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FROM CONSULTANCY TO A SOFTWARE SERVICE HOUSE

– A case study

TURKU AMK
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MASTER'S THESIS | ABSTRACT

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- A case study

The main goal of the present master's thesis is to explore how to ensure that the Nord Pool product development stays competitive in the future. The whole business environment is changing due to new regulations and technology trends. The strategic focus of the company has shifted from consultancy towards creating its own software with an in-house software development organization. The development organization already existed when the study was started, and it had delivered services to customers.

The research approach was mixed methods, where the main ways were the ethnographic observation of the organization and a survey sent to all Nord Pool employees. The results of the survey were used in the process development and employee training programs.

The results show that the strategy change was successful business-wise. The employees understand how their work affects the business goals and they are willing to produce even better service to the end customers. However, the fast growth and change period has changed job descriptions, which means that employees often feel their roles and responsibilities are vague. The company should now update the roles and give teams and departments time to take shape. At the same time, the ongoing process development gives the organization the opportunity to mature and standardize its daily operations. The study results have been used in the process development and the internal work continues in the organization.

KEYWORDS:

Organization, change, software development, software business, organizational culture, business processes

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KONSULTOINNISTA OHJELMISTOTALOKSI

- Tapaustutkimus

Työn tarkoituksena oli selvittää, kuinka hyvin tutkittavan organisaation (Nord Pool) tuotekehityksen kilpailukyky pystyy vastaamaan tuleviin liiketoimintaympäristön muutoksiin. Yrityksen strateginen fokus oli muutamaa vuotta aikaisemmin vaihtunut ohjelmistoprojektien ostajasta kohti ohjelmistoprojektien itsenäistä toteuttamista. Tämän työn alkaessa tuotekehitysorganisaatio oli jo olemassa ja ensimmäiset tekniset ratkaisut oli jo toimitettu asiakkaille.

Menetelmänä työssä käytettiin monimenetelmäisyyttä, jonka puitteissa tutkimusongelmaa tutkittiin käyttäen yleistä etnografista havainnointia tutkittavan organisaation toiminnasta sekä kyselytutkimusta yrityksen henkilökunnalle. Kyselytutkimuksen tuloksia hyödynnettiin organisaation sisäisessä prosessikehityksessä ja henkilöstön kehityssuunnitelmissa.

Tulosten perusteella organisaation fokuksen muutos on toteutunut teknisesti hyvin. Työntekijät ymmärtävät työnsä vaikutuksen yrityksen tavoitteisiin ja ovat kiinnostuneita palvelemaan asiakkaita nykyistäkin paremmin. Voimakas kasvu ja muutos ovat kuitenkin muuttaneet monen työnkuvaa, joten työntekijät kokevat roolien ja vastuiden olevan nykyisellään epäselviä. Yrityksen kannattaa pitkän muutosvaiheen jälkeen päivittää työntekijöiden toimenkuvat ja antaa tiimeille sekä osastoille aikaa muotoutua. Samaan aikaan prosessien päivittäminen antaa organisaatiolle mahdollisuuden kehittää kokonaisuutta kypsempään suuntaan esimerkiksi sertifiointien avulla. Tutkimuksen tuloksia on jo hyödynnetty prosessien kehityksessä ja tutkimustyö organisaation sisällä jatkuu tämän työn jälkeenkin.

ASIASANAT:

Organisaatio, muutos, ohjelmistokehitys, ohjelmistoliiketoiminta, organisaatiokulttuuri, liiketoimintaprosessit

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1 INTRODUCTION

Electricity markets in European Union are undergoing changes due to changing regulations and technology trends. So far, the electricity markets have mostly been operating as local monopolies in their home locations. In Nordic countries this local power exchange has been Nord Pool. In 2018 there are plans to begin so-called “XBID operations”, which would open daily electricity trading operations to multiple exchanges in about 12 countries. This means the power exchange operators will face competition in their previously-safe home markets. Nord Pool must make sure its own operations are efficient to face the upcoming competition.

Being competitive on highly regulated market requires modern development and HR practices. Software development practices are in constant flux and it is a challenge of its own to keep updated on the latest changes. This thesis describes the basic framework where IT service providers usually operate today.

The main goal for this thesis is to map the current shape of Nord Pool’s service development and then identify what would be the most important steps to improve it. The organisation has seen a challenging growth from consultancy business towards software service provider business in relatively short time. Like most of the companies that undergo similar change, there has been challenges adjusting people and processes to new operating model. This thesis aims to give the organisation better insight of its current situation and the next steps from here.

The research approach was mixed methods, where the main ways were ethnographic study of the organization and survey sent to all Nord Pool employees. The results of ethnographic observation are combined to chapter Operational environment and they functioned as feedback to crafting survey questions.

The thesis structure consists of four main chapters. The first chapter is a theoretical study on different features of software development business and modern organisations that provide software services. The second chapter examines the organisation under study. The third chapter describes the data collection process and its results. The third chapter also introduces development suggestions the company could do to improve its operations.

2 SOFTWARE BUSINESS

2.1 Software business

Software business is often project-based work where one organisation orders software from another organisation. The main goal for these projects is to produce a result that matches the client's requirements as well as possible within commonly agreed budget constraints between parties. (Haikala & Mikkonen, 2011, p. 12)

Projects can be executed within an organisation or with external vendors depending on resourcing and business needs. They can also include other, more specialised, consultants, such as technology experts or user accessibility designers. It often makes sense business-wise to use external vendors as modern projects require vast array of skills and some of these are highly specialised.

The resulting software product is often tailored to solve a specific business problem that the client organisation has defined. How well this happens is crucial for the success of the project. One specific software project may be part of a broad program that is formed to guide larger development. Each project should always have a defined strategic goal set by the client party.

Compared to more traditional engineering fields, software projects do not produce tangible results and they do not have strict constraints on time and place. Software business is more like service business than traditional engineering in this regard (Haikala & Mikkonen, 2011, p. 24).

2.2 Software lifecycle

Software lifecycle has different phases where product features are specified, implemented and validated. The lifecycle always begins from a need and specification; what is required and how to meet those goals? Specification basics do not differ from generic project management specifications. Every little detail may not be known in advance, so good change management practices are vital for software projects (Haikala & Mikkonen, 2011, p. 61).

One special feature of a software project is the almost endless amount of possible solutions for a given problem. Projects can be implemented in almost any modern programming language and frameworks. These technology selections affect the project in multiple ways, both predicted and unforeseen. Specification phase sets the boundaries and targets and it is vital phase for the success of the project.

The implementation phase is the main development phase where most of the project's core features are done. This phase is sometimes believed to be the only active phase of the project. Such thinking may increase business risks on remaining life cycle phases. Risks can be high especially on business-critical software projects.

Importance of the maintenance phase has become more important due to increased system complexity and security threats when most of the software components are exposed to the public internet. If software handles any confidential data or if the project is even a bit important for the business, it is advised to invest in cyber security.

For a comparison, in the construction sector one may safely use older stock and equipment (i.e. nails, lumber, hammers, power tools, etc) without major concern and they are often as good as brand-new items. Software is different in that; older versions are almost certainly less secure than the latest one.

Neglecting software security may cause major troubles to a business. For example, in year 2016 there was several massive ransomware attacks and information leaks around the world. Some examples on these were Panama Papers and email leaks from Hillary Clintons presidential campaign (F-Secure, 2017, p. 7).

In addition to security, requirements of handling user data will be stricter in the future. The European union will require GDPR (General Data Protection Regulation) compliance after May 2018 (EUR-Lex, 2014) and the recent news about questionable data handling practices at Facebook that were published in March 2018 will probably have global effects eventually. The Facebook case could cause more regulation to the software business as it is the first serious ethical battle in the Internet age that has had major consequences in the form of meddling in several elections around the globe. In a way it is similar to Therac-25 case that killed or severely injured six radiotherapy patients in the 80's due to bugs in medical equipment software (Leveson & Turner, 1993).

Technology advancement in software components is constant and that makes software business more dynamic than most of the other fields. Constant advancement causes active maintenance for any software project.

Most software projects are pieces of a larger systems and software components often communicate with other software components. Changes in one component may occasionally require modifications to other components. Modifications may be needed due to security issues, changing requirements, business decisions or whims of an individual programmer or a team. This constant change over time results the whole software industry ending up as an ever-changing dynamic environment where the only constant thing is change. For this reason, it is necessary to actively maintain any software project. Neglecting maintenance for a longer period often renders the software obsolete or too expensive to maintain.

When a software project or product approaches its end of life, its artefacts such as source code or databases are usually archived, and running software is stopped on active servers. Also, external accounts and accesses to external systems are shut down.

Project data is often archived to long-term storage as the costs of required storage are nowadays small compared to other business costs. This means resuming software project at later date is possible with relatively small investment. Limiting factors are often technology becoming outdated and project's original scope have changed.

More mature software projects often follow release cycle where new versions are created and old versions are retired after determined period. New versions could have breaking changes that require migration work for updating data between versions. One example of a software that follows this kind of release cycle is Node.js programming library, which lifecycle is presented in Figure 1 (Node.js Foundation, 2018).

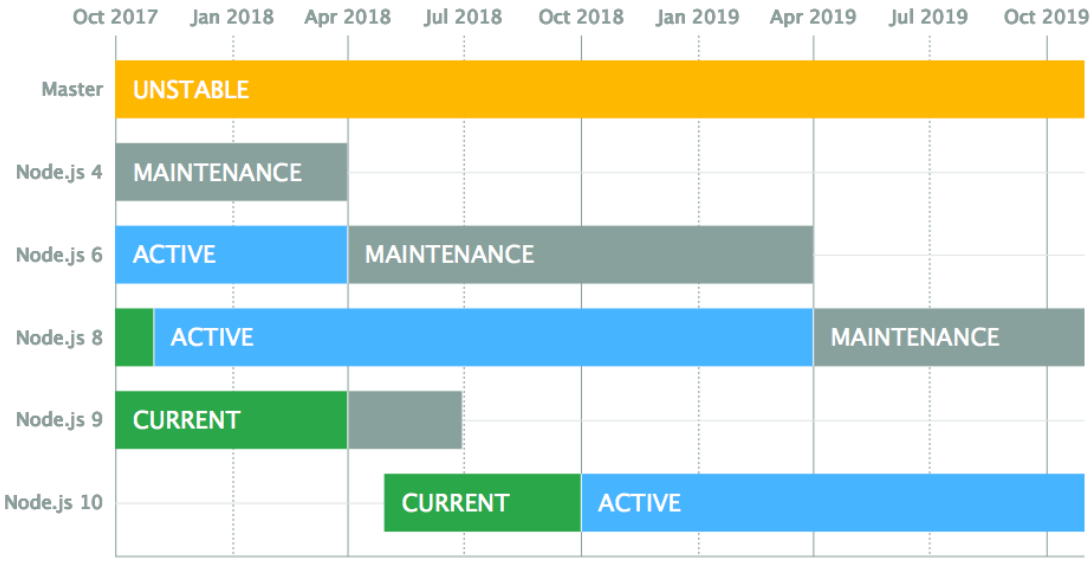

Figure 1. Example software release cycle (Node.js Foundation, 2018)

Release cycle times depend on the software project. For software libraries, typical supported lifecycle is often around 2 to 5 years where operating systems could have extended support available for 10 to even 30 years.

2.3 Technology choices and their implications on project lifecycle

The selection of technology for the core functionalities of a software project has major consequences especially in longer and larger projects. In short projects, technology selection is not as important as their lifespan is short and thus the maintenance requirements are much looser.

In practice, almost all modern software is built on top of other software and all these software layers have their own lifecycles. New programming languages and frameworks are developed all the time and many existing ones retire after their usage ceases.

If a project's lifecycle is estimated to be even a bit longer, it pays off to investigate in the technology selection. Selection of the technology often consists of finding a balance between multiple conflicting interest;

- Strategic technology selections in a company. There might be a list of strategic technologies that are used in all projects. These choices may have significant business impacts in terms of performance, licensing or support models.

- Technology suitability for given requirements. A software project may have some special needs that make it more suitable to certain technologies. Not all technologies are well suited for every need. These choices may have big impact how flexible the product or service will be and how expensive it is to maintain.
- Opinions and preferences of project personnel and generic trends in software industry. If there are no generic guidelines for software used at the company level, it is common for the teams and individuals to use their own preferences to select technologies for new projects. These preferences are often affected by current trends or fads in the industry, which fluctuate a lot and are in constant change. It is therefore difficult to predict the long-term maintenance effort or business risks if the technology selection is done purely based on current trends. One extra risk in leaning too much on trends is they often have too strong an emphasis on immature technology which is not often production ready.

Modern software is often built with open source licensed software components which may have restrictions on how the end implementation could be distributed or used. Software projects could also contain commercial components that have their own licenses and pricing models. Licensing schemes depend on company strategy and policies.

The selection of software that is used in a company changes over time. Technology change depends on many things, such as technology vendor pricing making modifications to their pricing models, new technology platforms coming available, or legislation changing. Also new employees or strategic changes within a company may change its technology preferences.

Company strategy (or lack of it) has strong influence on technology choices. If there is no visible strategy, projects often use whatever technology the company/department wanted to buy, or programmers preferred at the time. If the project team has full control on technology selection without the guidance of strategic technology selections, results are not necessary best for the whole company. Free technology selection suits better for start-up companies where companies are young and still looking for their direction. Technology selection should be part of strategic steering effort to better maintain technology related risks. One term for this is enterprise architecture. (Haikala & Mikkonen, 2011, p. 32).

Using several parallel technologies at the same time has some side effects, for example increased context switching when moving between projects and increased maintenance effort. How they affect business, depends on the business model. Consultancy companies may even benefit on having as many technologies as possible in use as they may invoice their efforts from their clients. For in-house development it is often better to reduce variation and gain more efficiency from that (Reinertsen, 2009).

2.4 Software development models

The first mainstream software development method is called waterfall. Its origins are in the 70's and it was the de-facto model for most of the 20th century. Common definition for waterfall is to perform lifecycle phases in linear order and having strict gates between the phases. According to this common understanding of waterfall, projects are carried on under great supervision and the complete implementation is tested and released after the whole system is implemented.

The common criticism against the waterfall model is it has too rigid processes, heavy forward planning, insufficient testing during implementation and slow change management. Software projects implemented with waterfall method often suffer from these issues.

These challenges for waterfall methods in software projects are not new. They were acknowledged in the original research papers from the 1970's. Royce (1970) based his research on earlier publications from the 50's and 60's (Boehm, 1986). Even the original Royce (1970) paper, which is considered to be the origin of the literal term, emphasises that the fully linear model does not work in practical projects. The article describes many practicalities that were often ignored when companies applied waterfall in their projects. These practicalities include for example shorter prototype rounds within the bigger project and constant feedback from customers. These measures are the same the agile methods are using. (Royce, 1970)

Later article from Boehm (1986), emphasises the waterfall was then an established method and in wide use. According to Boehm, the biggest mistakes at the time were ignoring the shorter prototype rounds. Mistakes on understanding the essence of the research papers gave the waterfall bad reputation (Boehm, 1986).

In the 90's, software business had a big growth and computers evolved fast. This growth got a huge number of new players to the software business to compete with the existing ones. The whole industry changed and that required different, faster and lighter, project models. Previous misunderstandings on waterfall method described by Boehm (1986) (both conscious and unconscious) also contributed on this development. Agile methods are modernised versions on older waterfall research papers that focus on much shorter iterations. The goals and methods are not that different from the original Royce (1970) paper.

Development of various agile methods was active in the whole 1990's. In 2001, a group of actives released a manifesto that described the ideology and concepts for agile movement (Agile Manifesto, 2001). Agile methods are researched extensively, and current methods are developed based on scientific research and practical experiences (Hoda et al., 2017).

The core idea of agile methods is to split the project into small parts that are executed in shorter cycles to get the feedback faster. This means the initial specification phase is often lighter and the specification scope is more focused on the most vital parts of the project. One common misconception on agile is that projects can be started without specification, which is wrong. In agile methods, specification is done constantly with help of strict change management. Specification focuses on features and issues that are selected as most important in the current situation and time. Precise specification of every detail in advance is often impossible as requirements change during the project (Haikala & Mikkonen, 2011, p. 22).

Agile iterations within the project often have the same specification, implementation and testing phases. For example, scrum, one of the agile methods, usually has iteration lengths of 1-4 weeks. The goal of a scrum iteration is to produce measurable added value to project. That value is then showcased to stakeholders who can give feedback to the next iteration cycle. Short feedback cycle makes it possible to handle potential issues before they hinder the project. Continuous conversation about software project features within the project helps managing project risks because of continuous expectation management. (Schwaber & Sutherland, 2016)

Besides time-slotted agile methods, there are also other models that are based on lean manufacturing. Lean manufacturing principles have their origins in Japanese process development practices. With these models, for example Kanban, the operation is

continuous. The focus is more on visualizing the work, limiting how much work is in progress at any given time and maintaining the flow. (LeanKit, 2018)

According to VersionOne report in 2017, 94% of the respondents practice agile methods in their organisations. 58% of the respondents stated that less than ½ of their teams are agile. (VersionOne, 2017). Later version of the same report (VersionOne, 2018) says 97% of the respondents practice agile and 46% said less than ½ of their teams are agile. Based on these figures, organisations are still using waterfall and agile methods mixed, but the trend is moving towards agile.

2.5 Different roles in software development

Software projects require many different skills. Development most often involves team work and projects may have multiple roles, such as:

- Software architect
- User interface designer
- Software developer
- Tester
- Domain specialist
- Server maintenance
- Project manager
- Service manager
- Trainer/consultant
- Technical support
- Customer support

Role definitions and boundaries are often vague, and they depend on company culture and current trends within the industry.

Product development tasks in different phases are often given to different teams. Especially in larger organisations the server maintenance and customer support tasks are dedicated to their own responsible teams away from the implementation work. Sometimes these functions are split even geographically or to external vendors. In these cases, the feedback loop from the end user to developers is either very long or in worst cases completely broken. Broken feedback loops may result in products or services that are not able to fulfil their users' needs or expectations.

Different functions often have different targets and metrics that drive their behaviour and may cause conflicts between organisations. One example of possible conflicts between teams is in Table 1. These are of course dependant on company practices and incentive models.

Table 1. Role focus example

Role	Main goal	Metrics
Sales	Close deals and get sales	Amount of closed deals and figures in pipeline
Programming	Implementing project functionalities that meet requirements	Delivery schedule targets, number of features and bugs
Maintenance	Maintain current services and products so they are usable	Technical SLA - Service Level Agreement (service accessibility and performance)
Customer service	Solving tickets	Service SLA (ticket amount and resolve times, customer satisfaction)

Looking this table reveals several conflicting goals and metrics that could hinder efficiency and employee motivation. It depends on company culture how these conflicts are handled and what metrics are used on business performance evaluation or personal incentives.

DevOps is a recent term which does not have a clear definition yet. It usually means collaboration between software development people and software maintenance people (Dev + Ops). These two functions have traditionally been close to each other but separated to different departments or even organisation silos especially in larger companies. In the extreme case, these separated silos have often had different goals and performance targets leading to conflicting incentives and motives.

The main goal of DevOps is to brings these two functions together by mixing teams and giving them common goals and motives. In practice this often means projects and deployments are no longer tossed between silos whenever there is a change in operations. Instead, the activities of development, deployment and maintenance are

done together using combined competence. Practical procedures, responsibilities and team formations depend on the organisation. There has been attempts to harmonize the practices across the industry, for example DevOps Agile Skills Association organizes trainings and manages their own curriculum on DevOps practices (DASA, 2018).

2.6 DevOps practices

One of the most common practices in DevOps is a deployment pipeline which forms the basic processes and methods for all technical operations around it. The deployment pipeline uses advanced process automation to minimise manual work. Optimised deployment pipeline automates software testing, release packaging and deployment to different environments. Increasing automation helps support organizations to handle failures better (DZone Research, 2017, p. 3)

For software developers the automated pipeline gives a defined way to test their changes and resulting software. Operations benefit from consistent way of deploying releases to testing and production environments. Business benefits are increased efficiency, more consistent quality assurance and higher customer satisfaction (Forsgren et al. 2017, p. 30-31).

Before DevOps as a term existed, development teams practiced continuous integration. Continuous integration means software source code is synced in central location and developers' changes are then saved there. After saving all the changes, the piece of software is processed and tested. This testing happens every time a developer commits changes to the server and then the applied testing automation gives back feedback how well tests succeeded. Code changes are saved continuously, and all developers could see each other's' changes. Continuous integration allows for faster feedback about potential issues and this usually improves the product quality and shortens the time to identify and solve the problems. (Haikala & Mikkonen, 2011, p. 175)

The next technical evolution after continuous integration is continuous deployment which means the changes that pass all the tests in controlled manner are automatically deployed to servers where the new functionalities can be verified and used. Continuous deployment requires a well-designed process and thorough testing implementations to work properly. One of the DevOps ideals, continuous automated software development pipeline, is based on continuous deployment process. (Agile Alliance, 2017)

2.7 From programming to service provision

DevOps is a good start for a wider collaboration within different roles and departments. I think team collaboration should be widened from pure product development functions to all functions that participate in providing services. The software business often contains at least these basic functions described in Table 2.

Table 2. Role relations in service provision

Technical foundation		Service value added	
Programming	Maintenance	Customer service	Customer

Classic DevOps covers only half of these functions. The other part consists of customer service and customer relations functions, which are often seen as alien to programmers. On the other hand, technical functions are often seen as hard-to-collaborate with from the other teams' perspective.

I believe the software business is going to be a more and more service-oriented business, as software becomes a commodity. Not all organisations are going to adjust, as change requires adjusting in thinking and behaviour. The change will also be too much for some of the employees who will get out of their comfort zone in adjusting organisations. In those organisations that can adjust, there will be changes in individual and team job descriptions. Both individuals and organisations must find their own way.

One indication on this change is IT4IT model from The Open Group that was published in 2015. In that model software business is service provider value chain. The core idea is IT services produce value to business. Figure 2 shows the visualization of IT4IT reference value chain. (The Open Group, 2017)

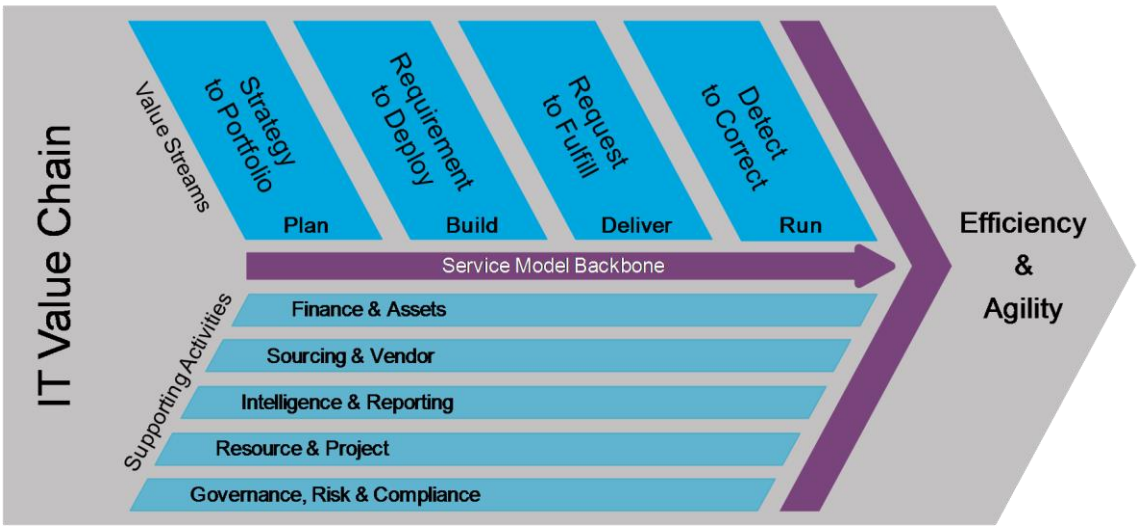

Figure 2. IT4IT value chain (The Open Group, 2017)

Value chain consists of four value streams, which each define one part of IT service. High-level IT4IT reference architecture in Figure 3 maps value streams to more practical services IT department could provide. (The Open Group, 2017)

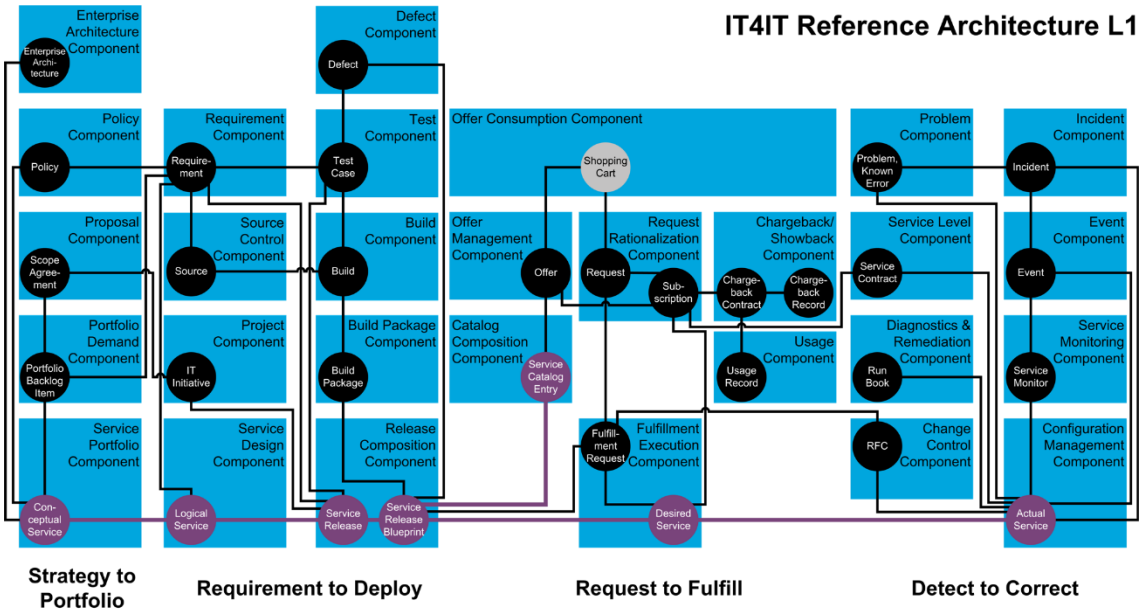

Figure 3. IT4IT Reference Architecture (The Open Group, 2017)

Software is becoming ubiquitous and people expect more and more from it. Technology is a commodity and the value come from what we create with it.

3 OPERATIONAL ENVIRONMENT

Nord Pool is a Nordic energy sector professional service provider whose main services are electricity exchange marketplace services. The company has offices in the Nordic countries and in several Central European countries. The headquarters and operations are in Norway and the product development unit is primarily in Finland. The majority of owners are the government-owned Nordic transmission system operators.

The customer base consists of major electricity producers and consumers who sell and buy electricity in real-time markets. Nord Pool employs approximately 120 professionals.

The energy markets are being re-shaped in Europe due to changing European Union regulations. These regulations are designed to increase the competition and all the existing market participants must adjust and adapt. Nord Pool is the original operator in this market and it wants to stay there. It is very important for the company to be able to stay competitive in this changing landscape.

These items are collected by the researcher's personal study of the organization. This means the results could be biased towards the IT and product development organization in Espoo. As the main goal is to find out how to ensure Nord Pool product development stays competitive in the future, this bias does not conflict with the goal too much.

3.1 Strong growth and strategy change

The personnel count in the company was much smaller only few years back. Originally most of the employees were domain or project experts and much of the IT development work was outsourced to external vendors. This allowed the company to focus on its core business.

In 2015, the company started a program to modernize its platform to *"maintain Nord Pool Spot's leading market position and ensuring the company can quickly, and with agility, respond to market opportunities"* (Nord Pool internal project documentation). This new program meant a clear strategy shift on IT operations and company began to hire more developers and decrease the use of external vendors. Organisation structure changed, and the Finnish office became a main product development hub.

Strong growth and change are always struggle for any organisation. At Nord Pool the team structure, organization, and procedures have changed multiple times, and this has caused some temporal inefficiencies as people have adjusted to the change. There have also been personnel changes due these changes.

Strategy change program acknowledged the huge effort it would take. In the program documentation it is stated as following; *"[X] is an ambitious, disruptive program of change that is taking NPS [Nord Pool Spot] on a journey of discovery through all areas of the company and all aspects of how the company lives and breathes. It is not only about facilitating and enabling business and technology initiatives but also about introducing best practice and, ultimately, cultural change throughout the enterprise."* (Nord Pool internal project documentation). Now, approximately three years later, these words are still relevant as the company and the individuals are ongoing the envisioned cultural change.

3.2 Project management maturity

The project management maturity level assessment was done as personal evaluation exercise as there was no official auditing available. Resulting maturity level approximation for Nord Pool product development organization is 2 on CMMI scale when this thesis began. This means that processes are in place and followed and the organisation has dedicated people to guide and follow product development process. (Chrissis et al., 2010, p. 23-30.)

Process development within the company is ongoing and during the time span of this thesis, there has been continuous effort to improve the processes towards the next desired maturity level. Service development projects are placed in common portfolio and release management is done at portfolio level.

All technical teams follow the same two-week agile sprint cycle. Development is done continuously, and features are pushed to testing and quality assurance environments. Production releases are less frequent as they go thorough longer acceptance testing phase. Deployments are automated, and they use the same development pipeline.

3.3 DevOps maturity

All core software projects have implemented a deployment pipeline automation, so the DevOps foundation is already set. Reception has varied depending on individual preferences and interests. A selection of active projects was studied against Solita Test for CD maturity scale (Figure 4), which rates deployment processes in 5 areas; test automation, quality, build and deployment, running and monitoring, typical lead time. Projects at Nord Pool score in average 2 out of 5. According to model used, that gives a typical lead time of 2-4 weeks. Indicated lead time is in harmony with the practice. In the survey conducted by the model authors, the mean continuous delivery maturity level was 2 and aimed maturity level was 3. This places Nord Pool in typical position of continuous deployment process adaptation. (Virtanen et al., 2017)

	Test automation	Quality	Build & deployment	Running & monitoring	Typical lead time
5 ★★★★★	• HA tests • Tests run in parallel	• A/B testing • User analytics direct QA measures	• Continuous delivery to production • Build promotion procedures • Zero-downtime deployment • Scripted, one click rollback (incl db)	• Application performance monitoring • Automated application usage auditing • Radiator for application usage (business value)	**< 1** day
4 ★★★★	• Automated test reports and trends • Automated performance tests • Automated security tests	• Zero defect policy • Root-cause analysis • Fail proofing	• Continuous deployment to customer QA environment • Monitored Customer QA environment • Environment configuration in a separate version control repository	• Application team rutinely inspects logs • Automated alerts based on application logs • Server performance monitoring	**1-5** days
3 ★★★	• End-to-end tests • Browser based end-to-end tests	• Exploratory testing methods • Prototype based design verification • Go & See	• Build radiator • Scripted deployments to QA • Configuration is documented • Controlled DB migrations	• Client side error logging to server • Team has access to production logs • User statistics collection and analytics	**1-2** weeks
2 ★★	• Integration tests	• QA environment matches production • QA process is well documented	• Separate build server • CI build process triggered automatically by new commits	• User action logging (audit trail)	**2-4** weeks
1 ★	• Unit tests	• Customer QA, acceptance test step before production	• Version control	• Basic logging: error, access	**> 1** month

Customer = Client company that employs a Services company to build a solution
Customer's customer = Usually the actual end user of the solution
Deployment = Fully automated delivery with no human intervention
Delivery = Automated delivery with human triggered step(s)

Figure 4. Solita Continuous Delivery maturity scale (Virtanen et al., 2017)

At Nord Pool, the current strength areas are “build and deployment process” and “running and monitoring”. Test automation and quality have both been lacking behind but there have been improvements in recent months. Investing in quality and test automation would benefit the company in improved reliability and customer satisfaction. Virtanen et al. found the biggest benefits of improving CD maturity were better efficiency in form of reduced amount of work, improved reliability and bugs would be found earlier. The same results listed biggest obstacle as being company culture lacking support for improvements. (Virtanen et al., 2017)

Similar results were found in 2017 State of DevOps Report, which concluded high-performing organisations spent 21% less time on unplanned work and 44% more time on new work compared to low-performing organisations (Forsgren et al., 2017). It is hard to place Nord Pool in the results, but rough estimate is medium-performer on three-step scale.

3.4 Business environment

Upcoming EU legislation is forcing local monopolies all over Europe to open electricity markets to competition. Like its central European competitors, also Nord Pool has been in monopoly position in its home region. The whole power exchange market is moving towards shared market under the XBID project (Entso-E, 2017). Also, Brexit and its implications to EU markets are yet to be seen. UK may be excluded from EU power markets after Brexit (S&P Global Platts, 2018). These kinds of big political moves affect the markets and all players must be flexible enough to adjust their operations. That means core IT systems must be flexible because everything works digitally in modern marketplaces.

Another megatrend is continuous movement from big fossil fuel or nuclear powerplants to smaller distributed renewal sources. IEA (2017) reported this year that *“wind and solar photovoltaics are currently the fastest-growing sources of electricity globally”*. For a power exchange this means increased flexibility requirements as renewables are less predictable sources than traditional ones. Market operators should be able to launch new services for new business models.

3.5 Technology changes

Nord Pool's IT portfolio contains over 200 components which have different history. This means there is a need for continuous maintenance work on keeping these codebases in good shape. Many microservice components have changed their ownership inside the organisation over the years. This has led to some confusion on their naming and maintenance responsibilities.

Some components haven't been updated for a while and they are starting to cause maintenance headaches. In practice, this means older software versions with bugs. These older versions often have unique build dependencies that must be maintained while most projects have already moved to newer workflows. Legacy build dependencies make it harder to maintain lean continuous deployment pipelines as they add extra dependencies and exceptions. Migrating legacy projects to new workflows is ongoing project on its own.

3.6 Roles, responsibilities and technical leadership

Nord Pool changed its CEO and CTO during winter 2017/2018 and began to reorganise part of its business due to changing European Union regulations during spring 2018. Organisation restructuring was announced to public in May 2018. These changes have left the organisation in somewhat waiting state for the new leadership. The organisation still works, and it has set direction and goals, but it is evident that people are waiting for the leadership positions to fill up.

In spring 2018, company announced the new CEO would start in June 2018. The reorganisation will also be effective in the same month, June 2018. To ensure easier change, Nord Pool must have a defined mission that employees are engaged to and a culture of open communication (Easter & Brooks, 2017, p. 2).

How these new leaders affect the organisation and its ability to produce competitive services? It depends of the individuals who will be elected to key positions. Those choices have huge impact on how successful the organisation will be.

3.7 Distributed teams

Nord Pool has offices in multiple countries and this causes gaps in communication between locations. It is therefore important to pay attention to how projects are run across the distributed teams. Time zone differences are negligible as the countries are close to each other's. Based on research, teams should have basic communication norms, role clarity and interpersonal trust in place to speed up the team-formation, which would lead to effective teamwork (Henderson et al., 2016).

Almost all Nord Pool employees have the possibility to work remotely, except for trading desk operators. Based on the survey to Espoo office employees conducted in November 2017, 45% of the respondents (18 out of 41 respondents) work remotely at least one day per week (Nord Pool Espoo Office Survey). This is in line with 2017 US survey, which reported 43% of employed Americans worked remotely *"at least some time"* (NYTimes, 2017).

3.8 Risk, vendor and asset management

Nord Pool has corporate level risk management processes in place that are handled by compliance and legal teams. Due to fast growth in IT operations, there are currently not unified IT risk management processes enforced in daily work. This is one obvious development area that requires attention.

Before bringing software development in-house, external vendors were managed by project basis. Now when most of the development is done within the organisation, vendor management has become less clear. All remaining vendors should now be managed by a dedicated team to keep the whole situation together. The current situation may cause inefficiencies and extra costs. Asset management in IT is in similar shape, where the whole situation needs a common governance. There has already been progress in these regards during spring 2018 where all IT assets have been centralized under one team.

Possible approach could be combining vendor management and IT asset management teams to handle all contracts, licenses, user accounts and access rights for both internal and external parties. The same team could also handle IT security coordination. Having a dedicated team to focus solely on these issues would help the organisation manage risks and prepare for further certifications and audits.

3.9 Skills and knowledge management

Large growth has caused increased recruitment and the organisation now has people with various backgrounds. A variety of people is vital for a functional and adaptive organisation, but it can also cause problems if people do not have the common competence baseline and common language. Fortunately, Nord Pool has a good selection of training for all employees and dedicated people who govern these activities. To further strengthen the skills, there needs to be more structured training paths. This work has been started in fall 2017.

One important training area in the future will be IT security training for all employees. That would ensure everyone have the basic skills. Developers and operations would receive extra training to be able to create secure services that can stand against ever-increasing security threats. This work began in spring 2018.

4 SURVEY

Organisations are complex systems which have their own unique behaviour. To find out what are the driving forces within Nord Pool, a survey was conducted across all employees.

4.1 Goals and methodologies

As a recent addition to the organisation, I did not have deep perspective of its intricacies. Therefore, I had to start from assumptions for my research questions and see what I could discover from the answers I received. This is often the case with qualitative research (Hirsjärvi et al., 2009, p. 125-126).

The main question of this thesis is “How to ensure Nord Pool product development stays competitive in the future?”. This question was then split to four sub-questions which act as a grouping factor for the survey:

- How to make roles and responsibilities clear?
- How to create motivated teams?
- How to build effective feedback loops?
- What are the current strengths and weaknesses within Nord Pool product development?

The selection of sub-questions was based on personal empiric experiences and literacy. Role and responsibility clarity has been proved to be important factor for effective organisations (Henderson et al., 2016). Motivated teams consist of people who have their own personal motivations aligned with team work (Martela, 2015). Effective teams also have psychological safety (NYTimes, 2016) and trust (Henderson et al., 2016) in place.

4.2 Survey practicalities

The amount of questions in a single survey must be limited to get the response rate high enough. For this survey, the limit was set to 30 questions. The survey platform also estimates the time to fill the survey, which was set to 15 minutes for this survey.

The survey was piloted by a small group of employees before sending it to wider audience. Pilot survey helped reveal ambiguities in questions and the wordings were adjusted to more precise based on the feedback. Also, the ordering was adjusted slightly to better handle the question narrative. The final survey was conducted in February 2018 and it was open two weeks. The link was sent to all Nord Pool employees via email and company intranet.

4.3 Survey results - demographics

The total number of respondents was 63, which is about half of the employees. The survey had two demographics questions; job function and years employed at Nord Pool.

If we have a look at the job function demographics in Figure 5, we can see the number of people from each department who have answered the survey.

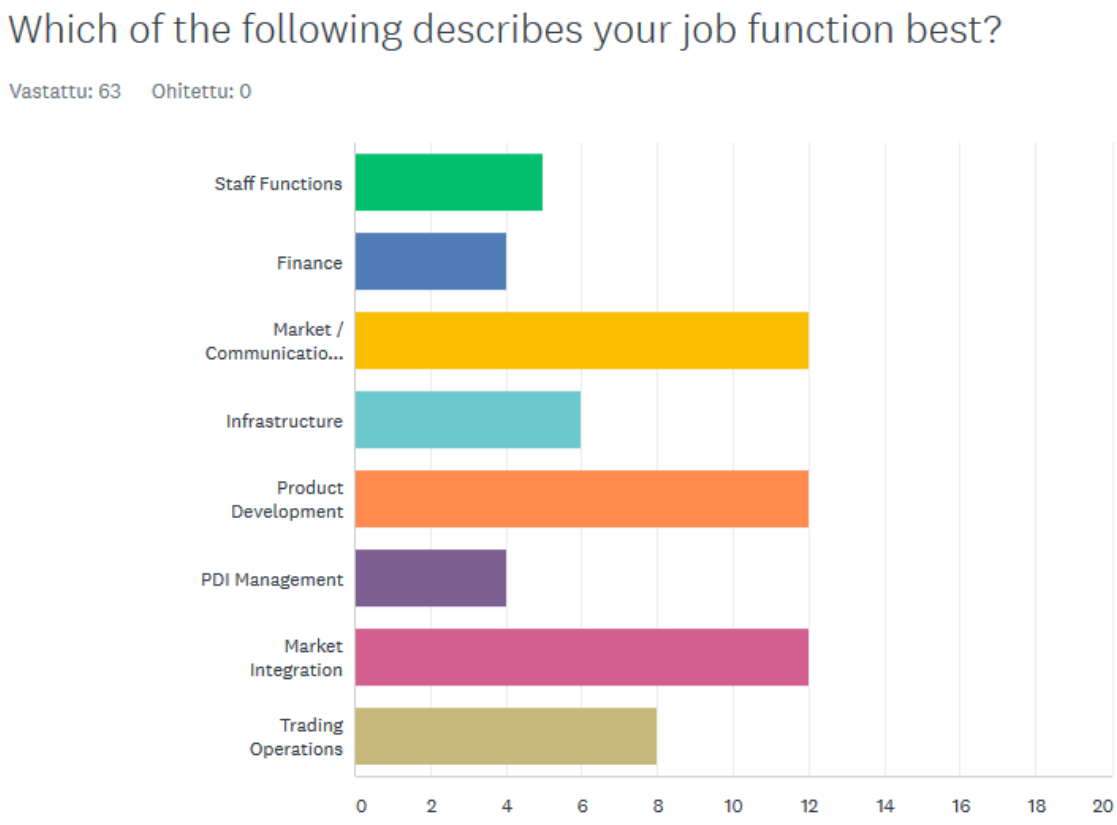

Figure 5. Job function

As the company itself is not that big and the participation is about 50 per cent, the job function pools are not large either. This will make it hard to achieve statistically significant results if we cross-tabulate with them. The good news is we have answers to every job function and can check if there are any trends visible.

The second demographics is employment years at Nord Pool, which is shown in Figure 6. There we can see the recruitment speed has increased in the last few years. Approximately half of the people who answered to survey told they have been in the company less than three years. Nord Pool has grown a lot and these figures tell the growth rate has increased recently. Another interesting finding here is the fact there are still many employees that have been in the company for over ten years.

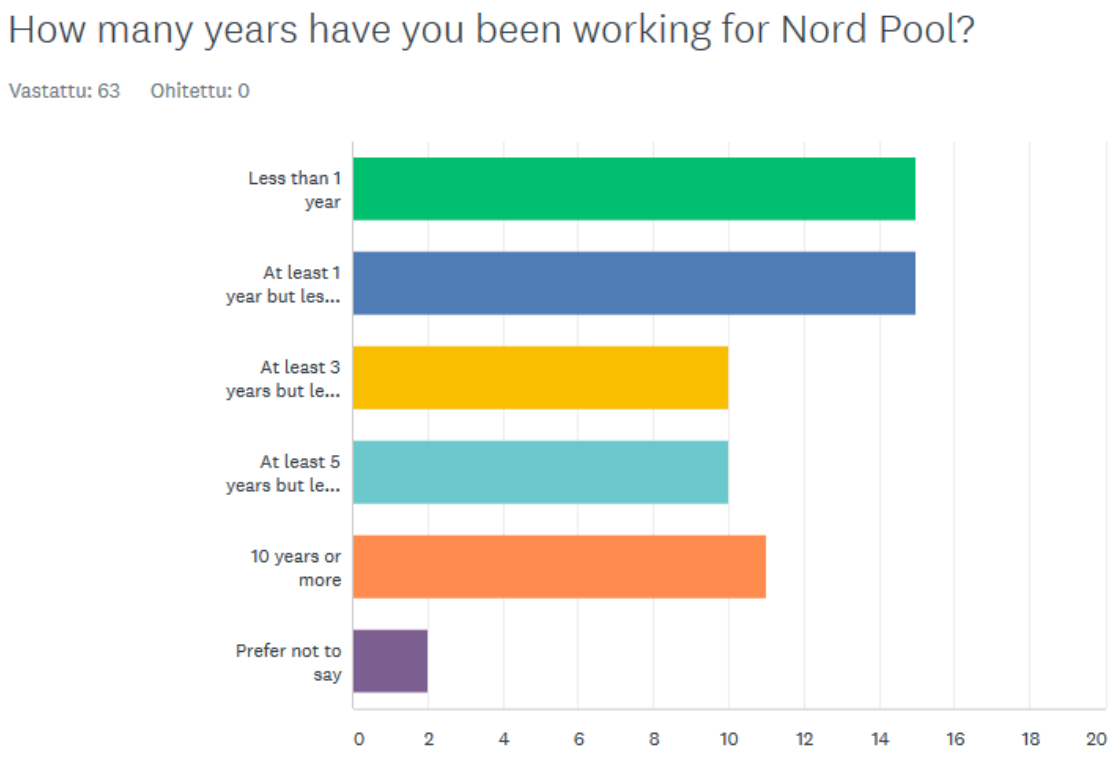

Figure 6. Working years at Nord Pool

Extra demographics question in the survey asked the total working years of the employees. It was included as it gives additional perspective on how experienced the employees in the company are and if it shows in further results. Total working years are shown in Figure 7.

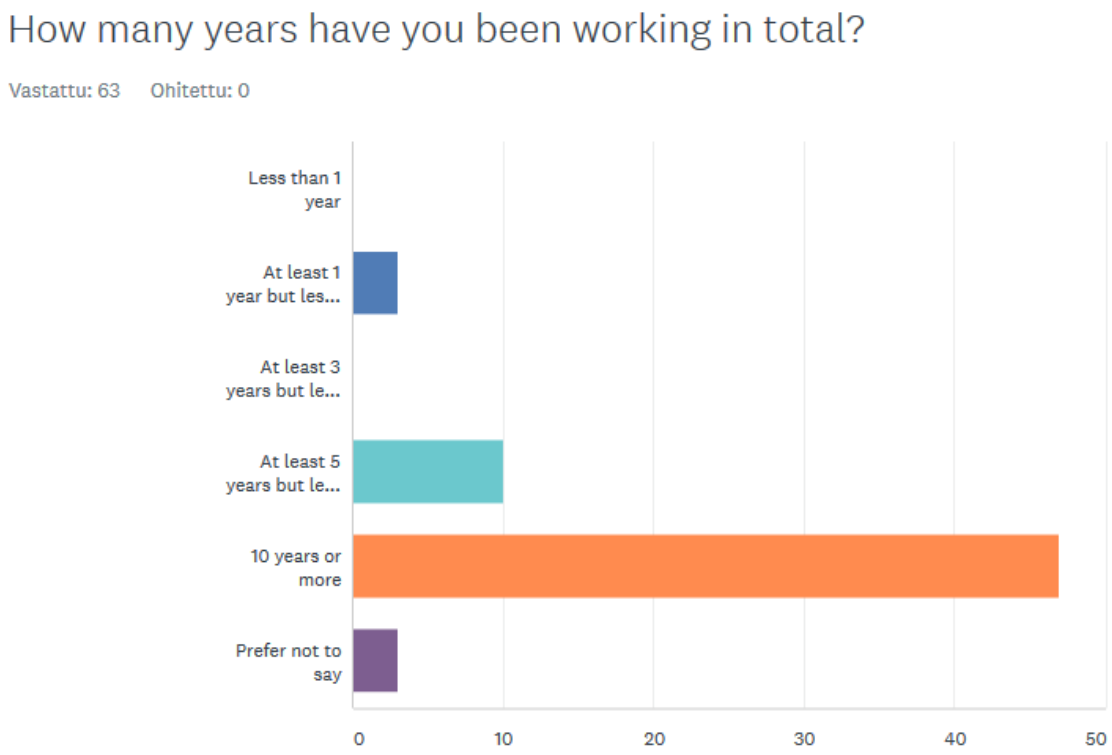

Figure 7. Working years in total

Based on these answers, employees at Nord Pool are generally well experienced as 75% of the survey respondents tell they have worked at least 10 years in total. This means quite experienced people were hired. How experienced the longer-term employees were when they joined the company, this question does not answer. In retrospective, this survey question should probably have been numerical input.

4.4 Question: How to make roles and responsibilities clear?

To investigate the clarity of roles and responsibilities, there were two main questions. The first was about the clarity of expectations given to an employee. Looking at Figure 8, we can see most of the results indicate the expectations are somewhat clear. About 20% percent answered their expectations are not clear, and that is something the management should improve. When cross-referred to demographics, these answers were quite consistent amongst different groups.

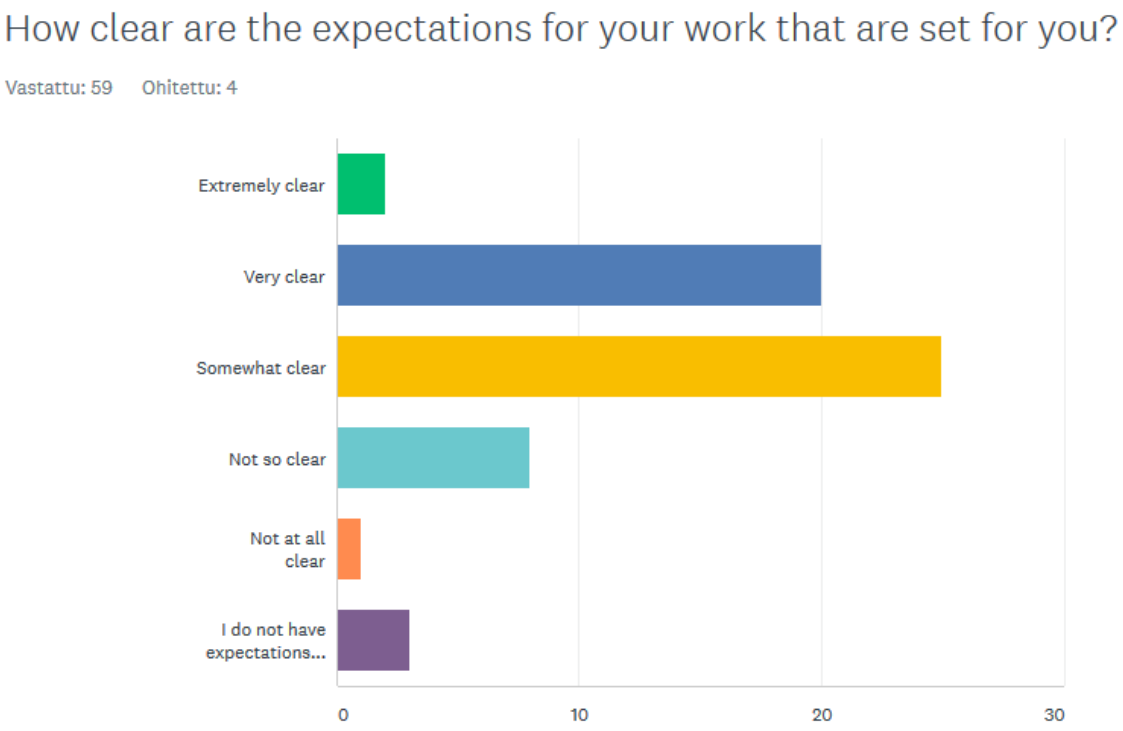

Figure 8. Clarity of expectations

The second question about responsibilities was how well people understand their work impacts the organisations business goals. 95% of the answers were either “Strongly Agree” or “Agree”. Another question asked if people are inspired to meet their goals at work and that had similar agreement levels of 90%. That indicates Nord Pool has succeeded to convey its business goals to employees, which is a good thing. Another survey question asked how well employees formal job description correlates with their daily work. Most of the answers (70%) said their formal job description somewhat matched their daily work and 30% did not. This is something HR should investigate, and update employees work descriptions.

4.5 Performance metrics

People were also asked their feedback what the most important success measures for their work is. Common themes were *customer feedback* and *quality*. At the same time, most of the responses (60%) said the current performance metrics for their team did not measure well their actual performance. The organisation does have one generic set of performance metrics that is used to calculate company-wide performance. Based on

these survey results, most of the teams do not have performance metrics that correlates with their actual work performance.

This reason of the mismatch between official performance metrics and practical team performance could be the ongoing strategy and culture change in the company. Or it could be a management issue. Whatever the reason is, the metrics should be adjusted to match future expectations instead of past results. Figure 9 shows there are differences in job functions on how well their metrics match their realities. Most of the groups that have lesser matching metrics are the functions which were in rapid growth period and changing management pressure. The whole company has shifted its focus and looking at these results, it has failed to change its performance metrics to this new operating mode.

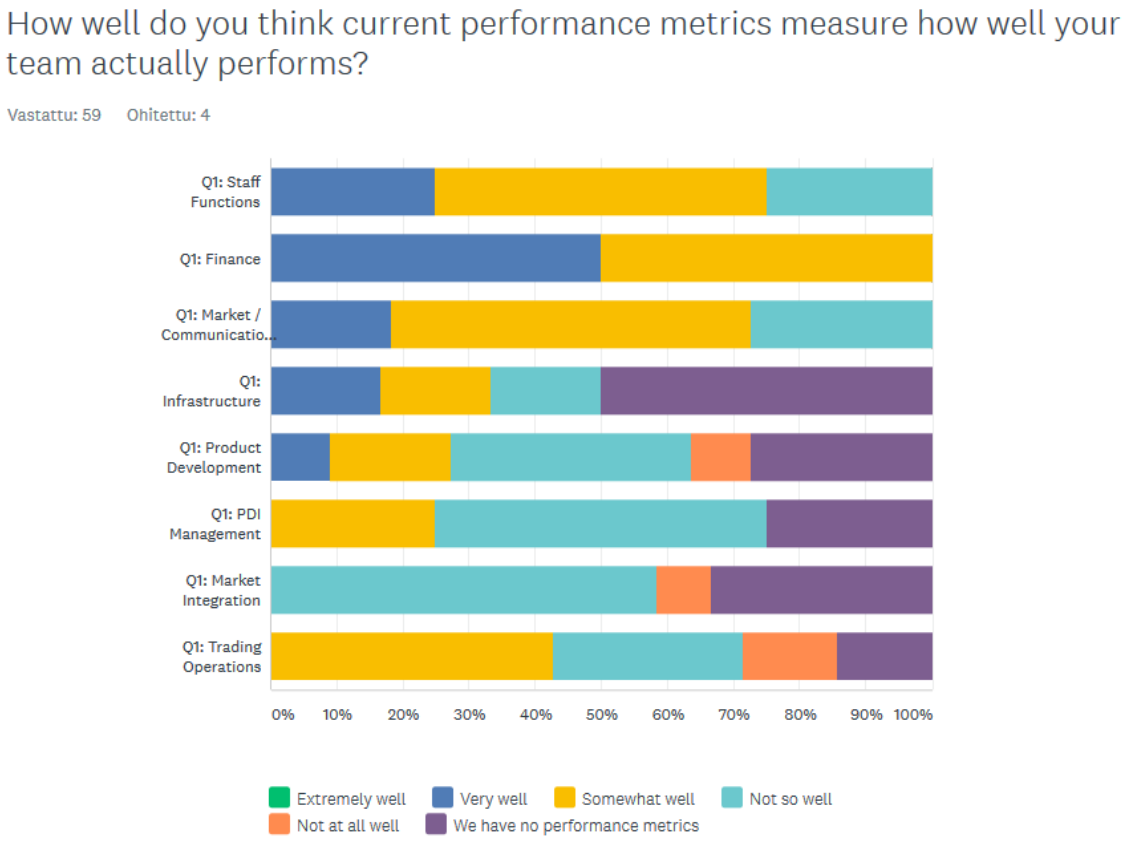

Figure 9. Thoughts on performance metrics

4.6 Question: How to create motivated teams?

The survey had few questions on personal motivation. Researcher Frank Martela describes four elements for human motivation (Martela, 2015). These are:

- Passion (combined from capability and volunteering)
- Overcoming yourself (combined from doing good and closeness to others)
- Acceptance and status
- Physical safety and resource safety

Combined, these elements make a "motivation diamond". The bottom half of the diamond describes the usual sources for external motivators and the top half describe the core needs for internal motivation. The most elementary motivation consists of physical safety and resource safety. These are often covered in modern office world, but they are still not obvious for everyone.

Once the safety issues are taken care of, the order what element people should pursue next is not that obvious any more. For IT industry it is very common that the bottom half of the motivation diamond is solid and well founded, but the top part does not necessarily give enough motivation for people. It is common to pursuit status and acceptance and gather as much resources as possible while doing so. That is the traditional image of a successful IT worker and it is often attached to a strong visionary leader, archetype white heterosexual male. Recent surveys support this. For example, a popular programmer community stack overflow surveys their community each year. Their 2018 survey results show white males (about 75% of the total respondents) usually value monetary compensation, technology choices and professional development the most. Women and non-binary answerers valued office environment or company culture the most. (Stack Overflow, 2018)

Worship of individuals is harmful for the IT industry as it often puts privileged white males before everyone else and causes biases about normality. In even grander scheme it comes to how people are compared on society levels. The 2017/2018 campaigns around the hashtag *#metoo* have shown that we as people still have work to do on this regard. We should treat everyone as equals and resist worshipping individuals.

To get the best motivation from work, it should fill most of the top half of the motivation diamond in addition to bottom half. If a certain job position offers its workers only status and resources without additional motivation, the people won't thrive in that job. The more upper half boxes a work can fill, the more motivated and thriving employees could be.

The first question mapped intricate motivation and its results are in Figure 10. About half (55%) of the responses were *“Doing interesting, challenging work that gives a sense of*

accomplishment", which suits well to a technology company. If we look at the results cross-referenced by job function, we can see there are differences on what motivates people.

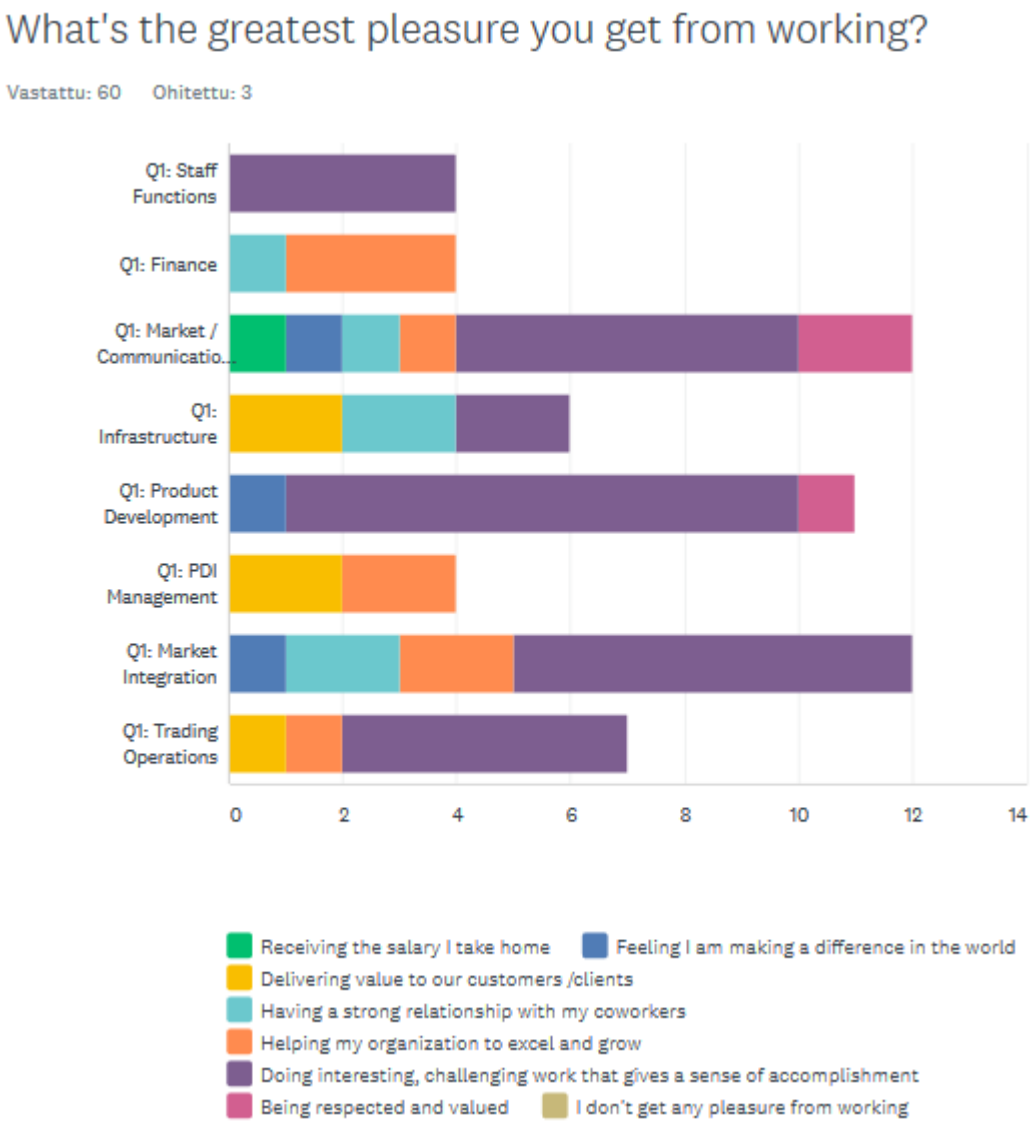

Figure 10. Pleasures from work

The weakness of this question is it allowed people to select only one choice. Further evaluation of Nord Pool employees' inner motivation would be a great exercise for the HR and management teams. The good part is nobody answered they don't get any pleasure from working and only one answered receiving salary was the main pleasure.

Next questions were about safety. Figure 11 shows how people feel their contributions are recognised. Very good finding is nobody answered their contributions are never recognized.

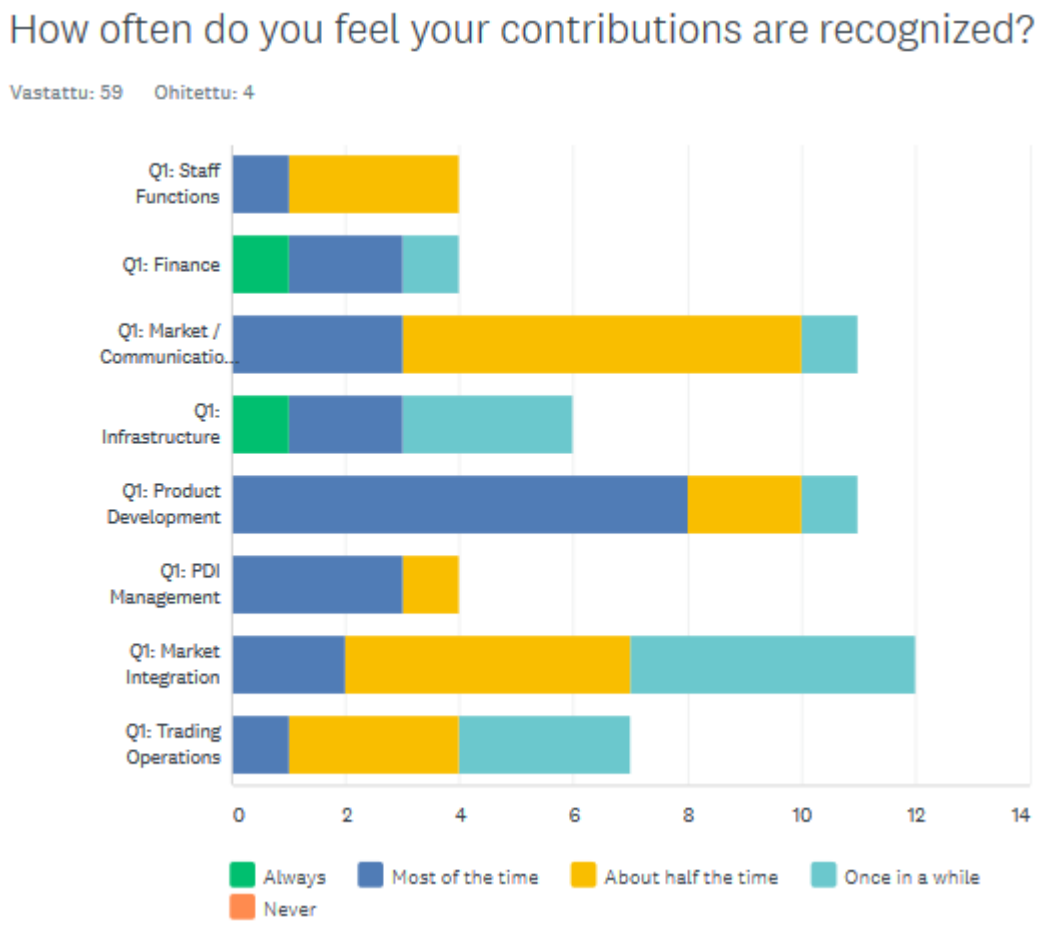

Figure 11. Recognition of contributions

The next Figure 12 shows how comfortable people feel voicing their opinions. Its results are in line with previous graph on contribution recognition. If people feel their contributions are recognised, they are more comfortable voicing their opinions and vice versa.

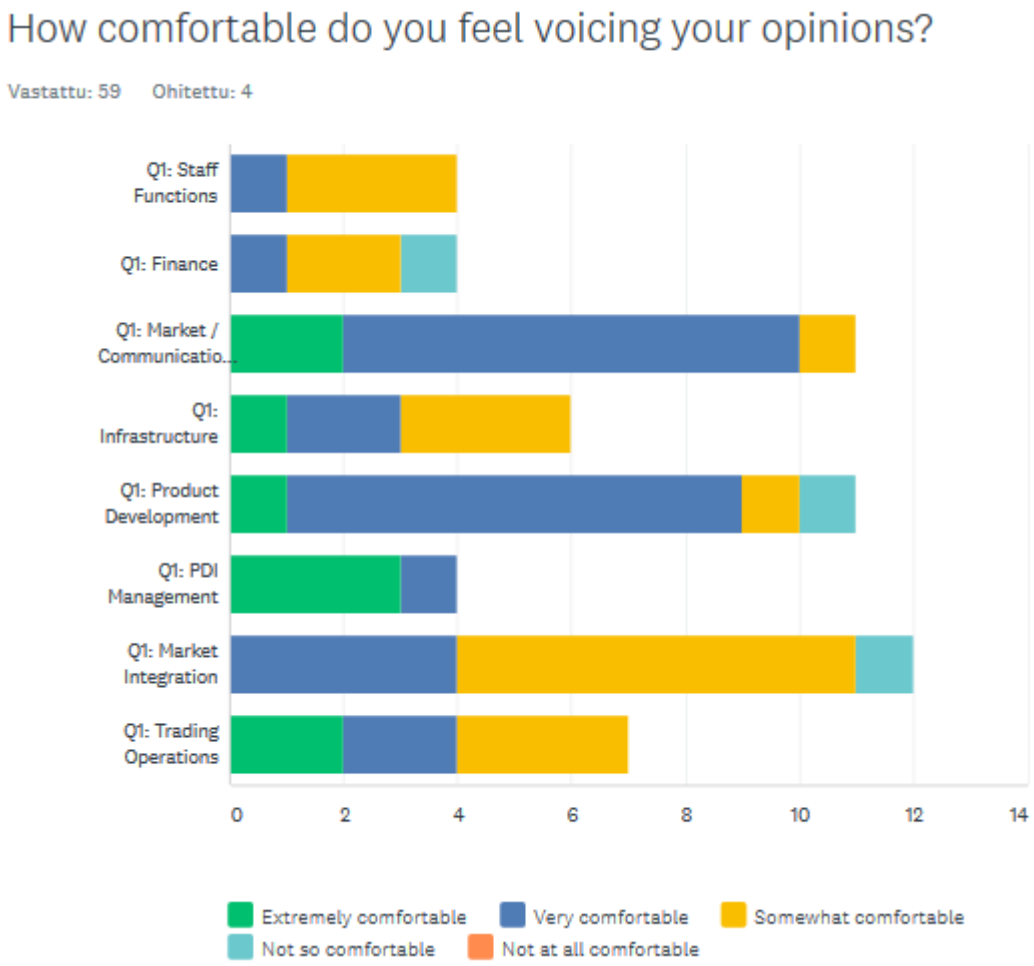

Figure 12. Comfort of voicing opinions

How people feel voicing their opinions and feel their contributions are recognised has an effect how well teams work. If we look at the answers in Figure 13 on how well people think their teams work together, we can see similar patterns.

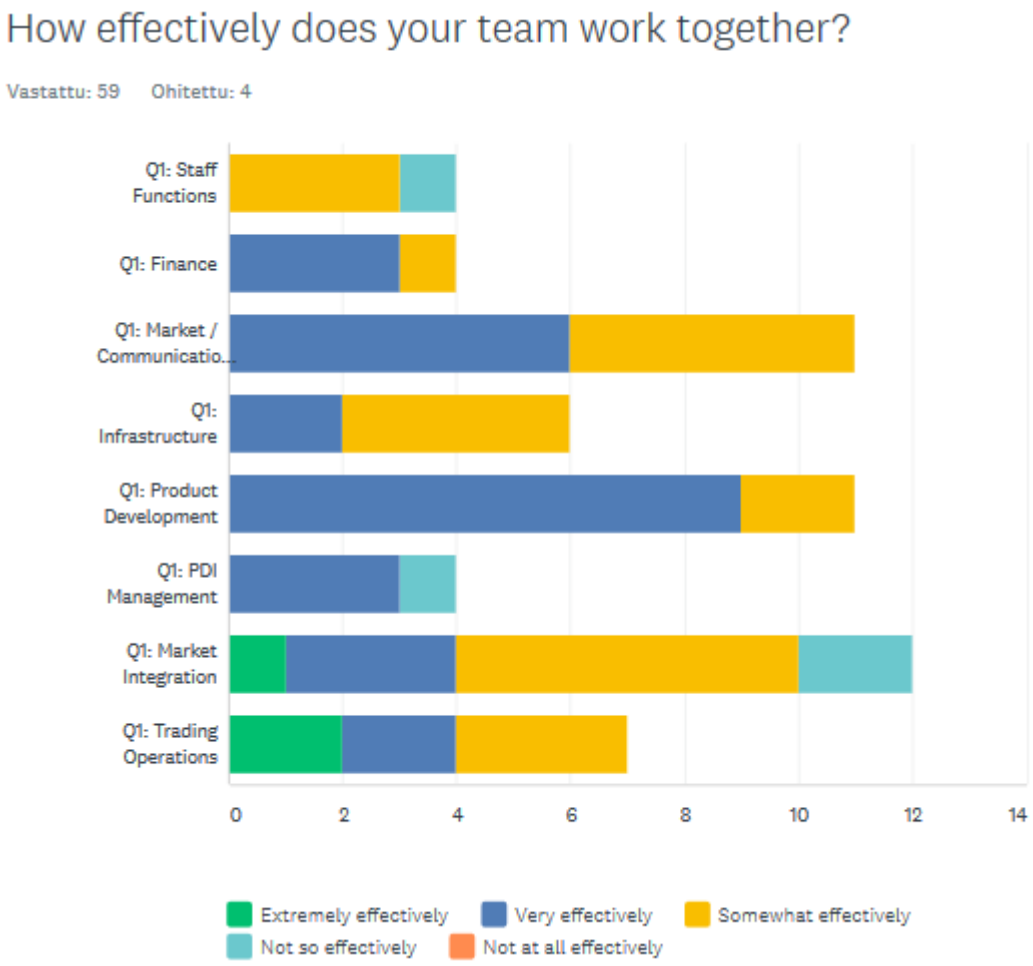

Figure 13. Team work efficiency

Based on these results, there is a direct connection between how safe people feel voicing their opinions and how well teams work together. In 2016 Google did a research on what makes a well-functioning team, they got the same results (NYTimes, 2016).

Nord Pool should investigate its management practices to make sure all employees have psychologically safe working environment where they can voice their opinions safely. Otherwise the company risks losing its potential due to decreased operational efficiency and higher employee turnover rate. Internal dysfunctions within a team often shows outside the team as well and that means the customer experience could also be compromised.

4.7 Question: How to build effective feedback loops?

Feedback loops in this context mean working communication between individuals and teams to convey important messages that could be used to improve the operations. It is also called communications norms (Henderson et al., 2016).

Modern world has many methods to communicate with and each person has her own preferences. People were asked to select their preferred communication methods and the results are in Figure 14.

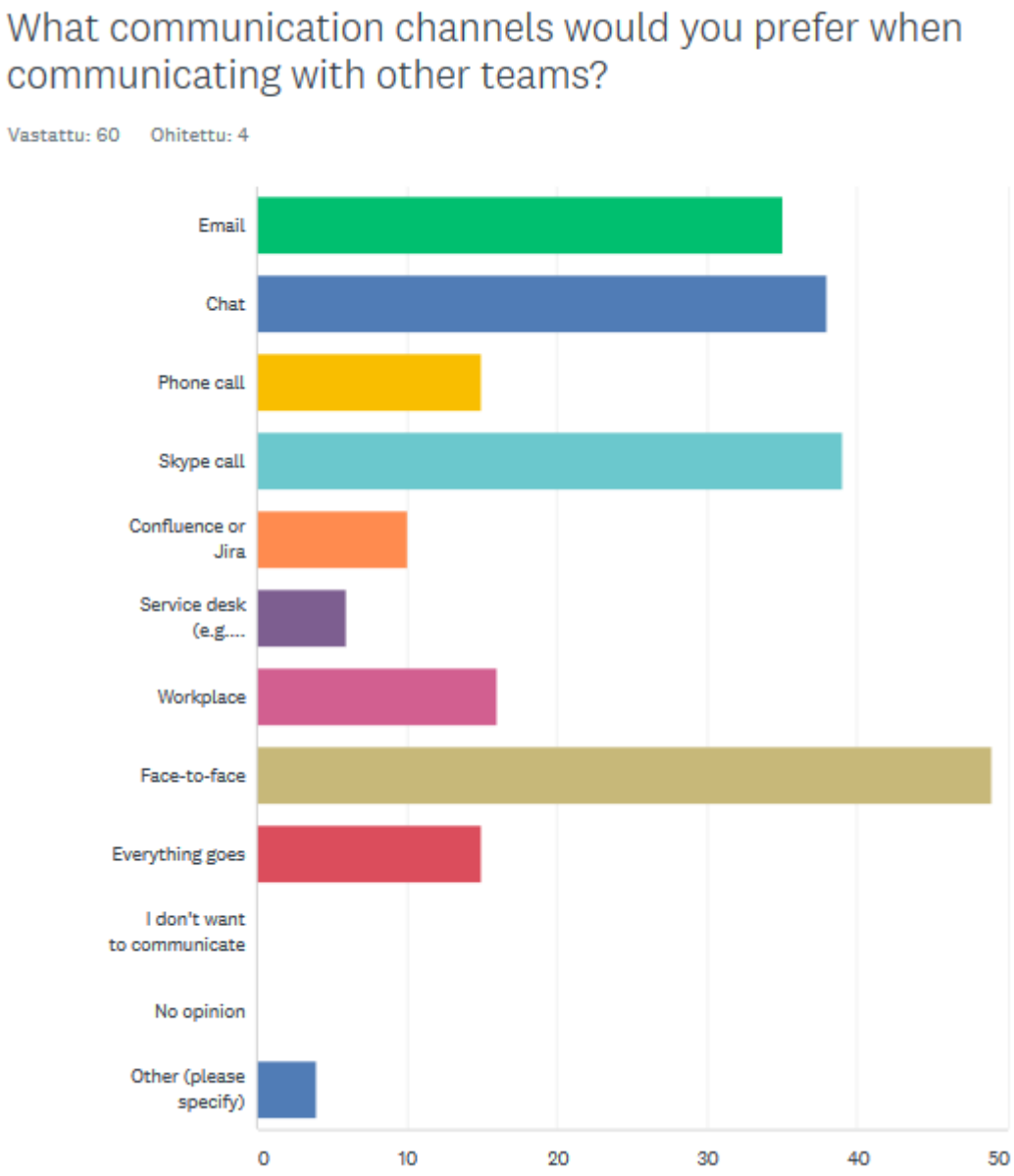

Figure 14. Communication channel preference

The most preferred communication method was face-to-face, which is not surprising. Humans are social beings and face-to-face communication is still the best way to convey the message and solve possible issues on the spot. The downside of it is it often interrupts other tasks, especially if done ad-hoc and without preparation from the receiving party. Face-to-face communication is efficient, but it requires established rules everyone should follow so it won't cause more damage to efficiency than it gains.

Other popular methods were Skype call, chat and email. Skype is the default online meeting platform at Nord Pool and people are familiar with it. As the company has its offices in multiple countries, online collaboration is often the only way to contact people. Email communication is the traditional method in corporate world, especially between companies.

Having chat high on the list tells people want to communicate in an asynchronous way where you don't have to interrupt the others right on the spot (especially face-to-face) or lose your message in a pile of emails. Modern chat tools provide easy collaboration within different groups and it's easy to share different media with them. Nord Pool has had multiple chat platforms in the past and during this survey it was decided to migrate chat activity to one platform available to all employees. This will probably make it easier and more efficient to communicate between teams. The new chat platform is now available to every employee and it was already used during a big service launch. Time will tell how the communication flows in the future.

Having communication norms aligned within the company would help the whole organisation perform better and have better job satisfaction (Henderson et al., 2016). To find out what the current communication flows are, one survey question asked which organisation functions the people communicate with. The results are in Figure 15 and they show teams are collaborating with each other quite well.

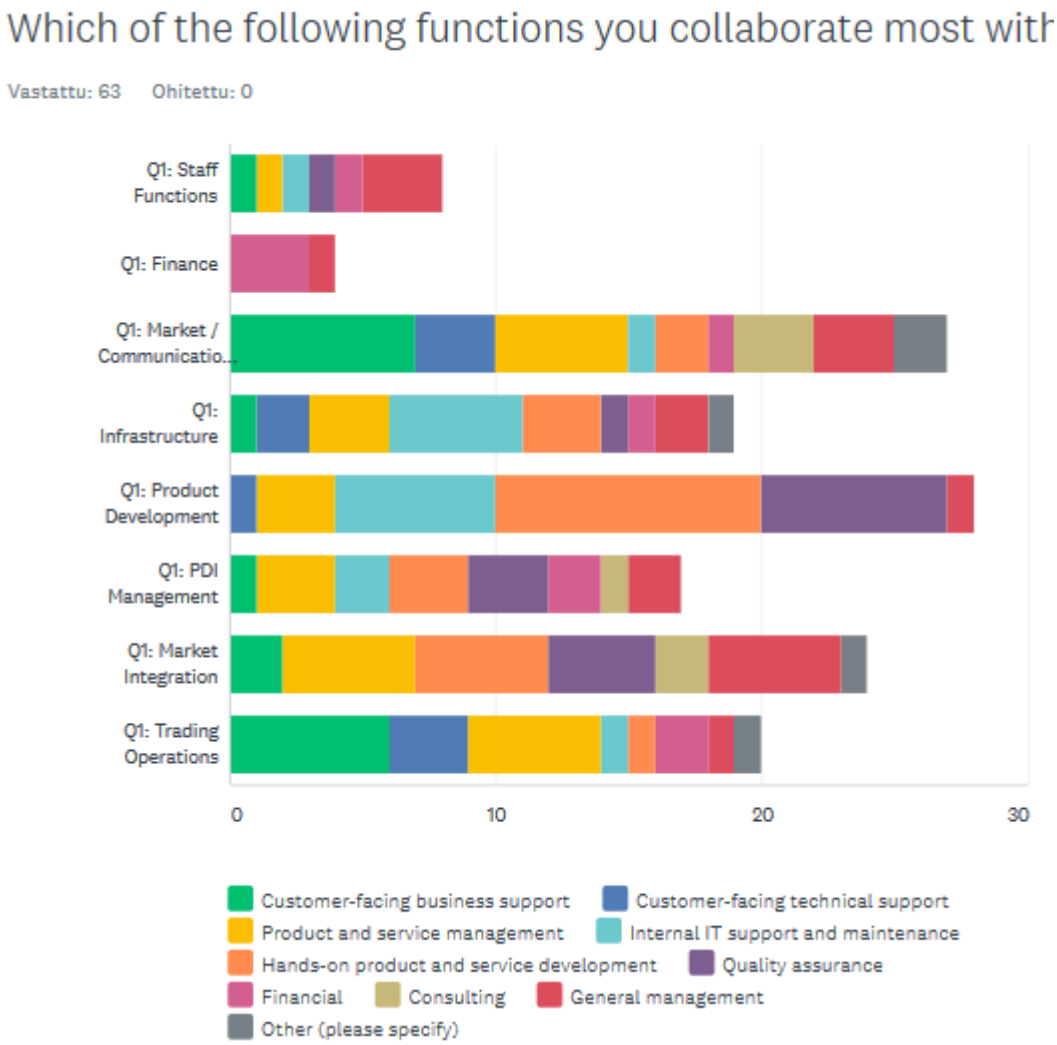

Figure 15. Collaboration between teams

If we take the data into the graph visualisation tool (Gephi), we can build a visual map of communication flows. The answers were converted to CSV format and imported to Gephi as nodes (groups) and edges (collaborations). Edge modularity was calculated using default Gephi algorithm (Blondel et al., 2008) with resolution value of 1.0. Resulted modularity was 0.246 with 4 communities. The results are visible in Figure 16.

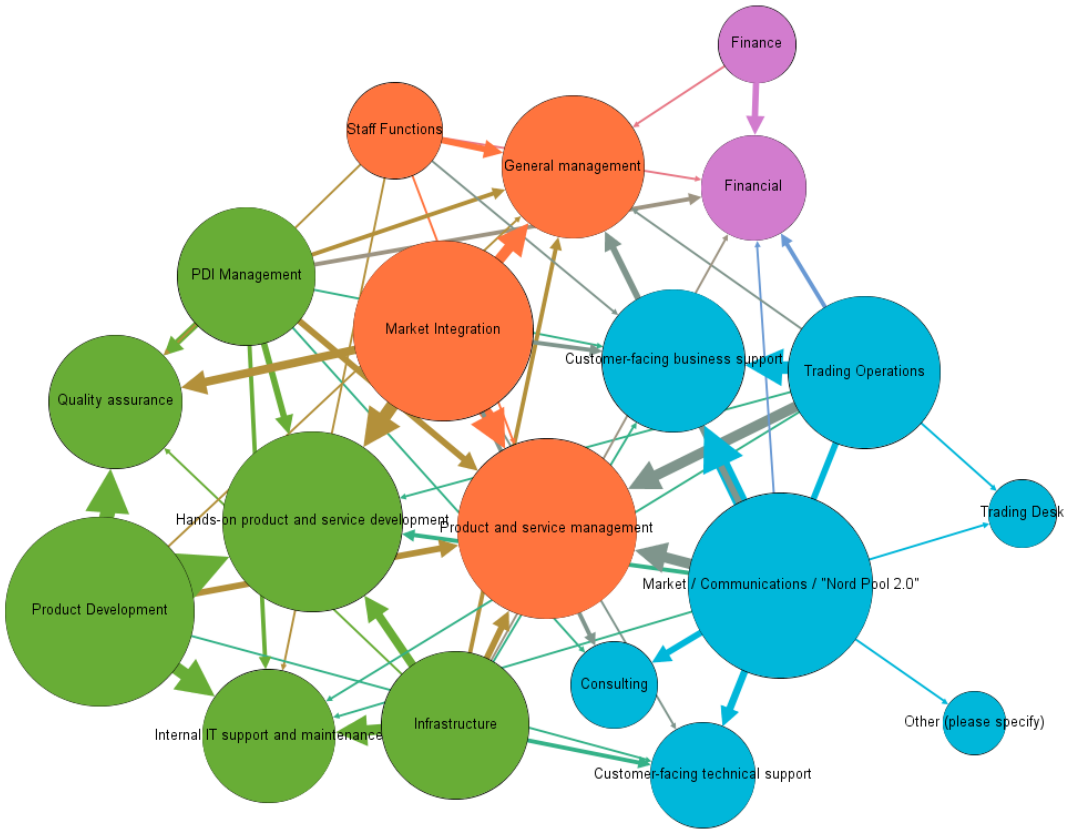

Figure 16. Collaboration graph

These calculated modularity results based on survey answers follow the actual organisational boundaries. Split between functions that are in different geographical locations are clearly visible here. Most of the projects within the organisation are done with a distributed teams and clarity of communication is important factor for both project satisfaction and performance (Henderson et al., 2016).

When asked how well people think the communication between teams work, 50% of the respondents said the communication does not work well (*"not so well"* or *"not at all well"*). There was a slight positive correlation on how well people think their team worked together but that is not statistically significant due to small answer sizes. People also

measured the overall service quality to one step worse if they answered communication did not work well. The same theme was also visible on free-text answers.

On team level this was most evident with “Market Integrations” team, which had all answers negative on how inter-team communication works. Looking at the Gephi-generated communication graph in Figure 16, that means one of the central party in cross-organisation communication flow thinks the communication does not work well. The current role of Market Integrations team is to act between customers and different internal functions. Based on these results, there are urgent needs to establish common communication norms between teams.

The company is currently ongoing an organisation restructuring that will separate Market Integrations team to another legal company in 2018. The split is done to anticipate European Union regulations that may require such change. How this changes the internal communication within the departments remains to be seen.

To find out how people are addressing IT issues, survey had question where people turn for tech support. Results are shown in Figure 17. Based on results, most people are somewhat used to figure out issues that require tech support by themselves or asking their team. Asking IT support is common as there could be issues that require deeper knowledge or more administrative access rights. One thing here to improve operations is to share knowledge between teams with training and provide self-help IT support in form of knowledge base or documentation.

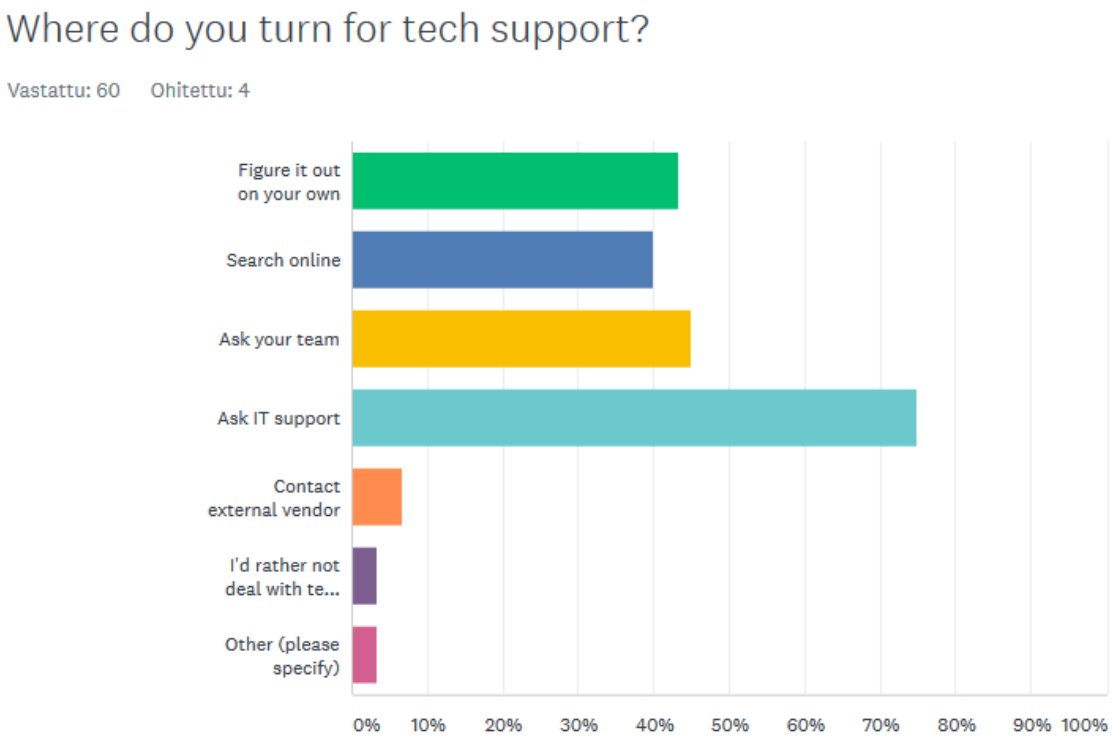

Figure 17. Tech support contact

Another question that maps the same thing asked if people know where to seek help. If we have a look at how different teams answered to it in Figure 18. Most of the teams seem to have some gaps in knowledge and were not completely sure where to seek help. This could be an indication of unclear responsibilities or broken communication between teams. Roles and responsibilities inside Nord Pool should be made clear so people would know where to seek help.

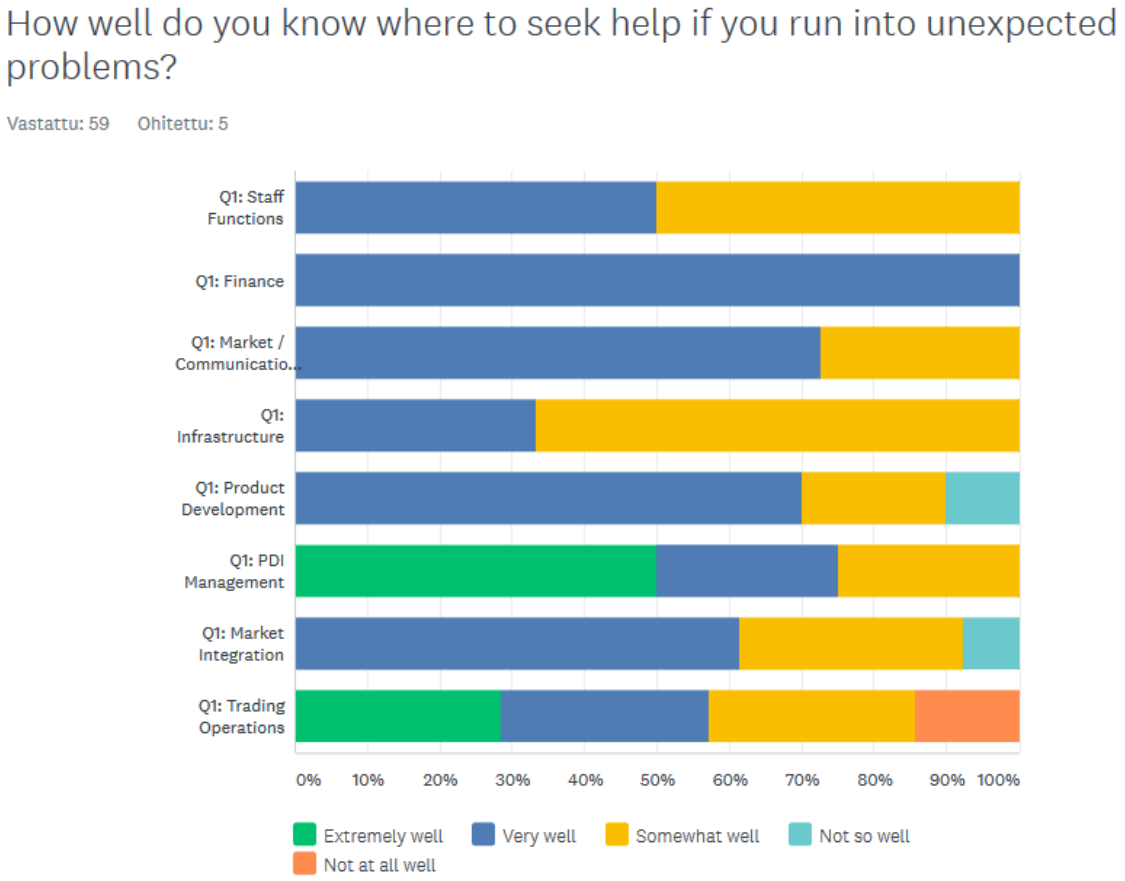

Figure 18. Help seeking preference

4.8 Question: What are the current strengths and weaknesses of Nord Pool?

Survey attendees were asked how often product quality and deadlines were in conflict. The results in Figure 19 show the opinions on this are mixed. Some teams have higher than average percentage of answers that say product quality is lowered because of deadlines. The discrepancy here might be caused by different mindset about quality and expectations. Nord Pool should have a common agreement on quality and development teams should have unified definitions of done for every feature set they are developing. This would help to get everyone on product development on the same page what “good quality” does mean.

In real-world business environment, some compromises are done all the time to get products and services into production use. In lean software development model, this is called “minimum viable product” which is polished after its initial launch. Start-up world even has an adage, which goes like “if you are not embarrassed of your service at launch

time, you launched too late”. In that regard, even if people feel the quality compromises happen too often for their personal taste, it is very often part of normal software business. Nord Pool did have a big service launch right after the survey was conducted and it may influence the results.

Figure 19. Product quality compromise

Major compromises on product quality may end up causing production incidents or customer feedback. Compromises could also be internal kind, causing increased effort on development or maintenance. In best case, people could consider lack of polishing as compromise on quality. It depends on the base level of quality set in an organization. If the base level is low, any compromise on quality may break production systems. On the other hand, if the base level is high, end users may not even notice any compromises. It is therefore good to set the base level expectations high enough to prevent negative effects on service quality.

4.9 Open-ended questions

The survey contained few open-ended questions. One question was “what does Nord Pool do really well?”. The answers divided mainly to following groups; domain knowledge (4), customer interaction (7) and employee treatment. The main finding is most of the answers highlighted good customer interaction as strength for Nord Pool. That is vital for the organisations success in the long run. People who gave negative answers asked for increased service quality, training and communication between teams. One respondent wrote; “We really do our best to support customers - I just think people have too much to do and support is not in the job descriptions of most of the people who deal with it”. The answer is in line with the feedback on the clarity of roles and responsibilities. These kinds of negative feedbacks are effectively handled by reviewing employees’ job descriptions.

Another related open-ended question was “what changes would most improve our service to our customers?”. The most common keywords were customer (average frequency 0.200), quality (avg freq 0.092), systems (avg freq 0.08), focus (avg freq 0.077) and development (avg freq 0.074). Several answers highlight the need to standardize internal quality assurance process; “I think the best way to improve our service to customers would be applying quality assurance processes throughout the company” and “A much more organised and structure approach to how we launch products and develop products (and communicate on topics relating to those”. This is a sign that people are willing to provide good quality services to the customers. Other responses highlighted the importance of good communication; “communcation and expectation management”.

Respondents were asked what metrics would be the most important for the company. The most common keywords were customer (avg freq 0.314) and satisfaction (avg freq 0.106). Together these send the strong message that people care about customer satisfaction and want to use it as a business driver. Also, quality appeared in many answers (avg freq 0.071). One respondent put it in context of business; “Use of our tech + personal member coaching to help them [customers] cut down on inefficiency”.

Definition of quality amongst the organisation is a difficult question. If there are no common discussion and agreement on what quality means, there are as many definitions as there are employees. Unless specified, there could not be consensus on terms like quality, which does not have strict definition. Nord Pool should review its Definition of

Done specification, which is a commonly used document in software development. This documentation should then be passed to everyone in the organisation so the requirements for a new features and changes would have crystal-clear definitions.

People in contact with customers wished customer feedback would be distributed wider in product development. Product development did not give much answers to these questions, unfortunately. It would be good to share customer feedback from other teams with development teams to get them familiar with how the end users use and see the services. This is very common within IT industry. One respondent also highlighted the need to share knowledge on releases; “Whenever there is a change to any product or system (update). Education to all employees should be considered to secure good understanding of what we deliver to customers and to be able to utilize new or updated systems to the fully.”.

People whose job included programming (18 answers) were asked their opinion on current build pipeline setup. Based on the results, developers build and deploy their projects quite often but merge code to master branch rarely. Build and deploy frequency is pretty good but merge practices should be reviewed so that merging would happen more often. Statistics from continuous deployment system show that projects have in average 5 deployments to development environments per day in Q1 2018. These numbers rank Nord Pool as “high IT performer” in 2017 State of DevOps report (Forsgren et al. 2017, p. 23).

4.10 Workshops to process selected improvement areas

After the survey results were presented to selected parts of the organisation, there were a series of workshops with various people to discuss changes. Based on these workshops, we identified few areas that would have the most beneficial effect for the whole organisation. These areas are described in the following subsections.

4.10.1 Definitions of Roles and responsibilities

Role clarity is an important factor of work satisfaction and performance (Henderson et al., 2016). After presenting the survey results to the HR department they started a new program to update the roles and responsibilities of the entire staff. The results from this

survey aligned with their previous findings and that convinced them to action. The current plan is to discuss the roles and responsibilities with all employees every six months. The process began in April 2018 and is driven by HR team.

The first round of the role clarification process was executed in April-May 2018 and it resulted in rearranging product development teams and their projects to more logical services. At the same time internal IT team revisited their own operations to better support the business requirements.

At the time of finalizing this thesis, one of the development teams runs short of developers, which slows their development and capability to support their services. There is ongoing recruitment program, but it has not been effective enough. If the company fails to attract enough talent, there may be internal staffing changes and team restructurings due to slow recruitment.

4.10.2 Training and competence management

Nord Pool started a new competence management program in fall 2017. The program started by mapping the competences and knowledge baseline of the staff and finding basic courses that could be used to train people. At the same time the company provides its employees access to web-based technical training service and another service that hosts in-house domain knowledge courses from previous training sessions. Energy markets are very complex systems and it is important for the company to arrange internal training for its employees. These internal trainings sessions are similar to Nord Pool externally offered courses.

In addition to technical and domain competence training, the company should offer more training to management staff (project managers, service owners etc.). The competence and performance of these people can have huge effect on the service level and stakeholder satisfaction. It is therefore very important to train these people well. The survey results indicated some of the long-term employees felt their training opportunities were not sufficient, so this would warrant further investigations.

The company recently launched a new security program that includes extensive security training for all employees. The energy and financial businesses are amongst the most susceptible domains for cyber-attacks and humans are the weakest links. Strengthening

the security awareness and competence greatly reduces security related risks and prepares the company to face possible upcoming regulations.

Without proper security awareness companies are prone to fall into phishing attacks and cause security leaks. For example, State of Michigan recently published a security review report which stated that 19% of its employees (945 out of 5000 randomly sampled) that were targeted in a phishing attack exercise entered their credentials to a test attack (Ringler, 2018). These attacks are difficult to completely mitigate but people can be trained to handle them better.

4.10.3 Regular production release cycle

Moving to a regular release cycle with predefined service breaks would help the company to focus on continuous deployment mode. This continuous release cycle could be weekly or bi-weekly. The main point of short release cycle is it makes the deployments regular and boring. Being boring is very good for the production deployment. Short release cycles often mean changes are smaller and risks are also smaller.

A regular product release process requires clear rules for operation and automated build pipeline workflow. Nord Pool already has pretty good and fast continuous deployment automation, so the technical requirements are already fulfilled. Moving to weekly releases would then require common agreement on rules and processes. These rules must be defined together with both development teams and customer-facing business functions. When the rules and boundaries are in place, the automation processes should be adjusted to match the business requirements.

Continuous production release process would really help Nord Pool as it makes the development much more structured and continuous process. Developers and managers would see the service updated and maintained more frequently and the end customers would know possible service break times well in advance.

Moving to regular production release cycle requires both cultural and technology changes. This means they cannot fit to the timeline of this thesis. Regular releases could be achieved during 2018 if it the project gains enough support.

4.10.4 Certifications

One concrete method to improve all these areas would be systematically implementing common processes and practices by adopting standard quality management certification such as ISO9001. Having certified organisation would help Nord Pool to sell its services to new customers when the markets will open for competition.

In addition to quality management certificate, Nord Pool would benefit from having certified security management processes (such as ISO2700x). As a power exchange, Nord Pool will always be a target for cyber-attacks. Having its security processes certified with industry standard certification, risks of cyber-attacks could be managed better. The European Union has also been active on drafting new cyber-security regulations and those regulations could affect Nord Pool. Certification processes are often time consuming and therefore they have been kept outside the scope of this thesis.

5 CONCLUSION

The main question of this thesis was “How to ensure Nord Pool product development stays competitive in the future?”. Study began with examining the current situation and how the organization got there. The original premise was to focus on the software development but after studying the organization, it was clear that the whole operating culture must be addressed to get lasting results. To get further feedback on selected areas decided by observation, a survey to all employees was conducted. Survey data was then analysed, and the key findings were processed further inside the organization.

Based on the survey results, Nord Pool has established a stable operation from the business perspective. The employees believe in the business goals and want to provide quality services to customers. Many employees want to do even better, which tells people are motivated to improve things.

The foremost finding is Nord Pool should improve its internal communication between teams. Comprehensive communication is found to be a critical success factor of an effective organization and change management (Chrusciel & Field, 2006). Nord Pool operates in several geographical locations, hence extra care should be put towards managing distributed teams. Team leads should be trained to have the knowledge on how to create functional distributed teams. The technical solutions are already in place. Focusing on communication and documentation should help to start the process.

The findings from Henderson et al. (2016) resonate with this thesis’ survey results. Nord Pool should invest in team building exercise where each team would have an updated purpose and role as a part of the bigger organization and company mission. At the same time, preferred communication flows between teams should be defined and technical solutions implemented. After that individual teams could arrange their internal operations according to their boundaries. This should result in every employee knowing their role and how to communicate with others. That knowledge would then eventually build up trust and work satisfaction, which are the building blocks of effective organization.

According to Henderson et al. (2016) emerging model, Nord Pool is currently in Role Making [Storming/Norming] phase of team development (based on Tuckman’s (1965) model). Recent growth and reorganizations have kept the teams in constant forming phase without the possibility to establish themselves. The next phase is Role Negotiating

[Performing], which would yield the outcome of satisfaction and performance. To achieve a proper team foundation, organization changes should be slowed down to allow adequate time for teams to find their form. On larger scale, the same applies to the whole organization.

Nord Pool should also clarify manager responsibilities and ensure employees have a direct manager known and available. Currently, the manager responsibilities and accountabilities are not always known, which often cause operational inefficiencies. Managers should also have enough time to handle their managerial responsibilities. Studies have shown that having a well-defined and maintained organization structure in place improves the efficiency and satisfaction (Capelle, 2017) and project portfolio management (Beringer et al., 2013).

The survey results also highlighted that Nord Pool should distribute the feedback received from its customers to wider audience within the organization. This is a clear improvement area that could benefit the whole organization with very little effort. Survey results also showed people are concerned about service quality. By demanding better quality along the whole organization, Nord Pool could improve both customer and employee satisfaction levels. Studies have shown that setting higher expectations will result higher results (Kierein & Gold., 2000).

On technical level, DevOps practices across the development teams should be reviewed and unified into one “Nord Pool DevOps Way” framework, which would act as a guidance to all daily operations. This would make the practices and processes known to all developers and managers. The goal should be as Callanan and Spillane (2016) framed it, *“making it easy to do the right thing”*.

Many suggestion items here depend on management support and the execution plan that will come effective after the new CEO starts in their position in June 2018. These plans dictate how effective the organization will end up being. The end note is that Nord Pool has endured turbulence due to rapid growth and strategy change but is now stabilizing on many aspects and approaching the next maturity level. Technology platform, market position and employee competence are already in place. Now it is time to continue with the plans and follow them thorough properly with good management practices and continuous improvement.

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Survey form.

Background

* 1. Which of the following describes your job function best?

- ○ Staff Functions
- ○ Finance
- ○ Market / Communications / "Nord Pool 2.0"
- ○ Infrastructure
- ○ Product Development
- ○ PDI Management
- ○ Market Integration
- ○ Trading Operations

2. Which of the following functions you collaborate most with?

- ☐ Customer-facing business support
- ☐ Customer-facing technical support
- ☐ Product and service management
- ☐ Internal IT support and maintenance
- ☐ Hands-on product and service development
- ☐ Quality assurance
- ☐ Financial
- ☐ Consulting
- ☐ General management
- ☐ Other (please specify)

3. How many years have you been working for Nord Pool?

- ○ Less than 1 year
- ○ At least 1 year but less than 3 years
- ○ At least 3 years but less than 5 years
- ○ At least 5 years but less than 10 years
- ○ 10 years or more
- ○ Prefer not to say

4. How many years have you been working in total?

- ○ Less than 1 year
- ○ At least 1 year but less than 3 years
- ○ At least 3 years but less than 5 years
- ○ At least 5 years but less than 10 years
- ○ 10 years or more
- ○ Prefer not to say

Motivation

5. What's the greatest pleasure you get from working?

- ◯ Receiving the salary I take home
- ◯ Feeling I am making a difference in the world
- ◯ Delivering value to our customers /clients
- ◯ Having a strong relationship with my coworkers
- ◯ Helping my organization to excel and grow
- ◯ Doing interesting, challenging work that gives a sense of accomplishment
- ◯ Being respected and valued
- ◯ I don't get any pleasure from working

6. I am inspired to meet my goals at work.

- ◯ Strongly Agree
- ◯ Agree
- ◯ Neutral/Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly Disagree

7. I understand how my work impacts the organization's business goals.

- ◯ Strongly Agree
- ◯ Agree
- ◯ Neutral/Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly Disagree

8. I am satisfied with the job-related training my organization offers.

- ◯ Strongly Agree
- ◯ Agree
- ◯ Neutral/Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly Disagree

Team

9. How effectively does your team work together?

- ◯ Extremely effectively
- ◯ Very effectively
- ◯ Somewhat effectively
- ◯ Not so effectively
- ◯ Not at all effectively

10. How well do you know where to seek help if you run into unexpected problems?

- ◯ Extremely well
- ◯ Very well
- ◯ Somewhat well
- ◯ Not so well
- ◯ Not at all well

11. How clear are the expectations for your work that are set for you?

- ◯ Extremely clear
- ◯ Very clear
- ◯ Somewhat clear
- ◯ Not so clear
- ◯ Not at all clear
- ◯ I do not have expectations set

12. How often do you feel your contributions are recognized?

- ◯ Always
- ◯ Most of the time
- ◯ About half the time
- ◯ Once in a while
- ◯ Never

13. How comfortable do you feel voicing your opinions?

- ◯ Extremely comfortable
- ◯ Very comfortable
- ◯ Somewhat comfortable
- ◯ Not so comfortable
- ◯ Not at all comfortable

14. How well do you feel your formal job description correlates with your daily work?

- ◯ Extremely well
- ◯ Very well
- ◯ Somewhat well
- ◯ Not so well
- ◯ Not at all well
- ◯ I do not have formal job description

15. How well do you think current performance metrics measure how well your team actually performs?

- ◯ Extremely well
- ◯ Very well
- ◯ Somewhat well
- ◯ Not so well
- ◯ Not at all well
- ◯ We have no performance metrics

Communication

16. What communication channels would you prefer when communicating with other teams?

- [ ] Email
- [ ] Chat
- [ ] Phone call
- [ ] Skype call
- [ ] Confluence or Jira
- [ ] Service desk (e.g. Freshdesk)
- [ ] Workplace
- [ ] Face-to-face
- [ ] Everything goes
- [ ] I don't want to communicate
- [ ] No opinion
- [ ] Other (please specify)

17. How well do you think communication between teams work?

- ( ) Extremely well
- ( ) Very well
- ( ) Somewhat well
- ( ) Not so well
- ( ) Not at all well

18. Where do you turn for tech support?

- [ ] Figure it out on your own
- [ ] Search online
- [ ] Ask your team
- [ ] Other (please specify)
- [ ] Ask IT support
- [ ] Contact external vendor
- [ ] I'd rather not deal with tech support

19. Does your work involve coding?

- ( ) No
- ( ) Yes

Build pipeline

20. How often do you build or deploy your active projects?

- ◯ Multiple times a day
- ◯ Once a day
- ◯ Few times a week
- ◯ Once a week
- ◯ Rarely
- ◯ I don't build code

21. How often do you merge your code to master branch?

- ◯ Multiple times a day
- ◯ Once a day
- ◯ Few times a week
- ◯ Once a week
- ◯ Rarely
- ◯ I don't build code

22. How do you see the build and deploy setup for your team's projects?

- ☐ Maintained well
- ☐ Fast
- ☐ Reliable
- ☐ Good enough
- ☐ Too slow
- ☐ Missing tests
- ☐ Other (please specify)
- ☐ Not maintained well
- ☐ Confusing
- ☐ Unreliable
- ☐ A mess nobody wants to touch
- ☐ I don't care
- ☐ No opinion

Service quality

23. How would you rate the quality of the service we (Nord Pool) offer to our customers?

- ◯ Very high quality
- ◯ High quality
- ◯ Neither high nor low quality
- ◯ Low quality
- ◯ Very low quality

24. Compared to your previous experiences, is our overall product quality better, worse, or about the same?

- ◯ Much better
- ◯ Somewhat better
- ◯ About the same
- ◯ Somewhat worse
- ◯ Much worse

25. How often do we lower our product quality in order to meet a deadline?

- ○ Extremely often
- ○ Very often
- ○ Somewhat often
- ○ Not so often
- ○ Not at all often

Open questions

This last section has few open questions. Even a small comment is valuable and I appreciate your effort. You can of course scroll past them and just send the results if you want.

26. What topics would you need training on?

27. On which topics would you consider yourself a good trainer for your colleagues?

28. What changes would most improve our service to our customers?

29. What does Nord Pool do really well?

30. Which metrics do you consider the most important success measures for your work?

1
2
3