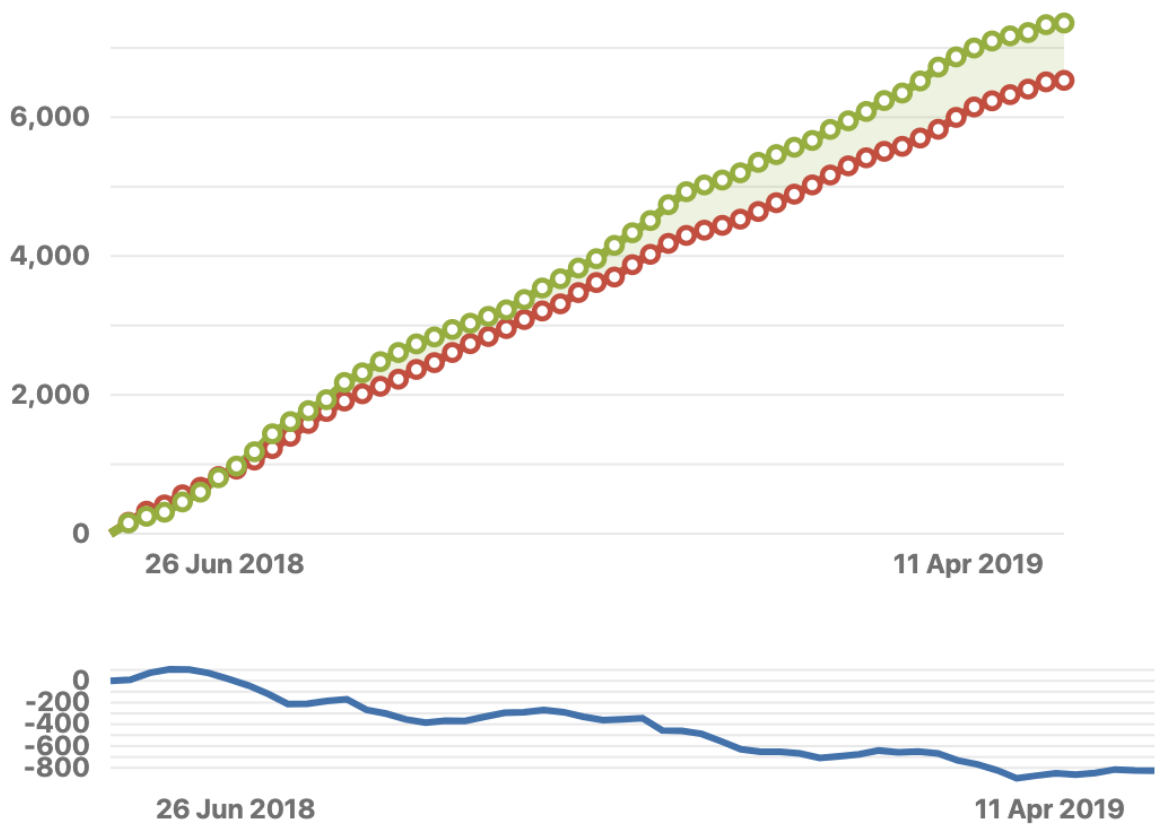


## Addendum 4 - Average release duration



## Addendum 5 - Quality reports

### Open vs closed bugs for all teams



### Defects escaping after QA

