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Enhancing Digital Capabilities within the Manufacturing Sector

How can Volvo Group's supplier portal be change to be made more usable and better fit the needs of its users?

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Abstract

This study has aimed to investigate how Volvo Group's Supplier Portal could be made more usable and better fit the needs of its users. The study was carried out in order to increase the knowledge of how the Usability of a Supplier Portal could be increased in the context of a manufacturing firm with a large user base by applying a user-centred perspective. The research was carried out using a mixed-method approach containing both a qualitative and a quantitative study, where the former laid the foundation for the latter. The results of the two studies were jointly analysed in order to take advantage of the benefits associated with mixed-method research, such as data triangulation, as well as receiving both in-depth responses and data from a large sample size.

The results of this study reveals that the Usability of Volvo Group's Supplier Portal could be increased in a number of ways. Efficiency could e.g. be increased by simplifying the navigation and information structure of the Portal, where a lot of information could be consolidated or removed for a better overview of the structure. Important functionality should also be placed for easy access within the portal, as it is evident that the users want to be able to solve their tasks as fast as possible. Effectiveness could for example be increased by creating an accessible and thorough help-section that could enable the users to help themselves when encountering problems, and therefore ultimately reduce unnecessary interactions with the case company, that waste time and resources for both parties. User Satisfaction could also be increased by adapting the Supplier portal for use on mobile devices, as this increases availability. Something that the findings highlight will become increasingly important over time.

The results of the study increase the understanding of how Usability can be improved in this particular context and in relation to the activities performed within the context. However because it is a Single case study, one has to be careful when attempting to utilize the findings in a broader context. The authors do however believe that the results should be somewhat applicable in the context of other manufacturing companies with similar characteristics.

Keywords

Usability, Supplier Portal, Interaction Design, Efficiency, Effectiveness, Satisfaction

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Definitions

Supplier Portal

A Digital Portal used for supplier communication and mutual business operations between a company and its suppliers.

Design

Design is differentiated by art, through its purpose, where design must serve human goals and needs. Design is therefore purpose driven, where good design enable people to perform tasks in safe, effective, efficient and enjoyable ways (Goodwin, 2009). The design of complex digital services and products require skills in several fields, such as a combination of Interaction design, cognitive abilities, information design, business requirements and visual/perceptual science, to mention a few (Goodwin, 2009).

Interaction Design

We have chosen the extensive definition of The Interaction Design Association (2015) to govern the concept of Interaction Design within this thesis:

“While incorporating the look, feel and style of text and images, Interaction design goes deeper and looks at every element on a screen that a user will interact with. Interaction Design (IxD) thus defines the structure and behaviour of interactive systems. Interaction designers strive to create meaningful relationships between people and the products and services that they use, from computers to mobile devices to appliances and beyond”

Usability

“The extent to which a product can be used by specified users to achieve specified goals with Efficiency, Effectiveness, and Satisfaction in a specified context of use” (ISO 9241-210, 2010).

Efficiency

How quickly a tasks can be done.

Effectiveness

How accurately and completely tasks are performed and how well goals are met.

Satisfaction

The level of comfort that a user experiences when using a product and to what extent the product is acceptable to the user in relation to achieving his or her objectives.

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1. Introduction

1.1. Background

The ultimate goal of any design project is to achieve certain organizational goals and business requirements. This means that every project should begin with the understanding of what the product or service is meant to accomplish, and the business and technical context that the service is surrounded by. In almost every case, the reason for a product being designed or redesigned is the objective to achieve one or multiple business goals. Therefore it is the obligation of the designer to create solutions and improve the current state of a process, service or product, without losing sight of these goals. It is thus critical for the designers to begin their work by getting a proper understanding of the opportunities that exist, as well as the constraints (Goodwin, 2009; Cooper et al., 2007).

Before starting on the project, designers should therefore ask some initial questions, such as: Why is the project important? What will the service be used for? How will it be used? (Goodwin, 2009).

In the design process, it is also common that products and systems are created without the proper consideration of human factors, where designers often have tended to focus on the technology and its features, rather than reflecting on the product or service from a user perspective. But acknowledging that the user is of central importance for the system or product design, by adequately determining the needs of the user, can have very positive effects on the Usability of the product (Wickens et. al 2004). Focusing the design efforts around the needs of the user means that the user should be involved in all stages of the design process, where the designer will focus on the user's performance of various tasks and asking for its preferences and ideas. This type of user-centered design does however not mean that the user has control of the design process, but rather the goal is to identify a design that support the needs of the users, instead of creating a system to which the user must adapt (Wickens et al., 2004; Rubin & Chisnell, 2008).

As one needs to be mindful of the needs of the user when implementing a user-centred design approach, it is essential to understand what factors that affects human performance, when using products or services. There are three factors that can affect the human performance: *Natural Human Capacity and Cognitive Abilities*, the *Activity* performed by the users, as well as the

Context, in which the digital system exist. In order to create a successful design, a designer need to consider all these three factors (Bailey, 1996).

The notion that good Interaction Design and a user-centred focus can increase Usability for the users of a web page or system, and thus save great amounts of time and money, reduce frustration and increase productivity, is not revolutionary. Much has been written on the topic of how to improve the design of interfaces, to increase the user-friendliness and usefulness (Wickens et al., 2004; Cooper, 2007; Goodwin, 2009; etc.).

However, there is a difference between how companies or even industries have been able to make use of the principles of Interaction Design in their digitization. One industry that has fallen behind in general, in the development of digital services, is the heavy manufacturing industry (Westerman et al., 2012). And one specific area within this sector, in which many companies have fallen behind, is the development of digital collaboration platforms, such as those used between companies and their suppliers, namely supplier portals (Manyika et al., 2015). Some research has been conducted within this area of digitization, among other on the effect these platforms have for the relationship building and performance between buyers and suppliers (Leek et al., 2003; Baglieri et al., 2007; Sanders et al., 2011).

Baglieri et al., (2007) argue that supplier portals could have a noticeable positive impact on the quality of the relationship between suppliers and the purchasing organization. Leek et al., (2003) also acknowledge that the development of communication technologies affect buyer-supplier relations, albeit to a lesser extent. Additionally, in a study by Sanders et al., (2011) the authors claim to have support for that Buyer-to-Supplier information sharing, feedback and communication openness, have a direct and positive impact on the performance of suppliers.

So while knowledge exists on the possible positive effect that good Supplier Portal communication and good Interaction Design can have on the relationships and performance between buyers and suppliers. Less knowledge seem to exist regarding how Supplier Portals can be designed to be more usable for the suppliers, and how a portal can be designed in terms of better being able to fulfil the goals of its users. Meaning that you apply a user-centred perspective, as to enable one company within the lagging manufacturing sector to catch up in their digital capabilities and improve their Supplier communication.

Therefore, the aim of this thesis is to investigate what Usability means in reality for the users of the Supplier Portal of our case company. This is done by examining the preferences and needs of these users, namely the suppliers, as it is seen as a strong factor for strengthening and facilitating the interaction and communication between Volvo Group and their suppliers. Ultimately, as previous studies has argued, this may increase the quality of the relationship between Volvo Group and their suppliers (Baglieri et al., 2007; Leek et al., 2003) or ultimately improve the performance of suppliers (Sanders et al., 2011).

1.2. Problem Discussion

The large and growing gap in the level of digitalization between different sectors and different companies has an ultimate effect on both productivity and profit margins, where companies that invest in and make use of their digital systems fully are the big winners (Manyika et al., 2015). As previously stated, one of the industry sectors that has lagged behind the most within recent years is the manufacturing industry, where the general trend is that few investments are made within digital solutions and technology (Westerman et al., 2012).

In terms of our case company Volvo Group and their digital supplier portal, this has historically been true. The current digital supplier portal has not been updated from its current format since 2005, and eleven years is a long time within IT development and digitization. However, the case company has recently initiated several IT improvement projects, and one of them is to improve the current digital Supplier Portal.

A lot of general theory exists on how to improve *Usability* and the *Interaction Design* of interfaces. Much has for example been written on the topic by writers such as; Wickens et. al. (2004); Cooper et. al. (2007); Goodwin, K. (2009); Wixon. D & Wigdor. D (2011); Jenifer Tidwell (2011); Rogers, Sharp & Preece (2011); Jacko. J (2012); Hinman, R. (2012), and several more.

As mentioned earlier though, most of this literature and research focuses on what Bailey (1996) defines as the *Natural Human Capacity* and *Cognitive Abilities*, which is general knowledge about components of human performance, Natural human capacity and general user preferences. In order to create a successful design though, designers also need to consider *Contextual factors* and the *Activities* performed in the specific setting, as these aspects affect Usability to the same extent (Bailey, 1996).

Much less is written, and much less is known, about how to improve Usability for large user bases within a manufacturing sector and digital Supplier Portal *Context*. Neither has much research been carried out on the *Activities* performed by users' in this context, as previous research of Supplier Portals have been aimed at investigating other parameters than Usability. To widen the understanding of this subject, the scope was therefore to investigate a contemporary digital Supplier Portal, within a large manufacturing company, and study what the contextual requirements, needs and activities of its users were, as a way to enhance the digital capabilities of the case company and improve the Usability of the current digital Supplier Portal for the users.

1.3. Purpose

As this thesis aims to find ways to improve the supplier web communication at Volvo Group by improving the Usability of the current Digital Supplier Portal, the focus will therefore be on determining what the suppliers want to be able to do, using the Supplier Portal, and how the Usability can be increased. By minding this overall goal, the intention is to combine what is previously known on the subject of interface Usability, with findings particular to the case study company context. This can provide suggestions for improvements that is suitable for this company and its users.

The research contribution made by this thesis is to extend the understanding of how large industrial companies with massive supplier networks, could communicate better with their suppliers and improve their digital capabilities through improved Usability of their digital collaboration platforms.

1.3.1. The Supplier Portal

The vision of Volvo Group is to be the most desired and successful transport solution provider in the world – this also goes for what they want to communicate externally to the Volvo Group suppliers through their communication channels and tools.

The Volvo Group Supplier Portal is the most important supplier communication channel for the Volvo Group. It has approximately one million visitors per year. The channel is impacting 30,000 suppliers within Automotive and Indirect Purchasing and 2,700 suppliers in serial production that delivers 1,9 billion parts to 45 Group Trucks plants annually around the world.

The Supplier Portal is used as a digital collaboration platform between the case company and the suppliers. It hosts important information, documentation, contact details, and gather links to the all the important Business Systems that is used in the mutual operations of the case company and the suppliers. Before this research project began the Supplier Portal contained some 180 pages and had not been redesigned since 2005.

This project has been initiated because the Supplier Portal is in need for a total update according to the case company, in order to meet and fulfill the current and future suppliers' needs. The aim of this thesis is therefore as mentioned to improve the Portal by increasing the Usability, something that is done by listening to user perceptions, preferences and feedback.

1.4. Research Question

In order to answer the scope of this research study, regarding how Volvo Group should redesign their digital purchasing platform, we formulated our research question as follows:

“How can Volvo Group’s Supplier Portal be changed to be made more usable and better fit the needs of its users?”

1.5. Delimitations

As this thesis is a single case study, specific to the context of the case study company Volvo Group, one should be cautious when attempting to utilize the results of this study for general and broad claims. However, the results should be somewhat applicable in the context of other manufacturing companies with similar characteristics, especially within the Automotive Industry.

Further, this thesis attempts to improve the Usability for the *users* of the Supplier Portal, something that may conflict with the goals and policies of an organization. Therefore the results presented in this study may conflict with other strategic objectives of other stakeholders than the users, thus making the direct implementation of the results problematic.

Resource constraints in terms of time and money sets limits to how thorough an investigation of this sort can be. The authors have attempted to be as thorough as possible given these constraints, but greater resources would provide even more comprehensive results. One measure that most

likely would have increased Usability further is to examine how changes made to the Supplier Portal would have affected the Usability, and update the Portal again based on that feedback.

Furthermore, as preferences of how Usability is improved is likely to be changed over time, some findings presented in this study could prove to be less applicable in the future.

2. Theoretical Framework

2.1. Selection of Framework

This theoretical framework will look upon and try to identify some of the so called “*Best Practices*” within *Interaction Design* for Supplier Portals. The term “best practices” in itself, can be considered to be a somewhat vague concept that have different meanings depending on what one want to achieve, and what preferences one may have. Instead we therefore sought to create a framework that can serve as a good guideline and have strong applicability for the purpose of our case study. The framework was therefore narrowed down to Best Practices in terms of the concept Usability, as this fits well with the overall purpose of this study, which is to investigate how Volvo Group’s Supplier Portal can be changed to be more usable and better fit the needs of its users. As such it takes a user-centered and human focus, looking at human factors, abilities and preferences. The criteria of Usability can however in itself also generate a large variety and multitude of definitions. When starting out with this study, we as researchers therefore had to find a suitable definition of what is incorporated in the term Usability.

2.1.1. The Definition of Usability

Usability is inherent in every product that people like to use, even though the user does not think about it consciously. When Usability is high, the learning effort is low and the rewards from using the product is high (Barnum, 2011). The term Usability can be therefore defined as the availability, convenience, ease of use, and learnability of a human made object (Dictionary.com, 2016), (Merriam-Webster Dictionary, 2016).

The International standard for *Human-Centred Design for Interactive Systems* share in with this definition by providing five principles that make up the definition of Usability. These are *Learnability* - how easily a new user can learn to navigate the interface, *Understandability* - how well a user will understand what they are seeing, *Operability* - how much control the user possess within the interface, *Attractiveness* - how visually appealing the user interface is, and *Compliance* - how well the interface adheres to standards (ISO 9241-210, 2010). A shorter but often used definition of Usability from the same organization, is stated as following: “The extent to which a product can be used by specified users to achieve specified goals with *Efficiency*, *Effectiveness* and *Satisfaction* in a *Specified Context of Use*” (Barnum, 2011).

Efficiency is related to the how quickly tasks can be done. Effectiveness relates to how accurately and completely tasks are performed and how well goals are met. Satisfaction refers to the level of comfort that a user experiences when using a product and to what extent the product is acceptable to the user in relation to achieving his or her objectives. These three parts increases Usability, where the new product should support the user in a manner that is better than how the user currently is working (Barnum, 2011). As the concept of Usability can be considered quite abstract, a division of the Usability in its three subcomponents can therefore be useful. This, as structuring the findings of this thesis in relation to these particular subcomponents of Usability, can increase lucidity for the reader, as it may be simpler to understand the connection between findings and these particular concepts, rather than the connection between findings and the concept of Usability itself. Therefore, by dividing the concept of Usability in these three sub-components, the reader will likely get a better understanding of how particular design and content changes can contribute to an overall improvement of Usability. With the aim of providing clarity to the reader, this thesis will therefore make use of this division. Furthermore, in order to be consistent the thesis will maintain this division throughout the theoretical findings, the empirical findings, the analysis section and the conclusion.

While a strict separation of the sub-components of Usability can be difficult, as their definitions touch upon some similar aspects and sometimes overlap, the division between them is still useful, as certain theoretical and empirical findings are closer linked to one specific component than the others.

Apart from improving clarity, we also believe that this definition of Usability is the most suitable for this thesis, as the focus is on how the current platform can be improved to better fit the needs of its users, in terms of efficiently carrying out tasks, carrying out tasks and processes in an as accurate and complete way as possible, and satisfying the users' needs and preferences through a user-centred perspective.

The following sections of this theoretical framework will now look at several aspects connected to the criteria of Usability and designing for Efficiency, Effectiveness, and Satisfaction.

2.2. Efficiency

This section will present measures that increase the Usability component labelled Efficiency, in regards to our Natural Human Capacity. As such, the segment will review how Efficiency, meaning how quickly tasks can be done, is improved by adhering to human cognitive abilities and general preferences regarding how people perceive and process information.

2.2.1. Efficient Preattentive Processing

The human brain possesses the ability to process certain visual information automatically, without the need for our focused attention. This process is called Preattentive processing. The brain does so by subconsciously detecting and decoding basic features of an object in display, such as colours, shapes, closure, line ends, contrast, tilt, curvature and size, etc. These basic features are decoded in the preattentive system and then joined in the focused attention system, so that a person can identify coherent objects. Preattentive processing is done very quickly, effortlessly and in parallel by the brain, without a user having to focus any attention (Healey, 2015).

Preattentive processing therefore makes the choices of how to present information important, because the choice will affect the subconscious assumptions a user makes of the underlying information, and the speed at which it will process the information and carry out tasks (Healey, 2015). Knowledge about the existence of preattentive processing is therefore important, e.g. when designing for decreased information overload for users, and when trying to convey specific information to a user.

To exemplify how preattentive processing works: If a person for example would look at a table where there was ten blue circles and ten red circles, the brain would instantly pick out the blue circles without any cognitive effort. As this subconscious process is done in massively parallel fashion, the cognitive effort would be the same for picking out the blue circles on a table of thousands and thousands of blue and red circles. The amount of time it takes, and the amount of cognitive load is constant. In opposite, a monotonous text or graphic, forces a user to read the values and think about them (Healey, 2015)

The concept of preattentive processing has great implications for text-based information and visual focal points. To decrease information overload, data points need to stand out from each

other, through e.g. colour, size, shape or another preattentive variable. These variables can also be used to differentiate features, functions, classes or dimensions of information, in a large information-set, something that is referred to as *encoding* (Healey, 2015).

2.2.2. Efficient Information Processing

Poorly designed interfaces, with bad navigational functions and a poor information architecture, incur cognitive costs for users. Meaning that a person has to place effort on understanding something, and in the process tire themselves. The design, the shape, the layout, the content, the entry- and exit points of an interface, and how a user carry out its tasks, thus all affect the amount of time and energy that a user will have to spend in the interface to reach their goal (Tidwell, 2011). Navigating within an interface will always lead to an *Environment Switch* that forces the user to refocus their attention and adjust to their new surroundings, in relation to what they were previously doing, and ultimately this will increase their cognitive processing load. But well-designed interfaces will limit the cognitive processing load of the users (Tidwell, 2011).

The reason information always incur cognitive costs is because it affects our brain's working memory (Hinman, 2012). The working memory is a mental workspace through which humans analyse, manipulate and synthesize information. The working memory thus help us humans make sense of the world, as we compare what we see, with what we know. But when the cognitive load increases, our ability to process information in our working memory decreases. Ultimately, when a person's working memory becomes exhausted, the person will feel frustrated and be more likely to fail completing tasks (Hinman, 2012).

While not undisputed, one interpretation of our cognitive abilities, our working memory and how we process information, have been concluded by psychologists William Edmund Hick (1952) and Ray Hyman (1953) under the Hick-Hyman law. Their studies focused on how much time it takes for a person to make a decision, in regards to the amount of information and the amount of possible choices they had.

Hick (1952) & Hyman (1953) found that increasing the number of choices increased the decision time logarithmically. But more interestingly, they found that humans don't analyse a group of choices one by one, instead we subdivide choices into categories, and thus eliminate around half of the remaining choices for every step in the decision process. According to the Hick-Hyman law, users therefore have an easier time to make a choice from a menu of ten elements, than from two menus of five items each (Hick, 1952; Hyman, 1953; Saffer, 2006). This would also mean

that it would be better for the users, if interfaces gave them several choices simultaneously, instead of creating hierarchical decision trees with choices within choices. This is however only true if lists or menus are created in recognizable order. To find a specific word or symbol in a list, where the order is random, a user would have to scan each element and time would be consumed linearly. If a list is however designed alphabetically, in descending numerical order, or similar, a user may be able to subdivide choices and subsequently solve tasks, or find information much faster, and time would be consumed logarithmically (Hick, 1952; Hyman, 1953; Saffer, 2006).

Hick (1952) and Hyman (1953) also suggested that the time needed to make decisions are affected by two more factors. Firstly, from the amount of familiarity that the user has with the choices, for example from repeated earlier use. And secondly, by the format of the choices, where different type of visual input are analysed differently. The different types of visual format, their applicability, as well as characteristics and differences of different visual cues, will be analysed and explained throughout this framework.

Contrary to Hick & Hyman's research, George Miller introduced his "Magic Number Seven Rule", in 1956, often referred to as *Miller's Law* (Miller, 1956). According to Miller (1956), humans are able to store and remember information in groups of seven items, plus or minus two items. After five to nine pieces of information, the brain starts making errors and have a hard time storing any more information in our short-term memory. Thus implying that interfaces should not be designed with more than five to nine pieces of choices.

Important to remember when talking about Miller's law in regards to Interaction design though, is that Miller was referring to information that a person would have to remember or visualise. Most often in digital interfaces, the information is available and displayed on the screen. In such instances users do not need to store the information in its short-term memory, as they can always find the information easily on the screen.

Miller's law is still considered applicable though (Tidwell, 2011), because while Hick (1952) and Hyman (1953) suggest that it is better to present several choices simultaneously, in opposition to creating hierarchical structures, Miller (1956) highlights, that the amount of choices should not exceed our cognitive limit of about five to nine pieces of information, since even though the information stays visible, it will still take up an amount of our working memory, although smaller.

As they are derived from our human cognitive abilities, the principles brought forward by Hick (1952), Hyman (1953) and Miller (1956) are therefore still considered applicable in modern

Interaction Design. Because while the medium has changed since the 1950's to include digital screens, the human brain has not changed (Saffer, 2006; Cooper, 2007; Jacko. J, 2012).

The information architecture of an interface thus matter greatly when it comes to the requirements of Usability. A poor information architecture or information structure will decrease Usability and create an information overload, as well as a cognitive cost. A good architecture will instead decrease the cognitive cost. Tidwell (2011) compares the navigation of an information architecture or interface, to that of commuting. We have to do it to get to the desired destination, but often the design of interfaces make the process infuriating and dull, and users waste time and energy. According to Tidwell (2011), the best 'commuting' is no commuting at all. To have interfaces where all the important information is right at the fingertips, in accordance with Hick's & Hyman's research.

As mentioned, a balance has to be kept though according to Tidwell (2011), because while keeping tools and information within reach is handy, it will increase the information overload. For intermediate or expert users, who have experience with the interface, it may be easy to find elements in such a structure, but for other users it may actually be better to put lesser used information or functions on separate screens, where they will not clutter the interface, as a mean to increase Usability, in accordance with Miller's research (1956). Tidwell (2011) argues that the most important aspect then, is that the "distances" that the user has to travel remains short. In essence, a common recommendation for digital interfaces is therefore that the less information that is put in an interface, the better. Meaning that increased Efficiency translates to decreasing the overall information in interfaces, only including truly important information, and focusing on making that information easily accessible (Cooper, et. al, 2007; Tidwell, 2011; Hinman, 2012).

The time dimension is also an important aspect within Interaction Design, as it will impact a user's experience and information processing, by how much time that the user spends, or have to spend in the interface. The dimension is considered complex though, since at times it would desirable that a user interacts with an interface for an extended amount of time, and at other times progress could instead be measured in how short amount of time a user can solve a problem, entirely depending on the purpose of the system (Moggridge, 2007).

2.2.3. Efficient Navigation

The navigation within an interface can be one of the most disorienting tasks for users. As mentioned earlier it will involve a significant shift of attention, which may disrupt a user's flow and force them into a new context. Navigating to a new view will also most often mean that the previous content and information that the user looked at disappears, which may infuriate a user and disrupts its flow even more, because it now needs to focus on remembering the interface and store information and content in its memory (Cooper, et. al, 2007).

Users that are forced to repeatedly shuffle back and forth between screens to achieve their goal will become even further disoriented and frustrated, and their effectiveness and productivity will drop significantly. If the number of screens that a user has to navigate becomes too large, they may even experience *Navigational Trauma*, which means that the user becomes completely lost in the interface (Cooper, et. al, 2007). Choices regarding both information overload, logical structure, and "keeping travel distances short", therefore have to be considered, as it can help identify better practices than what is currently used (Tidwell, 2011).

One consideration that can help users avoid Navigational Trauma is to provide clear entry points and escape hatches. Clear entry points will show a user where to go first, and are especially important for first-time and infrequent users, as it removes some of the cognitive load of learning a new interface. It therefore gives them information about where to start in a complex site or app (Tidwell, 2011).

Just as an interface needs clear entry points for its users, it also needs "Escape Hatches", for when the users gets entangled in an interface, reaches an error state, or gets so deeply immersed in a page that they have no context for understanding how to get out of there. Escape hatches should be clear and well-labelled navigation that lets the users get back to a known place (Tidwell, 2011).

2.2.4. Efficient Browsing and Sorting of Information

When structuring information, two dimensions have to be adhered to, Focus and Relation. A good structure of information should permit a user to Focus their attention on a specific point of interest, while also showing enough related information to give the user a sense of Relation between the different information (Tidwell, 2011). Extra care have to be taken to provide visual and textual cues that help orient users, as interfaces with lots of navigational options can be visually disorienting. The most important aspect for improving browsing of information is therefore to understand the users' mental models and workflows (Cooper et al, 2007).

Users should also get the opportunity to develop their own understanding of the information and navigation, where the user gets the opportunity to not only open a point of interest, but also dive into the underlying data, and use, and sort that information as well, with options for navigation between the “parent” and “child” information (Cooper et al. 2007; Tidwell, 2011).

Search functions is a great feature in relation to this, for allowing a user to identify specific information in a big set. Interfaces could also have options for sorting the data through common filtering options such as: alphabetic order, numerical order, by date or time, by physical location, by category or tag, and by popularity (most used and less used). Additionally, options could also be given to the user to rearrange information and features in new and unique ways that they come up with. Meaning that flexibility is built into the system so that new filtering or navigational options can be created (Tidwell, 2011).

2.2.5. Using Design Unity and Disunity for Efficiency

Efficient interface design conveys *Unity*, meaning that it is perceived as a single entity. The best way to reach unity in a design is to repeat visual elements or motifs, such as the look of elements, colour, fonts, angles, curves, line and other building tools. These building tools should also complement each other in a structural and visual way (Goodwin, 2009). Angles and curves should for example be diagonal lines, with the same angle or lines, and with similar curvature.

When similar groupings of text or elements is repeated along a line, a visual unity, or visual rhythm will occur. Rhythms are powerful designs tools, and if used right they can group comparable elements or set elements apart, as users will assume that similarity in form, means similarity in function, which will facilitate for the user to make choices (Tidwell, 2011).

In contrast *Disunity* can purposefully be used to increase Efficiency. Non-rectangular shapes and elements with odd angles can very effectively be used to create visual interest in the design and set elements apart. The disunity creates strong contrast and attracts attention. The use of different angles and curves can also be used to make the lines of different elements cross each other, or converge. These cross-sections can used to draw the viewer's eyes and attention, as a *Focal Point* (Tidwell, 2011).

2.2.6. Using Visual Hierarchies for Efficiency

The page layout, or the organization of information within an interface, affect the user's attention and how meaning is conveyed. The aim or intention of a good page layout is thus to grab and move a user's attention and help the users extract meaning from the interface and the information (Tidwell, 2011).

As mentioned earlier, the human brain is extremely good at identifying patterns and making sense of vast quantities of visual information, as well as sorting this information into categories. By making use of visual hierarchies that guide and control which information users get to see, and in what order users get to see the information, the cognitive burden of users can be reduced, and patterns and functions be identified faster by them (Cooper et al, 2007). Visual hierarchy revolves around displaying the most important content so that it stands out, in relation to lesser important content, as well as to help users identify which content is related and which is not. This is often done through ranking visual elements in declining order of importance, or by grouping or setting elements apart. In essence a good visual hierarchy should instantly give a user information about the relative importance of page elements and the relationships among them (Cooper et al, 2007), (Tidwell, 2011), (Goodwin, 2009).

Some common methods for emphasizing the importance of specific page elements are *Density*, *Colour and Saturation*, *Position and Size*, and *Rhythm* (Cooper et al, 2007; Tidwell, 2011).

Dense and heavy-looking blocks serve as a strong contrast to the surrounding design, while less density will have lesser contrast and therefore more easily get neglected by the eye. High contrast and visual weight can thus be used to attract attention to important elements.

Since contrast draws attention, a good way to attract attention to a certain element is by using a contrasting *Background Colour* from the rest of the design. The important focus is however to maintain readability and catch attention (Cooper et al, 2007; Tidwell, 2011).

Position and Size are powerful tools for attracting attention to a certain element or block and thereby increase the Usability. Elements should always be large enough to be easily found, read and used, in typical conditions. Size can furthermore be used to create hierarchy among the content and also increase the aesthetics, as a large object or text generally appear more friendly, approachable, easy to use, and more playful (Cooper et al, 2007; Goodwin, 2009). Larger blocks, with a central placement will define the element as the primary content. While a

smaller block, placed in the periphery will express less importance. However, important items that are not related to the main content of a page, and which can be displayed through smaller size buttons or elements, could contradictorily be displayed in the absolute bottom left, or top left and top right corner, where they are easy to find.

This is connected to *Fitt's law* (Saffer, 2006), which states that how long it takes to reach an element is correlated to two factors, the size of the target and the distance to or position of the target. The law is applicable to both finger pointing (e.g. when using a physical object or using a touch-screen), and the use of a control device, such as a mouse. The larger the element, and the faster a user can find it, the faster a user can also interact with it.

According to Dan Saffer (2006), *Fitt's law* has three implications for Efficiency. *Firstly*, since the size of the target matters, objects that are meant to be clickable should be of reasonable size. As smaller objects become harder to manipulate. *Secondly*, the edges and corners of screens are great places to position important elements such as menu bars and button, as the edges and corners of a screen indirectly have “infinite” size. This since the user cannot overshoot them, as a mouse will stop on the edge of a screen and subsequently land on top of the menu or button.

When using Fitt's law, the different functionality of different devices has to be remembered. An interface for a smartphone can for example not make use of Fitt's “infinite size” solution, but even on a smartphone elements in corners and edges are however easy to find, as they become distinguishable from the other content. Lastly, Fitt's Law state that creating interfaces where commands or tasks appear close to where the user is already working, will facilitate processes and decrease the time it take for users to complete a task. Thus, increasing the level of Efficiency for the users.

The position and size of elements also touches upon the spaciousness and crowding of an interface. A lot of spaciousness in an interface gives an impression of airiness, openness, quiet, calmness, freedom. Crowded designs on the other hand can evoke urgency and tension. As the human eye prefers to see a margin around things, text and other graphic elements should be allowed to “breathe”, in order not to create visual tension. However, this is not true when the attempting to signal relation or similarity among content (Tidwell, 2011).

Lastly, the *Rhythm* of how elements are placed, will draw the attention of the eye. Lists, grids, alternating style, separation, whitespace, etc, are thus important when trying to attract the attention of a user to the most important elements and pieces of information (Tidwell, 2011).

Connected to these four methods of displaying the relative importance of a certain element, techniques for how to best show *Relationships* among page elements can be used to increase readability and usability. Among the most common principles used are; *Proximity* (grouping or isolation), *Similarity*, *Continuity* and *Closure*. Often referred to as *The Four Gestalt Principles*, the principles are derived from the properties hardwired into our visual systems, and humans ability to acquire and maintain meaningful perceptions of visual information (Cooper et al, 2007; Tidwell, 2011; Norman, 2013).

The first principle of *Proximity*, looks at how grouping items or placing them together will make us associate them with each other, subsequently, isolating items will make us think of them as separate from other elements. Placing related elements in close proximity will decrease the visual search effort and thereby decrease the needed amount of perceptual-cognitive resources (Wickens et. al. 2004; Cooper et al, 2007; Tidwell, 2011; Norman, 2013).

The second principle of *Similarity*, states that if two elements have the same shape, size, colour or have the same position, users will associate them with each other. Of course, using a different shape, size, colour or position will set two different elements apart. Two elements associated with each other, but which needs to present two equally interesting but different alternatives, can thus be given both an identical and a distinctive visual representation.

The *Continuity* principle has shown that the human eye looks for, and desire to distinguish continuous lines, patterns, curves and alignment in visual information. Placing a large amount of smaller items on a vertical or horizontal line will therefore both please the viewer and facilitate the readability and Usability of an interface.

Lastly, the *Closure* principle defines that the human eye has an easier time to process information or elements that are clearly defined within certain frames, or known shapes, such as rectangles, squares or circles. So while associated information or elements should have close proximity to each other (as mentioned in the first principle of *proximity*), a large group of smaller elements should also preferably be aligned so that the user for example sees a rectangle, and within that rectangle several smaller elements is included. This frame, or this rectangle does not always have to be defined through a border or colour distinction, but also be achieved through the alignment of items, as mentioned in the continuity principle.

Important to remember is that while every principle is important individually, the best Usability is achieved through the combination of all the different principles (Cooper et al, 2007; Tidwell, 2011; Norman, 2013).

2.2.7. Using Visual Flow for Efficiency

Best practices when it comes to the visual flow is very closely related to the theory of visual hierarchies, as a good visual hierarchy set up focal points for a user to direct their attention to. The visual flow is then aimed to guide the user on to the less important information through either natural reading tendencies or manipulated redirection of attention (Wickens et. al, 2004; Goodwin, 2009; Tidwell, 2011). When designing a user interface, visual flow considerations and practices can therefore help guide users through a sequence or process in the best way (Wickens et. al, 2004; Goodwin, 2009; Tidwell, 2011).

When setting up a visual flow, several aspects can work in tandem or against each other. Different design layouts can for example draw attention to an element, to a *Focal Point*. And this redirection of focus can either work with, or against natural reading tendencies, such as reading from top to bottom, or cultural reading tendencies, such as starting to read from either left or right. Strong focal points (elements that stick out due to form, colour or other) can thus govern visual flow, or be used to redirect a user from usual reading tendencies and create a new visual flow. Important to remember is that the human eye follows focal points from the strongest to the weakest, therefore great interfaces tend to not overuse focal points, as more focal points will dilute the importance of the other ones (Tidwell, 2011).

Wickens et. al (2004) state that the more contrary a focal point, or an element, is to what is expected as normal behaviour or natural reading tendency, the more visual strength must be given to the element, to guarantee that the visual flow is interpreted correctly. Good Visual Flows should therefore consider the sequences in which a user should be directed through the process, and then take the theory of visual hierarchies into consideration, in tandem with knowledge of natural reading tendencies for the intended users (Wickens et. al, 2004; Goodwin, 2009; Tidwell, 2011).

2.3. Effectiveness

This section will present measures that increase the Usability component labelled Effectiveness, in regards to our Natural Human Capacity. As such, the segment will present findings on how to help users carry out tasks accurately and completely, and successfully fulfil their goals.

2.3.1. Effective Display of Data and Information

Through *Information Graphics*, knowledge and data can be communicated visually rather than verbally, for example through trees, charts, maps, tables, graphs, flowcharts, bar plots and diagrams. The term Information Graphics, encompasses all ways to present data visually with the ultimate goal of conveying information to a user (Tidwell, 2011). If used well, such information graphics can help a user may make use of their eyes and minds to make complete and complex conclusions on their own (Tidwell, 2011). Information Graphics are important, since in most interfaces, there will be pages dedicated to the presentation of numbers, values and data in an as accessible way as possible, and the format of depiction for such data will have a strong influence on its interpretability (Gillian et. al., 1998; Wickens et al., 2004).

At many times, interactive tools that let a user hide and show information as they need can also improve the usefulness of the data. Being able to manipulate and rearrange data creates a lot of value, since a user moves from being a passive observer, to an active observer in the discovery process. Especially inexperienced users that have not mastered the art of manipulating the data to the best advantage, will comprehend aspects of the data that they never would have as a passive observer (Tidwell, 2011).

The users aim when using information graphics is to comprehend or learn something. The aim of the designer is thus to understand what the user needs to learn (Tidwell, 2011). If a user needs to sort out very specific information, options for direct search or filtering out redundant information may be needed. If they instead need to grasp and comprehend the ‘big picture’ they will need tools for overview, making general assumptions, finding general interconnectedness and compare data.

A good user interface, and good interactive information graphics, thus helps the user answer questions such as; How is the data organized? Which data is related? How can I explore the data?

Can the data be rearranged? How can I distinguish/filter data? What are the specific data values? (Wickens, et al. 2004).

2.3.2. Creating Effective Interaction

The appearance of an object or element, how something looks, give us subconscious hints and suggestions of how it will behave and how we should interact with it (Saffer, 2006). The appearance of an object, and the properties of it that provide an indication of how we can interact with the object, or interact with a feature of the object, is often referred to as its *Affordance* (Saffer, 2006).

The affordance of an object is thus closely related to previous experiences, since earlier experiences may affect our knowledge of *how* to interact with an object. Accentuating the importance of understanding the intended users well (Saffer, 2006).

Some experts state however, that the principles of Affordance alone do not provide a full picture when trying to explain the interaction with digital objects.

Don Norman (2013) suggests that in addition to affordances, interfaces should also make use of *Signifiers*. Signifiers are digital elements and perceptible signals that allow people to discover possibilities of what can be done in a digital interface. Signifiers are therefore clues that signify important information, and provide a communication of the purpose and the structure. Signifiers are thus essential for pointing out what elements that can be manipulated, e.g. touched, slid upward, downward, sideways or tapped upon, etc. The affordances then visualize how, or where the user should click to perform a certain task or interact with a specific feature. Meaning that they work in unison.

In addition to helping users through affordances and signifiers, a user will sooner or later have to be asked a question through an input form, for which task that should be carried out, how it should be carried out, and other similar considerations, so that systems can work more efficiently and tailor better to a user's needs (Cooper et al, 2007). While these interactions may seem easy to comprehend and design, they can also be done in a better or worse manner, creating a lot of confusion and questions from a user, when designed badly.

In general, digital interfaces should make use of clear and easily comprehensible language when asking users' questions or asking the user to do something. Labels and words should be tailored to the targeted user segment, adhere to the skill-level and knowledge of the user and promote the right type of action. Acronyms, abbreviations, jargon and specialized vocabulary should be

avoided if possible. Semantics and wording are thus powerful conveyors of information and should be selected carefully, as they lend much opportunity for misinterpretation, when asking the users for input (Cooper et al, 2007; Moggridge, 2007).

2.4. Satisfaction

This section will present measures that increase the Usability component labelled Satisfaction, in regards to our Natural Human Capacity. As such, the section will present measures on how to increase the comfort that a user experiences when using an interface, and how to facilitate for the user to achieve its objectives.

2.4.1. Visual Style and Aesthetics

In studies that have looked on what makes people trust or distrust a web interface, it was shown that company reputation, customer service, sponsorships, and similar, for obvious reasons had a large effect on whether users considered a website or interface to be credible and trustworthy. More important than all such aspects however, turned out to be the *appearance* of a website (Tidwell, 2011). Users turned out to be less likely to trust sites and interfaces that looked amateurish, and contradictory, professionally designed interfaces made users feel strong trust. The positive emotional response, *The Affect*, that a good design gives users, also translates to them being more tolerant when encountering difficulties and make them more flexible and creative in finding solutions to encountered problems (Norman, 2013). A good and well-looking design can thus make interfaces more usable. And the appearance of an interface therefore affects the *time* and *behaviour* of a user, since it affects for how long users will stay, and whether or not they will return to, or recommend the product. It is therefore important that designers adhere to the preferences and needs of the users when designing interfaces to increase their comfort and help them achieve their goals (Moggridge, 2007).

2.4.2. Increasing Satisfaction through Increased Availability

Interfaces should make it easy for the user to pick up where they left off, regardless of context or device. For users to be able to pick up where they left off, interfaces and functionality sometimes has to be designed for a whole ecosystem of devices. If understanding how different devices can

supplement each other, through different use cases and different contextual user needs, the Usability of systems can truly be increased and create a seamless experience (Hinman, 2012).

The system should therefore be designed so that both other devices and the computer reinforce the Usability of a system together. Because it is important to remember, that depending on the specific user, and depending on its specific needs, the computer may or may not, be the center of the device ecosystem (Hinman, 2012).

2.4.2.1. Relationship Types for Device Ecosystems

Several relationship principles exist, which when used, can improve the user experience of a digital system that users make use of through different types of devices. While sharing similar concepts and touching upon each other to some degree, the following principles highlights some aspects of designing for the whole technology eco-system (Hinman, 2012): Coherence, Synchronization and Simultaneity.

Coherence is about optimizing the digital experience for every specific type of device, in regards to that device's characteristics, while at the same time ensuring that there is a strong sense of continuity of the experience across all devices. Experiences are therefore tailored to each type of device, but have some sense of consistency among all the devices. Three recommendations that can help improve *Coherence* is to: Identify the primary use case for each device. Optimizing the design for each device and use case separately. And by maintaining a unified design, both in terms of visual style and the interaction, which works across all devices.

Synchronization focuses on keeping content in sync, regardless of which device the user is working on, to facilitate continuation on the task at hand. If a user for example starts filling out a form on his mobile device, then the system and interface should save that data, so that the user can continue exactly where it left off, on the computer or another device.

A *Simultaneous* screen experience is when the user make use of one device to look up or check something, while working on another device. The devices are thus used simultaneously.

2.4.2.2. The Difference of Designing for New Devices

In some aspects, the considerations of designing a platform for other device use, does not differ at all from a platform meant for computer use. Most of the considerations regarding the information architecture, focal points, cognitive abilities, visual perceptions and other still holds true.

But in other circumstances the differences vary greatly. Computer interfaces are used in fixed spaces and in specific time intervals (where we can focus solely on the interface), they therefore usually offer a multitude of commands and options (Wixon & Wigdor, 2011). Other devices, such as mobile devices differ however, in the sense that they need to depict and visualize information within ever changing external spaces and contexts. When designing for mobile devices, designers therefore have to design for partial attention and interruptions, since users often will connect with the interface when being mobile, and in contexts where lots of interruptions and cognitive stress will occur (Wixon & Wigdor, 2011; Hinman, 2012).

Therefore it is important that interfaces meant for mobile devices, such as mobile phones, tablets or wearable technology, decrease the cognitive workload for users to an even further extent than when designing for computers. Navigation and functionality therefore have to be extremely relevant, with no added redundancy, and functionality could even be limited to the most used features of a system (Hinman, 2012). Not only because of the aforementioned cognitive burden and information overload that otherwise is inflicted upon users, but also due to these kind of devices having significantly smaller screen sizes and less options for control than the computer (Hinman, 2012).

3. Method

As the focal point of the study is the Supplier communications of the Volvo Group organization through its Supplier Portal, the empirical study of this thesis will aim to investigate the Context and the Activities performed on this platform in order for us create suggestions for improvement according to preferences of its users. These findings will be discussed in the analysis section of this thesis in relation to the theoretical findings that look at Natural Human Capacity, and the three factors will therefore jointly be taken into consideration for our conclusion and recommendations, in our proposal for the improvements of the current Supplier Portal.

3.1. General Strategic Considerations

3.1.1. A Single Case Study

This thesis aim to investigate how a digital supplier portal can be changed to better fit the needs of its users. The object of focus for this study is therefore the Volvo Group and its vast supplier base that make up the users of the digital portal. This focus therefore strongly affected the research design of the project.

The research design of a project depends mostly on the purpose of the research, but the case study approach is the most suitable approach when the research question is formulated in the form of “how” or “why, used to investigate a present phenomenon in its real context (Yin, 2009). This position is agreed upon by Gerring (2007), who accentuate that it is the real-life context that characterize a case study and that this is the greatest benefit of the model, since it allow for the capturing of findings that other forms of research forms would have missed.

As our research project takes a “how” perspective and since we aim to investigate a digital system within its real-life context, these definitions highlight the case study characteristics of our research project.

The case study approach has also been chosen by us as researchers since it facilitates in getting to know subjective factors, like thoughts and feelings (Bromley, 1986). This is beneficial in the case of our research project since we aim to investigate the subjective preferences, needs and thoughts of the users of the portal, as our Interaction design process had a user-centered focus.

The reason we have decided to focus on one in-depth single case study, instead of performing multiple case studies has been due to the trade-off between depth and breadth. Multiple case studies are more useful when the study is concerned with holding a strong external validity, making a stronger case for universal applicability. Single case studies on the other hand are more convincing for strengthening internal validity (Gerring, 2007). In this study the researchers therefore hold a bias in favour of a single case study and internal validity, given the concern of being able to provide results that are accurate and useful in the Volvo Group context.

3.1.2. Case Study Company Selection

Before starting this research project we knew that we wanted to investigate how digital Interaction design could help create business value in practice for a real company, in the form of a case study.

When trying to decide upon which sector and what specific company that we would like to perform a case study for we therefore sat down and looked at contemporary research regarding digitalization and the digital transformation.

Since both us thesis writers had written our bachelor thesis in collaboration with the Volvo Group, a huge international manufacturing company based in Gothenburg in the Western part of Sweden, and since one of us had worked within the Volvo Group organization, we decided to see if they had any open Master Thesis projects that touched upon the area of digital transformation. It just so happened to be that the organization were about to launch a large scale project where they would seek to develop and improve their digital supplier portal that was used in the contact between Volvo Group and their suppliers. The project intended to look at how the usage and visual parts of their supplier portal could be improved, a project that was closely related to the topic of Interaction design. We therefore applied for this project in competition with other Master thesis students, as it was posted on the Volvo Group website, and a couple of weeks later we were entrusted by the organization to contribute to this project.

3.1.3. An Inductive Approach

This thesis aim to unveil how Volvo Group can create a supplier portal that fits the needs of the users, the opinions of the users are thus at the centre in this thesis, rather than testing relationships between independent variables. Therefore we utilize a process that create inferences that are based on the empirical findings, as we believe that this process holds merit in terms of fulfilling

the goal of this thesis. This process can therefore be described as inductive, as theory is based on these observations contrary to hypothesis testing (Bryman & Bell, 2011).

3.1.4 Explanation of the Chosen Methodology

3.1.4.1. A Mixed-Method Approach

This study is investigating Usability, a broad subject involving many components, for a portal that is utilized by a great number of different users. Finding solutions that enable us to improve the portal for many different users means that we need to acquire and analyse large amount of data, and that in the short time given to write a thesis. For this purpose, we needed both the in-depth understanding provided by qualitative methods, while at the same making use of large sample sizes associated with large quantitative studies, in order to come up with suggestions that would benefit the large number of users. In order to satisfy both these elements, we have made use of both a qualitative as well as a quantitative research method in this thesis, an approach known as a *Mixed-Method Approach* (Brymann & Bell, 2011).

According to Hammersley (1996), there are three benefits associated with a mixed-method research approach. The first benefit is that of *Triangulation*, where the results of an additional research method is used to validate the results of the other method. Secondly, a mixed-method approach could be used to *Aid or Facilitate* the research process of the other method. Lastly it could also be used to find *Complementary Findings* in order to merge the findings of the two research methods. The aim with a mixed-method approach should be to make use of all these benefits as a way to achieve a greater understanding of the research project.

As such the quantitative survey would both have the function of Triangulation where the results of the qualitative study could be validated, as well as having a Complementary function where new findings may arise. Additionally, in the case of qualitative study, it was used to facilitate the creation of the quantitative study, but while at the same time being used for the purpose of validation and for producing complementary findings.

For the first part of the data collection we utilized a qualitative approach, more specifically qualitative interviews. This part of the research was partly designed to orient or familiarize us as researchers with the very complex task of finding solutions that is suitable for the Volvo Group organizations and its many suppliers. In such situations qualitative techniques are appropriate (Shields and Rangarajan, 2013). The importance of conducting interviews with the users could

not be understated as the users of a product should be the primary focus of the project, as users are the ones utilizing the product to reach their goals (Cooper et al., 2007).

The qualitative research was very useful in helping us understand the patterns of behaviour among the users in an easier and more rapid fashion than would have been possible by utilizing a quantitative approach. This, since qualitative research is much more suitable than quantitative research at unveiling the attitude and aptitudes of the users, as well enabling the researchers to understand the context from a technical and business perspective, in which the product is being designed. Furthermore, problems associated with current procedures is also more likely to be revealed (Cooper et al., 2007). In essence it will therefore provide credibility and authority to the designers, where they can prove that their decisions have been made on in-depth user insights.

The qualitative interviews were conducted in a semi-structured manner in order to enable us as researchers to ask follow up questions. This approach was taken as it allows the respondents to cover subjects that they feel are relevant, but are not covered by the questions asked by the researchers (Eriksson & Kovalainen, 2008). Other benefits by utilizing a more flexible interview approach is highlighted by Cooper et al. (2007) where the authors claim that when making use of a fixed questionnaire, the researchers risk to alienate the interviewees as well as make the interviewers miss out on valuable data.

As previously stated the results from this quantitative study allowed us to cross-check the results from the qualitative study, as well as with the findings from the theoretical framework. It also produced several complementary findings as we included free text forms in relation to several of the questions, where the users had the opportunity to specify what they meant in particular.

In summary this approach therefore allowed us to receive a greater accuracy in our findings, by utilizing the larger sample size of the quantitative study results, while at the same time having the opportunity to identify idiosyncrasies by comparing the results of the qualitative and quantitative study, as well as unveiling perceptions and preferences in an elaborate manner (Bryman & Bell, 2011). Furthermore, due to the inherent weakness of surveys posted online, where one should be aware that this kind of uncontrolled survey can be prone to produce low quality data, as users can provide undeliberate answers, something that may decrease the validity (Buchanan, 2000). Therefore the use of a mixed-method should be useful as to better be able to help explain and justify some phenomena in-depth rather than relying solely on quantitative data, where some

respondents may be careless in their responses thus reducing both validity and reliability (Meade & Craig, 2011).

3.2. Qualitative Interviews

3.2.1. The Creation of the Qualitative Interview Questions

As mentioned initially we started off with a qualitative stage, which was used to gain a greater as well as deeper understanding of requirements of the users (Cooper et al., 2007). Designing a useful product means that user preferences need to be greatly considered in the design of the product. When conducting the interviews we focused on areas where users could provide very useful insights. Cooper et al. (2007) furthermore list several interesting aspects and questions, such as; How the product fits into the user's' workflow? When, how and why it is used? What does the user need to know to perform their jobs? What are the current tasks and activities that are required, and what activities are not supported? What are the goals and motivations for using the system? What expectations do they have? What are the problems with the current system? Such questions, as well literature findings related to the improving the Usability in terms of Effectiveness, Efficiency and Satisfaction, enabled us to formulate a questionnaire with interview questions used for the qualitative part of this study. These questions were specific to the supplier portal and the context and scope of this research project, given the importance of the activities as well as the context have in order to create a successful design (Bailey, 1996).

3.2.2. User Selection

In this study, the group of users were narrowly defined from the beginning as we have been investigating a Supplier Portal that is intended to facilitate the communication with Volvo Group's suppliers. Therefore the intended users are employees working for the supplier organizations. It was however important to identify users of varying experience and of varying levels of system usage. This was important since preferences may differ between users, and while designing a system for sporadic users is not optimal, non-frequent users might be able to identify more problems with the current designs than more experienced users that have gotten used to the interface, thus still making their input valuable.

Therefore a combination of experienced users as well as less frequent users were desired in order to find a mix of users that enabled us to come up with a design that perform well on Efficiency,

Effectiveness and Satisfaction. Furthermore, we wanted to have some geographical dispersion of the respondents, in order to reduce bias towards suppliers located in the Gothenburg area, as the qualitative interviews reveal essential information regarding user preferences.

In order to find respondents that qualified for these requisites we had discussions with Volvo Group employees. Having identified the suppliers that we wanted to interview we e-mailed them and scheduled sessions for the interviews.

Respondent 1 had many years of experience of using the portal, while at the same having the role of “Super-user” at the supplier organization, a role that enables him to grant accesses to other employees working at the same company and involves him taking responsibility for helping new platform users within his own company. Respondent 2 also had great experience of the platform, having worked in the portal since it was first launched. Respondent 3 were not as experienced as the previous two respondents, but interestingly enough had a long background in IT-development, enabling him to provide insights greatly related to the subject of this thesis. The remaining two interviews with respondents 4 and 5 was chosen due to the two respondents belonging to a huge supplier organization in one of Volvo Group’s key markets of Central Europe. The two respondents was also chosen due to them having very different work roles, which meant that they made of use of the supplier portal in different ways. Respondents 4 and 5 were not beginners to the system but their experience of using it was much lesser compared to the other respondents, thus possibly having a different perspective on the system. Because of confidentiality concerns, the names of the respective respondents are not presented in this study.

#	Work-role	Nationality	Experience of Using the Supplier Portal
Respondent 1	Sales	Swedish	10+ Years
Respondent 2	Sales	Swedish	10+ Years
Respondent 3	Senior Management	Norwegian	5+ Years
Respondent 4	Logistics	German	1-2 Years
Respondent 5	Sales	German	1-2 Years

Table 1. The table show the work-role, nationality and experience of the Supplier Portal for the respondents in the qualitative study.

Testing systems and their Usability require a lot of resources. Therefore the resources used to conduct them should be weighed against the benefits. The optimum number of user tests are in this aspect between three to five. When the number of user tests surpasses five, the same patterns will re-emerge as approximately 85% of findings will have been uncovered in a particular test (Barnum, 2011). Five in-depth user interviews was therefore considered sufficient for identifying the majority of the issues and problems with the existing platform, especially as we would reinforce this with an extensive quantitative survey.

3.2.3. Interview Process

The respondents have various backgrounds and areas of expertise and therefore they had varying input of what they considered to be important. As we attempted to make the most out of the interviews we made use of semi-structured interview process where the discussion could deviate from the set of questions included in the initial questionnaire. However, despite the difficulties in conducting similar interviews when utilizing a semi-structured interview process we attempted to increase the coherence by following a process called Contextual Inquiry (Beyer and Holtzblatt, 1998), in order to have key guidelines for the interview process.

In their book *Contextual Design* Beyer and Holtzblatt (1998) provide a comprehensive guide to how to conduct contextual inquiries, where four guiding principles are listed. These principles are *Partnership, Context, Interpretation and Focus*, where they all represent an aspect of the interaction with the user. This process was used in all interviews, and served as a guideline to help us be consistent when conducting the interviews.

In the first 5 minutes of each interview we tried to establish a sense of collaboration or *Partnership* between us as interviewers and the interviewee. This was done in order to get the respondents to understand that each of their suggestions were appreciated, as well as to create a situation where both parties are in control of what is being discussed and how much time are devoted to various topics (Beyer and Holtzblatt, 1998). We also engaged in the testing by asking for feedback on suggestions for improvements. Suggestions on improvements that we as interviewers could identify during the interview were brought up immediately to get direct feedback from the interviewees on what could be improved. Although this might be considered a distraction, the benefit from receiving the direct feedback outweighed the negative (Beyer and

Holtzblatt, 1998). The suppliers often elaborated on ideas and findings in ways that we had not considered, something that provided very interesting findings.

Detailed descriptions of the usage of the platform, or the *Context* in which the platform is used, was essential for the understanding how to update the design from the perspective of Usability. Observations about how the interviewees are using the portal enables us researchers to get a more comprehensive and detailed view, as people otherwise tend to summarize when describing how they are performing tasks (Beyer and Holtzblatt, 1998). Therefore observations have been a key element in investigating how to improve the Usability, as we attempted to observe the usage rather than relying on generalizing statements of the usage in order to get a better understanding of how the portal was used. Avoiding this sort of user abstraction and generalization allow for more useful and truthful insights (Beyer and Holtzblatt, 1998).

As the potential benefit of the designs are contingent on the accuracy of the data being provided by the interviewees, the *Interpretation* of this data needed to be correct. This is the case since interpretation is the basis of our findings. Therefore we asked the respondents to clarify answers that could be ambiguous.

Another important factor for the interview process to be efficient was that the interviews had *Focus*, where the emphasis lie on the actual use of the platform, and served as the main foundation for prepared questions and follow-up questions. The aim of this project was thoroughly explained to the interviewees beforehand when scheduling the interviews, giving the interviewee and the interviewers a shared starting point. However this starting point is augmented by the various focuses of the different individuals, where each person has their own unique perspective (Beyer and Holtzblatt, 1998). The strategy was for us as researchers to have an expanded focus with intention of not being constrained by our own expectations. Therefore we had to be aware of idiosyncrasies in answers, and examine them closer instead of instantly dismissing them as irrelevant. Furthermore, we tried to be as curious as possible by asking follow up questions even when the interviewee expressed views similar to our previous experience. This was important in order to investigate the underlying reasons for this response, rather than assuming that it would equal previous respondents or one's own assumptions (Beyer and Holtzblatt, 1998).

Furthermore, to in order receive useful results, and increase the amount of feedback from the qualitative interviews we often asked follow up questions. This approach enabled us to receive information that gave us a greater understanding of the tasks performed and how the users were interacting with the system. Therefore the questions and follow up questions resembled the steps used in a process called *Task Analysis*, which is a way of describing how humans interact with a system and to understand how to match the demands of the system, to the capabilities of humans (Wickens et al., 2004). In this process we focused on what the users wanted to achieve, where follow up questions could be linked to how the user believed that their goals could be facilitated by asking them to make suggestions on how the portal could be improved (Wickens et al., 2004).

In order to better prepare the respondents we sent the interview questionnaire as well as the description of the purpose of the study, in the same email used to schedule the interviews.

Further, the interviews were recorded using the audio recording program on our cellphones, with the permission of the respondents. This was done in order not to misquote the respondents. All of the relevant content was later transcribed to text. The three interviews were conducted in Swedish and then later translated to English. Due to the similarities between the two languages the translation process was not perceived as a problem for us as researchers.

Three interviews were conducted with Volvo Group suppliers that are represented in the Gothenburg area, as this enabled us to meet the representatives of the suppliers face-to-face. According to Jacobsen (2002) face-to-face interviews can be very advantageous as they allow the interviewer to observe the interviewee and establish an informal and more personal contact with the respondent. Each of these interviews took approximately one and a half hours to conduct, allowing both the interviewee and us as interviewers to rigorously cover all aspects and opinions of the platform.

The interviews with the suppliers located in Central Europe were conducted using the computer software Skype for Business. The use of this system made the interviews more interactive as the interviews were not merely phone-interviews but also comprised of the visual component, as the interviewees were able to share the content on their screens. This facilitated the communication between the researchers and the respondents and allowed us as researchers better to understand how the interviewees made use of the supplier portal. Due to a stressful work situation for these employees the interviews were only 45 minutes long. Therefore, these interviews are less

elaborate than the face-to-face interviews. No translation were needed for the interviews conducted with Respondent 4 and Respondent 5 as these were conducted in English.

All respondents were asked if they wanted to receive their interviews in transcribed text. Only Respondent 1 asked for his transcribed interview and only had small alterations to make, mostly connected to clarifying his answers.

3.2.4. Analysis of Qualitative Studies

As this thesis is making use of a mixed-method, the analysis of the findings that were provided by our qualitative study were not exclusively aimed at providing a definitive conclusion of this thesis. Rather this analysis would have to wait to be combined with the findings of the quantitative study (see section 3.4.). However, the qualitative findings had to be analysed to that extent that we as researchers were able to create a questionnaire based on these findings to be used in our quantitative study.

Therefore, the analysis were used as a mean of finding questions or issues that needed further validation, as well as a method used to identify new questions, not previously envisioned by the researchers. As such the analysis did not at this stage go into detail, by for example juxtapositioning the qualitative findings with contributions made by other authors in the theoretical framework. Rather we attempted to identify patterns in the responses from the interviewees in order to come up with new questions.

One such pattern that was identified and that we considered interesting to investigate that there seemed to be a discrepancy between the answers provided by the older respondents and the younger respondents. In order to investigate this matter further we created a screening question asking for age, in order to be able to examine if this difference would be persist in a larger sample.

3.3. Quantitative Study

As stated earlier in the method, the quantitative part of this study had several purposes, which was to utilize it for the purpose of triangulation, where the findings of the qualitative study could be validated. But also to discover new findings by making use of the complementary information that can be uncovered.

3.3.1. The Creation of the Quantitative Interview Questions

The questions included in the quantitative study was based on codified findings, opinions and preferences from the qualitative interviews, that then could then be tested on a much larger user sample, with more geographical-, work role- and experience dispersion. These questions were mostly formulated in the form of Likert scale questions (Bryman & Bell, 2011), where the respondents were met with specific statements and claims, that they could evaluate on a five point scale of strongly agreeing with the statement, to strongly disagreeing.

These questions aimed to investigated how well the respondents perceived that elements such as the navigation was working and provided insights in what needed to be improved. We further made of use of other type of check-box questions for example in order to investigate the levels of usage.

As the scope of this thesis has continually been to include user preferences and opinions, we also decided to include free text forms connected to some of the specific questions, where respondents had the possibility to elaborate on their answers and provide complementary findings. We decided to do so, because while Barnum (2011) states that five interviews will be enough to identify 85% of the preferences, opinions and issues with a digital system, this still leaves the opportunity to identify even more findings, as well as collect other interpretations of those findings. In total we included free text forms in seven of the questions, since these questions included space for specific preferences on content or features that the respondents would like to see and if there was important information missing. The free text form also allowed the opportunity for users to give recommendations for any given part of the Supplier Portal that might have been overlooked by the researchers. The free text form questions thus followed logically on an original statement and lent opportunity to the respondent to specify what they meant in particular.

Furthermore, three screening questions were added in the beginning of the survey. The motive for asking these questions were different for all three questions, where the first questions about the respondents' age was intended to investigate the previously described pattern where younger respondents seemed more eager to be able to use the Supplier Portal on a mobile device.

We also included a question regarding the origin of the respondent. This was done in order to check if the sampling was representative for the population. The third screening question was related to the work role of the respondents, as this aspect related to the importance respondents gave to specific questions.

3.3.2. User Selection

The sample selection was rather easy in this case as we solely needed to identify users of the Supplier Portal. To be eligible to participate in the survey you therefore needed to be a user of the Supplier Portal, meaning that you had login credentials, as the survey was posted on a page on the Portal only accessible after login.

Other than the purpose of the screening questions above, it was not necessary to separate the Portal users into segments, since all user feedback is valued equally in the case of this research project and since we take a holistic perspective. Therefore, the questionnaire was posted on a page of the portal that we believed would have many visitors in order to quickly be able to reach out to a large number of users.

3.3.3. Process

The questions were phrased in English as all content of the Portal is phrased in English. The questions were phrased in a simple language, to reduce the risk of confusion or misinterpretations by the respondents. Before being made available to the respondent the questions were examined by three Volvo employees that provided their input on the wording of the questions in the survey to better suit the intended respondents, while we still made sure that the questions would provide us with the answers that we sought. For this reason there could be minor discrepancies in the phrasing between questions in qualitative study and the quantitative study.

The survey was created as a questionnaire in a software called Survey Gizmo and was then posted on a general page of the Supplier Portal, used by all types of users, as this is a natural and visible place within the Portal, where we could reach a large amount of suppliers. A limitation of

placing it on this main page of the portal is that many suppliers may have created favourites within their browser that leads them directly to subpages within the interface. As the portal contains up to 180 pages it would not have been viable to place the survey link on all of these pages. Placing it on this main page of the portal thus allowed for the greatest visibility, but may have limited us from reaching all visitors of the portal.

3.3.3.1. Response Rate

The study was placed on the start page of the portal for a total of 7 working days. With the help of personnel at Volvo Group, responsible for managing the supplier portal, we could extract the total number of unique visitors during this time. The statistics show that the page of the portal where we placed our survey, had a total of 251 unique visitors during these seven workdays. After this, the survey was removed from the portal, as to not receive any more respondents. The total number of respondents in the survey was 203.

As mentioned earlier, we included both Likert Scale questions, and free text form questions, where the free text forms was included as a mean for respondents to clarify their answers and provide complementary findings.

Respondents were not forced to complete any questions, as we did not want to dissuade any respondents from finishing the survey. The total number of respondents for the Likert questions therefore differed slightly. None of the evaluation questions had fewer than 189 respondents though.

Bryman & Bell (2011) exemplifies that to count the response rate, researchers should take the numbers of usable questionnaires, divided by the total sample, times a hundred (*numbers of usable questionnaires / total sample × 100 = response rate*).

The response rate for the whole survey was therefore 203 respondents out of 251 unique visitors (81%), and the lowest response rate for a non-free text question was 189 respondents out of 251 unique visitors (75%). Bryman & Bell (2011) continues by stating that any response rate over 70% should be considered very good, something that indicates that the validity of the responses should be quite high. In order to screen if the sample was representative we asked a question regarding the respondents' nationalities. In total 31 nationalities were included, representing all major markets for the case company. This indicate that the sample should be fairly representative, despite the difficulties of creating such a sample.

3.3.4. Analysis of the Quantitative Studies

As previously stated, for the quantitative study we made use of a survey-software called Survey Gizmo, where the responses in this study were collected. The use of this software was beneficial as it also enabled us to create reports where the data was presented in diagrams and charts as presented in the Empirical Findings-section. The results presented in this report was analysed together with the qualitative findings as described in the section below.

3.4. Analysis of both the Qualitative and the Quantitative Study

Rather than interpreting the results of the qualitative study and the quantitative study we interpreted them together where the results of each of the studies could help shed light over the responses of the other study. As the purpose of this study is to identify how the Usability of the supplier portal can be improved for its users, the idea was to find areas for improvement in the subcomponents constituting the concept of Usability. These are as previously mentioned, Effectiveness, Efficiency and Satisfaction. As the questions for both the qualitative and quantitative parts already had been divided in these three areas as to make it easier follow the logic how Usability could be improved in various ways, the analysis followed the same partition. The subcomponents were then divided in various topics. Topics that were the same for the qualitative and quantitative study, something that done to increase coherence as the phrasing of the questions was somewhat different in the two studies, where for example some qualitative questions had to be split in two in the quantitative survey. By organizing the findings in this way we believed that it was easier to cross-reference the findings, both for us as researchers and the readers.

In order to identify key findings that could have a major impact on improving the Usability of the Portal and thus helping identify the answer of the research question, methods to identify those findings had to be determined. The researchers believed that the most important issues would be identified either by having been attributed great importance by many users, where improvements in the investigated area thereby should be highly likely to have a large positive impact for a great part of the user base. Additionally, where similar responses to open questions are provided by the respondents, the results are most likely to be important, especially when the finding is stressed multiple times in the both the qualitative and quantitative study. Moreover, suggestions for improvement that can be important to overall Usability may have been identified in opinions expressed by of only a few of the respondents, but could still be extremely important in

increasing the Usability for these users and thus have a quite strong overall impact on the Usability. Other findings expressed by a few users could probably also be quite important if there exist a strong correlation to best practices that have been identified in the theoretical framework.

3.5. Validity and Reliability

3.5.1. Validity

When performing a single case study, one has to be careful when utilizing the results of this study for another company or another context, given the limitations of the single case study approach. This since the main problem with this approach is linked to representativeness (Gerring, 2007). Here the single case study generally carries less external validity than multiple case studies. However as previously stated, claims of internal validity are stronger when using a single case study approach (Gerring, 2007). As this thesis is making use of triangulation of findings by employing multiple methods of study, the internal validity of claims made in this thesis should be quite strong.

A strengthening of such claims can further be found when the findings are consistent with what is stated in the theory. This approach added additional support for validation of the findings. The opposite could be stated by when there are divergences between the case study findings and what theory predicts, however these divergences could indicate divergences between the particular context and the theory rather than accurately predicting a lower validity.

However, as previously stated the validity of the quantitative findings, when using an uncontrolled Internet-based survey can yield to produce low quality data, something that may decrease the validity (Buchanan, 2000). This lower validity can to a certain extent be off-set by the use of a mixed-method, as findings can at least be more easily questioned and examined when there exist discrepancies between the qualitative and the quantitative findings.

3.5.2. Reliability

The concept of reliability means how consistent a measure is. The concept of stability is a subcomponent of refer to if a measure is stable over time (Bryman & Bell, 2011). This is questionable in the long run considering that preferences may change given that the thesis is related to the fast-paced IT-sector. However, in the short-run there is nothing that implies that results in the qualitative study would alter significantly, given that the questions are phrased

equally. As this thesis is making use of a semi-structured approach in the qualitative study, a repetition of the interviews is unlikely to yield the same results, something that is far from what is desired in terms of reliability as utilized in quantitative studies. However, this is not desired given the function and nature of qualitative research (Bryman & Bell, 2011). Furthermore, as previously discussed, quantitative studies of the kind used in this study may yield careless responses (Meade & Craig, 2011), thus most likely also lowering the consistency of the responses.

4. Empirical findings

Within this section the empirical findings will be presented.

The formulated interview questions and the quantitative study was specific to the Supplier Portal and the context and scope of this research project, which has been to improve the Usability in terms of Effectiveness, Efficiency and Satisfaction. All findings have therefore been summarized within these three categories.

As mentioned initially in this thesis, the empirical study has aimed to investigate the activities of the users, and their preferences and needs within the context of the Supplier Portal of our case company. Below, the findings will follow.

4.1. Qualitative Findings

4.1.1. Efficiency

4.1.1.1. Respondents Usage Levels of the Portal

All respondents stated that they visit the Portal once or twice a week, but also that the use could differ heavily from week to week. The time spent on the Portal ranged from 5-15 minutes.

4.1.1.2. Information and Features that are Difficult to Understand & Hard to Find

According to respondent 1 the most difficult thing about the platform is finding new information, as he believed it was very difficult to know where to look for it, as well as to know what information one can expect to receive in various sections. Respondent 2 and 3 were mainly focused on the functionality of the Business Systems in which they normally operate in. Both respondent 2 and 3 were mainly focused on how they more easily could find information in these systems, and they both suggested that one should be able to search for certain documents using more search variables. Furthermore, respondent 2 stated that the navigation on some of the pages could be facilitated by limiting the amount of scrolling. Respondent 4 and 5 did not find any difficulties working in the system.

Respondent 1 furthermore mentioned several examples where documents existed in places that did not seem obvious. For example, he believed that the FAQ section should be placed in the Portal Guide section rather than in the Contact Us section.

Respondent 3 also went into a lengthy elaboration on that contact information should be easier to find, an argument he developed by proposing to have the entire contact register available in the Portal. He clarified this need by stating: *“In my role I am in contact with operational buyers, project buyers and sourcing buyers as well as their managers. When you have a lot of products that are linked to several functions within Volvo it easily become a lot of people to keep in mind. On top of that these people are replaced in a quite rapid fashion, something that complicates the issue of whom to contact. To have the entire purchasing organization for the areas that one work in, be clearly shown in the Portal, would be advantageous so that I don't have to call and ask whom to contact. The same is true for my boss, I have to show him instead of him being able to find this information in the Portal. Also the contact information for persons working in development would be interesting to have, as well as contact information for quality and scheduling. We would like to have this information easily accessible without having to call and ask whom to contact. This would be really interesting”.*

He developed his argument further by stating:

“Today we receive the purchasing organizational hierarchies within Volvo Group in Powerpoint format. This only creates a situation where data is duplicated, instead of having this information placed in the Portal. For purchasing we already receive the organizational purchasing hierarchies all the way up to the level of vice president so the information cannot be that sensitive. There is a lot of changes to this however, so it is seldom the situation that we have the correct version. When someone quit Volvo and e-mail is not sent to us showing us the correct structure. Rather we have to wait until the next time we have a business review with Volvo and receive new information. This could be six months after this change occurred. I believe most people send an email when they cannot find contact information, having to ask whom is responsible. If someone at quality or someone at production have a question, they often come to me as I am the person responsible for Volvo within our organization. Then I have to send this query to the buyer, as I do not have this information. Either I get the response, or that person tell me that he or she do not know. This creates a long chain of messaging, rather than that the people working in quality or production could find the information for themselves.”

Respondent 3 finished his statement by saying:

“All problems cannot be solved through the Portal, but it would be good to have the most amount of information available in the Portal, while there is a balance to not create a system that is

overly complex. The best solution would be to have a link specifying my contacts, that is, contacts that are connected to my personal login. A quality manager should have the contact information to two SQRs within Volvo and not everyone else. Because for me, for example, it would not be important to know who are working in logistics. Rather the most important information for me are who the contacts for purchasing as well as product development.”

Respondent 2 stated that information related to Logistics is hard to find today. This information should be displayed in a clearer fashion. He further stated that it is very important to find employee contact information related to this area, as it is a complex area given that custom legislations differ heavily between various parts of the world.

He clarified the need by stating:

“I don’t know how to find information about who to contact at Volvo about this. I would like there to be some visible contact information/details about Transports and especially Express transports, because when there has been an error in the logistics and plants are waiting for parts, then I need to find such information immediately”.

Furthermore, he believed that there should be more information about the other brands and functions of the Volvo Group in this section of the Portal, and that the information should be as elaborate as it currently was for Volvo Group.

4.1.1.3. Respondents Views on Redundant Information and Unnecessary Features

None of the respondents felt that there were too much information overall. However, respondent 1 felt that the information should be more updated. Respondent 2 also believed that the information should be structured in a better way and that the E-Library section had a confusing amount of menu options. Further, he believed that the news and events section was redundant since it had not been updated in a long time. He further stated that other information that is outdated should be removed, so that one accidentally would not make use of something that is not valid anymore. Respondent 5 expressed the need to remove old content that is redundant, in order to this make it easier to find information that is relevant.

4.1.1.4. Efficiency of Portal’s Search Function for Finding Relevant Content

Respondent 1 and 2 had the most experience of the search function, where both emphasized that the loading time should not be too long when trying get a query. In relation to this Respondent 1 believed that the response time was alright, but that it could not be longer than it currently was, as the he believed that response time was quite lengthy. Respondent 2 stated that the loading time

was way too long, and that he almost closed down the search function because of the delay. Furthermore, he stated that the results that were displayed looked strange: *“It’s hard to distinguish between the different search results and where they lead.”*

The other respondents had no remarks to make about the search function as they did not make use of it.

4.1.2. Effectiveness

4.1.2.1. The Most Common Use of the Portal & Information and Features to Display First

The most common task performed on the Portal varied among the respondents. For respondent 1 the most common tasks was to deal with orders and claims. He was also interested in delivery precision, invoices and webcasts. Respondent 2 was mostly interested in checking if the invoices had been paid, controlling what orders that had been made, delivery precision and payment terms were also interesting. Respondent 3 was primarily interested in downloading orders, as well as check the performance of his company. Respondent 4 was mainly interested in registering outgoing packaging, ordering packaging material as well as downloading prototype blueprints and purchase orders. Respondent 5 were also mainly focused on managing orders.

All respondents apart from Respondent 5, wanted to have shortcuts to the Business Systems/Applications on the first-page, where respondents 1 and 3 also stated they wanted to be able to design their own quick links, as was mentioned earlier. Furthermore, Respondent 1 felt that the information about the Business Systems in their respective subpage looks outdated, and that he would rather arrive at the system directly. However he added that it would be good to have information regarding what the functionality the various Business Systems have, and that this information should be available to everyone, including those who do not have access to the Systems. The Business Systems should therefore be made more accessible and the description and information about them should be kept, but moved to a less visible page. Respondent 2 stated that one should not have to scroll up and down on the first page to find valuable information, and that the useful systems should rather be placed in a menu on the first page. Respondent 3 wanted to see all sourcing opportunities valid for his company, and documents related to such opportunities, on the start-page of the Portal. Furthermore, he wanted to have quick access to projects as well as information regarding their performance as a supplier. The respondent further

stated that these features would be nice to have readily available for him personally in his role, but that people working in production or quality might have other needs.

4.1.2.2. Functionality and Information that is missing in the Portal

Two of the respondents (Respondent 1 & 2) expressed that they found it difficult to sort, manipulate and export data from the Supplier Portal. One of them (Respondent 2) expressed that the lack of any good such features forced him to take print screens of important information and then manually type in the numbers and data into a new document, since no easy export function was available. He believed this to be a very simple task for a digital system to handle, but which now forced him to spend a lot of time on a mundane task.

Many of the respondents (Respondent 1, 2, 3 & 5) also explained that they would have appreciated ways to dig even deeper into the data on their performance and key metrics, related to their operations with Volvo Group, as this would have enabled them to understand their results better and improve their performance.

Respondent 2 & 3 also expressed that they would appreciate more ways to track team and project progress within the Supplier Portal, and that all relevant information and documentation related to this actually was uploaded into the Supplier Portal. As it was now, many of the respondents experienced that various people within their organization received different information and documentation from Volvo Group, which meant that they had to administer the collection and summary of documentation themselves. This led to a lot of extra work for the suppliers. Especially since the documentation as a result often contained irrelevant information that had been updated since the document was distributed.

It was also expressed that being able to track all information and progress within the Supplier Portal most likely would decrease the amount of time that now had to be spent in meetings between Volvo Group and their supplier organizations, as most of these meetings were simple “information briefings”. Not having to tie up resources in these meetings was seen as a great way for both Volvo Group and the supplier organizations to save time and human resources (Respondent 3).

In summary most of the respondents (Respondent 1, 2, 3, 5) therefore wanted the Supplier Portal to contain all relevant and updated information related to their operations with Volvo Group, and that more information sharing should be carried out with the features that already existed. Or as one of the respondents expressed it:

“This would have simplified our daily operations immensely. By adding more of these great features in the Portal, the use of the Portal would increase a lot. If the Portal had more information that we need, the utility of the platform would increase both for us as suppliers as well as Volvo” (Respondent 3).

Several of the respondents furthermore suggested improvements in relation to the navigation (Respondent 1, 2 & 3). As the Portal today were perceived to contain too many pages and to have too difficult navigation for finding content, a mutual suggestion by Respondents 1 & 2, was that users should be able to assert their own quick links and create favourites on the start page of the Portal, to their most used content. Since this could increase the efficiency of their work. Lastly, two respondents (Respondent 1, 2) highlighted that they would like to be able to give feedback and suggestions to Volvo in an easier way. As it was now the respondents had informal feedback loops with their specific contacts within Volvo, but found it hard to find the right person to give the information to, and did not know whether or not the feedback they gave was ultimately given to the right person. When asked on how they would like to be able to deliver this feedback, Respondent 2 gave the only suggestion, by recommending that Volvo could implement an “improvement feedback system” within their Supplier Portal. He stated that a similar system was used by competitors to Volvo. With such a system, recommendations for all aspects of the mutual operations, whether it related to processes, materials, quality, logistics or the Supplier Portal itself, could be delivered to Volvo. Such a system was believed to be able to improve the operations and processes at both the supplier organization and within the Volvo Group organization.

4.1.2.3. Business Related Updates Communicated through the Portal

When faced with the question, on whether or not the respondents believed they received all important updates related to their and Volvo’s mutual business operations through the Portal, the findings seemed to differ slightly. Most of the respondents though, seemed to highlight that they did not receive, and did not know how to find relevant information in the Supplier Portal. All respondents except one expressed that they would like to receive more information related to their business operations and requirements, as well as have it more easily accessible (Respondent 1, 2, 3, 5). Preferably this information would include changes to mutual documentation, information about changes or addition of new information in the specific Business Systems that exists within the Portal, information regarding plant or production disruptions and information

about changes to the navigation or structure of the Supplier Portal. Such information was perceived to be able to give the suppliers better opportunity to better adapt to unforeseen events or circumstances, as well as better align their own operations and productions with that of Volvo Group and the market.

At the moment, updates or news sections were rarely visited by the respondents, since they were perceived to be too general, and poorly targeted towards the users of the Supplier Portal (Respondent 1, 2, 3). Subsequently, news and information were conveyed that did not even relate to the work role of any of the users of the Supplier Portal.

Since all users of the Supplier Portal need to state their work role and expertise area, respondent 2 even went as far as suggesting that the platform should make use of the information and only convey news related to user's specific work roles. Updates concerning quality should for example only be targeted towards users who had stated quality as their work role. This was believed to greatly decrease the amount of irrelevant or redundant information.

4.1.2.4. Comprehensibility of Navigational Sections and Headlines

Respondents 4 and 5 stated that the headlines and menus were good and understandable. Respondent 1 did not however think it was obvious what content that can one could presumably find under some of the headlines. Respondent 2 had a similar opinion and stated that the headlines needed to be changed, as it is tough to understand all the acronyms and that it is not clear what one can expect to find under each headline.

4.1.2.5. Respondent Actions in Face of Supplier Portal Issues

All respondents expressed that technical issues or problems related to the Supplier Portal was experienced quite regularly. Not knowing where to find specific information or how to use all functions and features of the systems properly, had been experienced by all respondents at some point. When such issues was encountered however, the respondents differed in how they wanted to solve the problem. Most of the respondents (all but Respondent 5) had no idea that there were clear and detailed manuals and trainings guide on how to use the platform and all its Business Systems. They therefore requested such information, since they had not been able to find it, even though it already exists.

These respondents (all but Respondent 5) expressed that their solution to the problem was to call or email someone at the case company, asking for help. Usually this would mean that they would contact the person that was the most accessible to them at the case company, meaning a person

within purchasing. Further, it was expressed that these people often could not answer all questions regarding technical issues, and the respondents all expressed, sometime during their interviews, that they were frustrated with being redirected around within the case company's organization.

These respondents also pointed to the Portal being too complex to understand fully by themselves, and that when they encountered issues they did not know where to find any sections with FAQ's, training manuals or guides, or relevant contact information.

Furthermore, they expressed that much time was wasted both on their side and for the case company and that they would have appreciated a single point of contact for each encountered issue, which was capable of solving the specific problem.

Since the navigation was considered so complex at times, and since information was perceived to be so hard to find, two respondents (Respondent 1 & 2) also expressed frustration with the fact that a lot of time now had to be spent by their own organization, in training their employees in how to use the Supplier Portal, since the Portal was not intuitive or usable enough to start using without help.

4.1.3. Satisfaction

4.1.3.1. Respondent Opinion on Portal Mobile Usage

Most of the respondents (Respondent 1, 2, 4, 5) did not see an immediate personal need to be able to use the Supplier Portal on a mobile device. Two of these respondents (Respondent 1, 2) did however see, and had heard from colleagues, that younger personnel within their organization would like to use the Supplier Portal on a mobile device, since it corresponded more to these colleagues work habits. Respondent 3, who was the youngest of our respondents also expressed a strong interest in having the Supplier Portal adapted for mobile use since it would facilitate his work tasks by being able to use the platform while travelling, without having to access the computer, and he even went as far as saying:

“Volvo should start to think about the younger generations and not the ones going into retirement, because they would want to access the platform on the phones.” (Respondent 3).

The respondents who answered that they did see a use case, either for themselves or their colleagues to be able to use the platform on mobile, was asked what features or functions that

they thought would be most important for them or their colleagues to use on a mobile. The view of the respondents here was that the most important functions for mobile would be to be able check general information, read documentation, look up contact information and access orders.

4.1.3.2. Capturing Additional Feedback from the Respondents

Respondent 1 believed that the system should be more flexible in terms of what is being displayed to various users working for a supplier by arguing that there should be restrictions to what information people receive. If someone e.g. is placed in Brazil, they should only be able to access the Brazilian company information as well as the general group information and not receive all available information of all group companies. He believed that companies should be able to tailor the information in this way.

Respondent 3 believed that the system was good overall, but that there are areas for improvement. His view was to simplify the Portal for the users, where it should be made easier for the users to find the information that they need. Therefore, Volvo should remove unnecessary subpages and simplify navigation.

4.2. Quantitative Findings

In this section all our quantitative findings will be presented. They will be analysed jointly with our qualitative findings in the Analysis Section.

Screening Questions

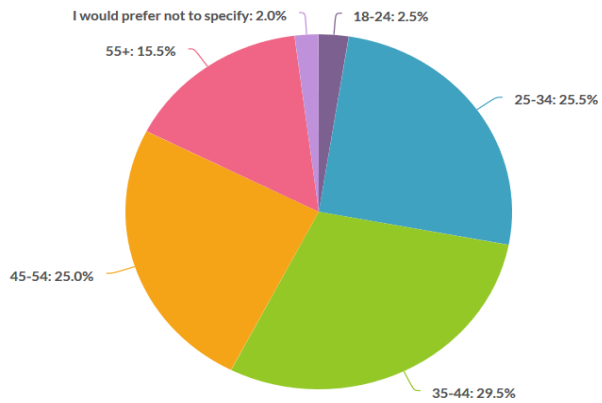
Question Asked:

- “What is your age?”
- “What country do you work in?”
- “What is your main role within your company?”

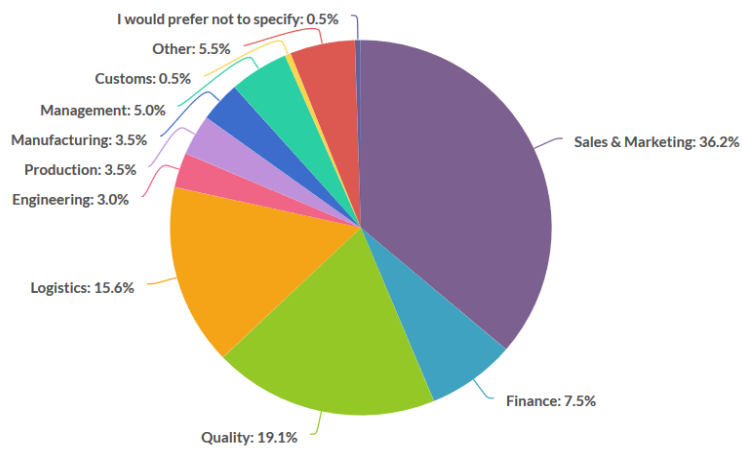
As described in the method (3.3.1) we included three screening questions in the survey, with a varying purpose for these questions. The first screening question age were introduced based on the qualitative findings where there seemed to be a connection between age and the desire to be able to make use of the Portal on a cell-phone. This correlation something that we found interesting and wanted to investigate further. Therefore this screening question was included. The age of the users were quite evenly distributed between the age groups 25-34, 35-44 and 45-54. 80% in total belonged to these groups, where the age group 35-44 was the biggest with 29.5% of respondents. The age group +55 made up 15.5% of the respondents. 2.5% were between 18 and 24. The second screening question, what countries that were represented was introduced in order to test the representativeness of the user base.

31 different countries were represented, with the largest user bases being located to Sweden and the US. All large markets for Volvo Group are represented in the sample. For confidentiality reasons the specific countries are not disclosed here. The third screening was concerning what role the users have within their companies. The largest group was Sales & Marketing, consisting of more than a third of respondents. Quality was the second largest followed by logistics. The work role question relates to which information and which business systems that should be most important to those users and therefore added a lot of information to the study.

“What is your age?”



“What is your main role within your company?”



4.2.1. Efficiency

4.2.1.1. Respondents Usage Levels of the Portal

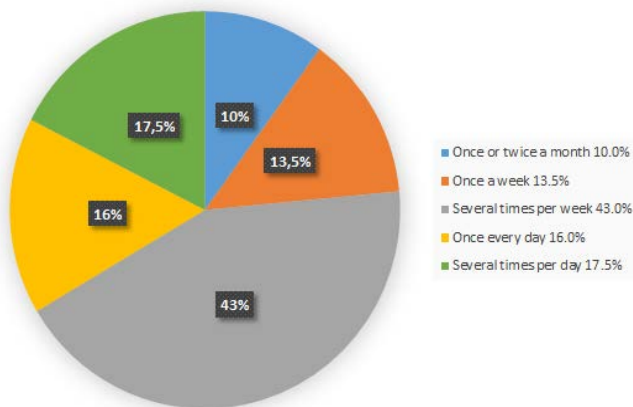
Questions asked:

- “How often do you use the Supplier Portal?”
- “How much time do you spend on average per visit?”

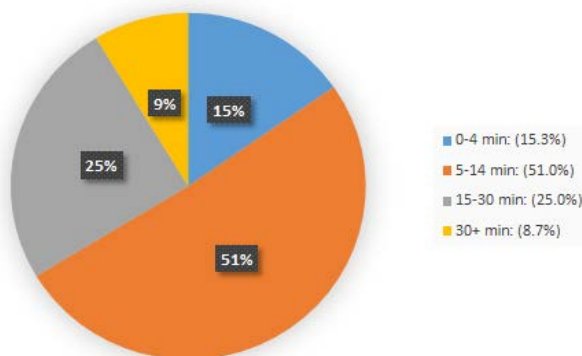
Our qualitative interviews had provided quite coherent findings between the respondents on the usage levels and general usage time of the Portal. As the time spent, and amount of visits by the suppliers have a strong impact on the future design decisions, due to them highlighting usage behaviour, we wanted to validate the usage levels for the users on the platform.

How often the suppliers visit the Portal differs quite some, but the vast majority still visit the Portal several times per week. Also, it is evident that the suppliers spend very short amounts of time per visit, most often under 15 minutes per session.

“How often do you use the Supplier Portal?”



How much time do you spend on average per visit?



4.2.1.2. Information and Features that are Difficult to Understand & Hard to Find

Questions asked:

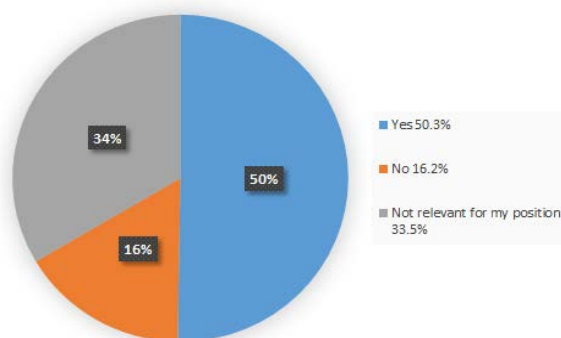
- “What information have you found particularly hard to find?”
- “Do you know where you should go in the Portal to track invoices?”

We wanted to validate and provide additional findings on what information and features that were perceived as difficult to understand, as well as hard to find. We therefore chose to ask one very specific question and one more general, which could provide complementary findings. The first very specific one dealt with the respondents’ ability to track invoices (if it was applicable to their position). We decided to ask this specific question since it related to the very common work-roles of the users, “Sales” and “finance”. The area within the Portal to track such information, and especially invoices, is therefore very important. The qualitative findings had also touched upon the difficulty in tracking and finding such information.

We therefore included the question as a validation towards the answers previously given. While the majority of the respondents knew where to go, an important finding was that out of the respondents (for which the ability to track invoices was applicable) a whole 25% did not know where to go in the Portal.

This question was then followed up by a free form question in which suppliers had the opportunity to add complementary findings in free-text form on information that they had found particularly hard to find. Several of the responses touched upon the same topics, namely that it was hard to find some of the Business Systems, as they were nested far down within the hierarchy levels. That it was hard to find relevant contact information. And that it was very hard to find important documentation on drawings/models and on the specific standards and rules that the suppliers must adhere to.

“Do you know where you should go in the Portal to track invoices?”



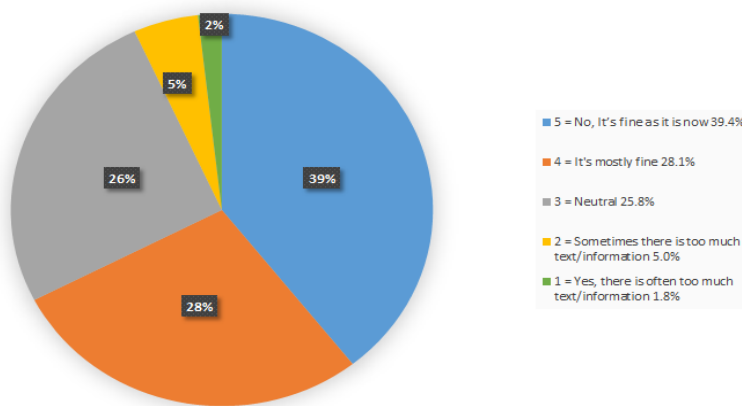
4.2.1.3. Respondents Views on Redundant Information and Unnecessary Features

Question asked:

- “Do you think there is too much information/text on the pages in the Portal (in general?)”

We decided to ask the question to our respondents if they believed that there was too much text within the pages of the Portal. A majority of the respondents believed that the amount of information was fine as it was now. With an additional large part of the respondents also stating a neutral opinion towards it.

“Do you think there is too much information/text on the pages in the Portal (in general?)”:



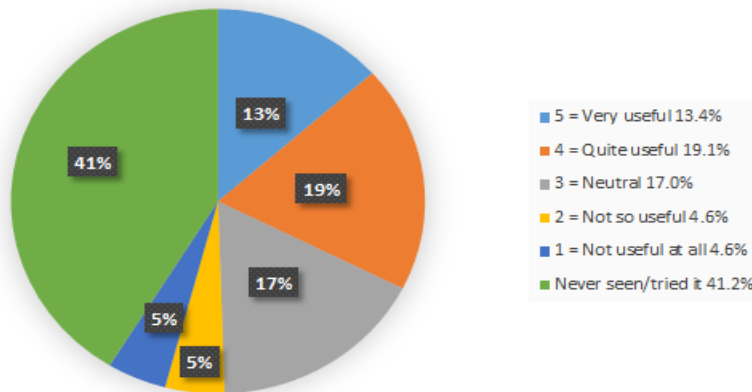
4.2.1.4. Efficiency of Portal's Search Function for Finding Relevant Content

Question asked:

- “How useful do you think the search function is for finding information in the Portal (the function in the upper right corner)?”

As several of our qualitative findings have touched upon the issues of navigating the interface and finding content, we wanted to ask for further validation and opinions on the functionality of the Portal's search function. We therefore included a question on the respondents' opinions on the search function of the Portal. While more respondents considered it useful than not, a very interesting finding was that a whole 41% had not used or seen it at all.

“How useful do you think the search function is for finding information in the Portal (the function in the upper right corner)?”:



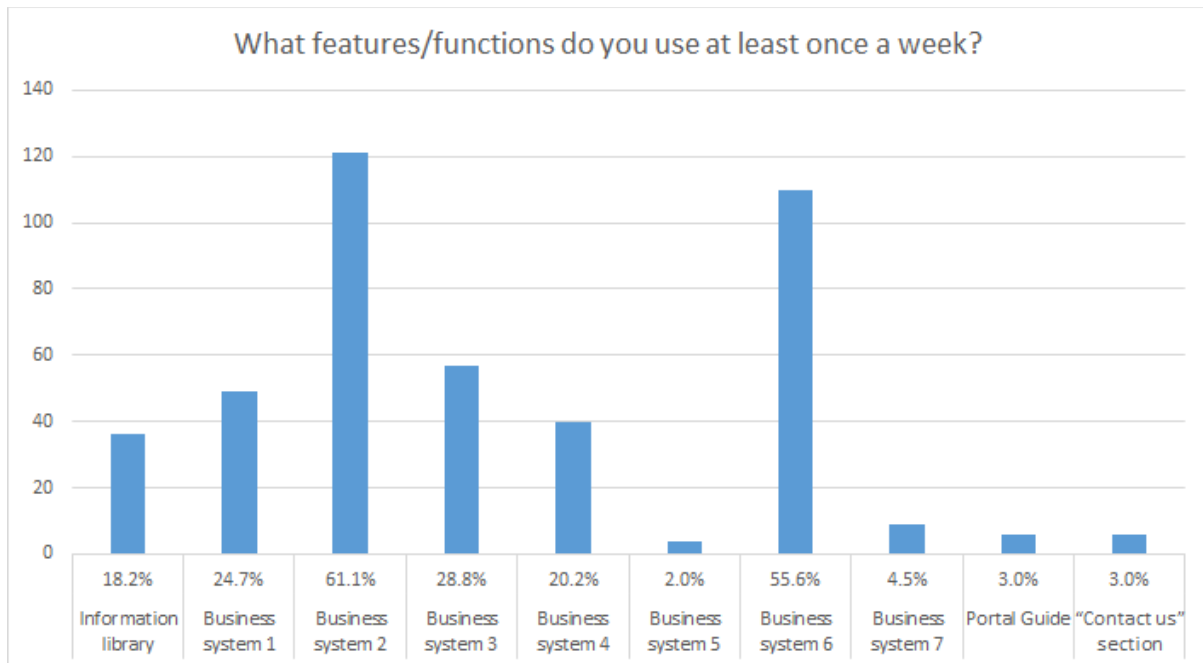
4.2.2. Effectiveness

4.2.2.1. The Most Common Use of the Portal & Information and Features to Display First Question asked:

- “What features/functions do you use at least once a week?”

In order to validate which features that was most commonly used in the Portal and therefore validate which information and features that should be given emphasis in the design, we asked the respondents the question of which “features/information” that they used at least once a week, out of all the Portal features and information. The quantitative data highlighted that the most common usage areas of the Portal related to specific Business Systems. Due to secrecy considerations, the names of many of the systems and sections have been replaced with general names in the graph below.

“What features/functions do you use at least once a week?”



4.2.2.2 Features and Information that is missing in the Portal

Questions asked:

- “Do you think that there is important information/text that is missing in the Portal?”
- “If you think there is important information missing, could you please specify what information”

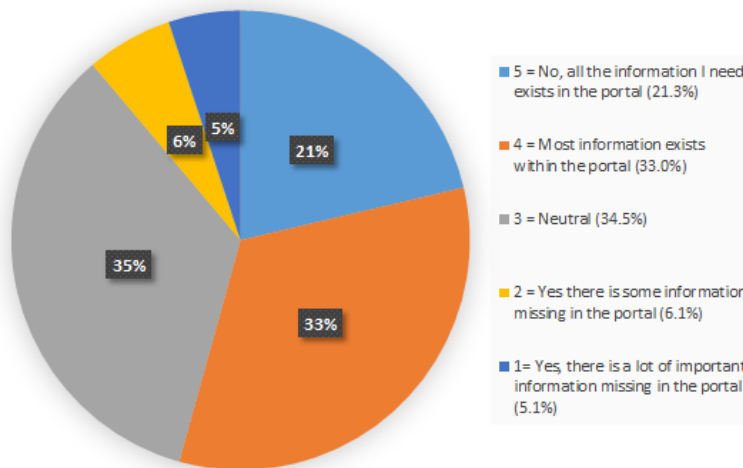
In order to validate or contradict the qualitative findings the users was allowed to value, on a scale from 1-5, if they considered important information to be missing in the Portal. They were also given the opportunity to add complementary findings in a follow-up question that asked for specific information or features that might be missing.

As is evident from the graph below, most users did not seem to believe that there was important information missing in the Portal. The answers did however provide complementary findings, and highlighted an important aspect of the Portal.

Firstly, the users did exemplify information that is currently missing in the Portal today and that should be added by the case company, information related to the mutual operations of the suppliers and the case company, such as documentation relating to quality, logistics and model prints. Also, when the users had the opportunity to state information or features that they thought was missing in the Portal, they requested a lot of information and features that already exist within it. For example: specific forms and documents related to the suppliers’ operations, contact

details to key personnel for certain encountered issues that actually do exist, and specific information in the Business Systems that help inform the users of the case company's requests.

“Do you think that there is important information/text that is missing in the Portal?”:



4.2.2.3. Business Related Updates Communicated through the Portal

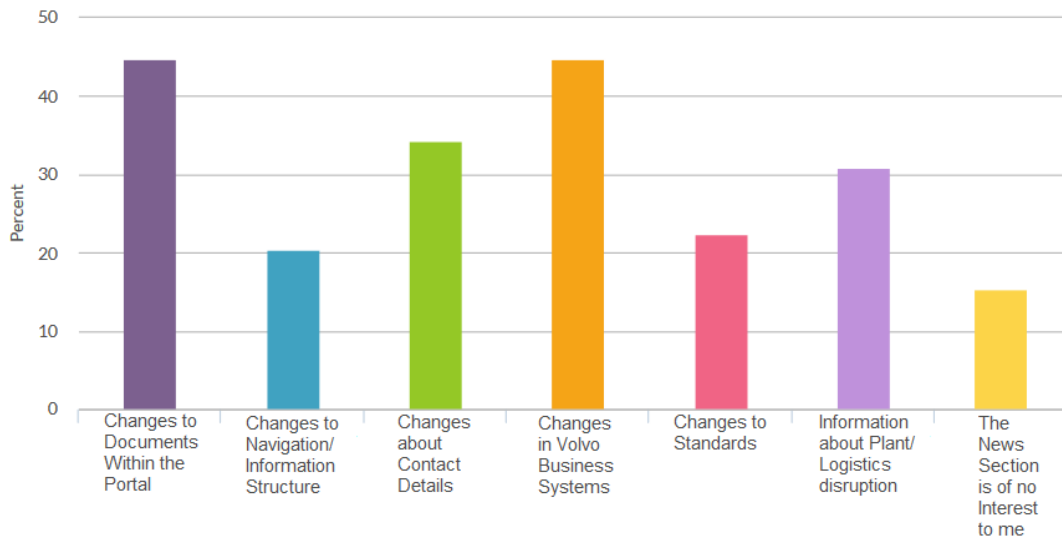
Question asked:

“What information would you like the news sections to contain?”

In order to validate what business updates that were the most important for our respondents, and whether or not such information was currently being communicated by the case company through the Portal (as several of the qualitative interviewees had touched upon not receiving enough updates), we decided to investigate which information that the respondents would prefer the most, to be communicated through the current news section of the Portal. The alternatives were chosen based on the answers in the qualitative interviews, and on the current businesses processes between the case company and the suppliers. The users had the opportunity to select more than one category.

The graph below show that all specified categories were interesting to at least 20% of respondents and the most popular categories were interesting to more than 40% of respondents. Most desired, were news or updates about changes to the systems and content on the Portal.

“What information would you like the news sections to contain?”



4.2.2.4. Comprehensibility of Navigational Sections and Headlines

Questions asked:

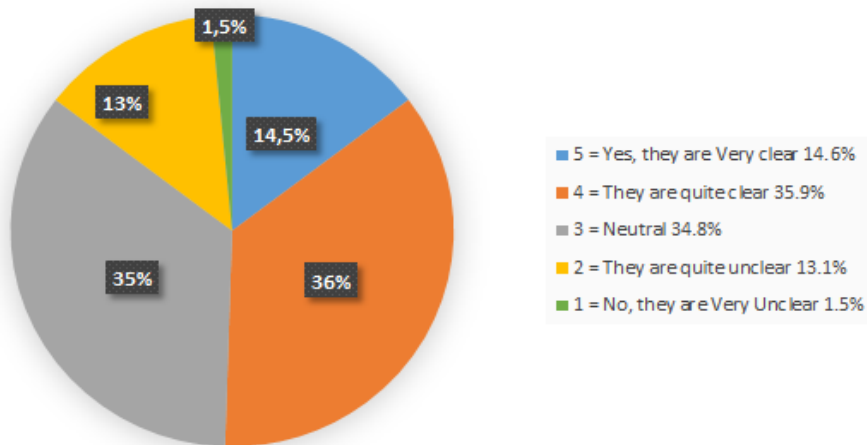
- “Do you think the headlines make it clear what information that you can find under each section?”
- “Are there abbreviations or acronyms on the webpage that are unclear?”

As several respondents from the qualitative interviews had expressed issues with the naming of current headlines, menus and sections, and with knowing what information that could be found beneath each of them, we decided to include two questions on the subject.

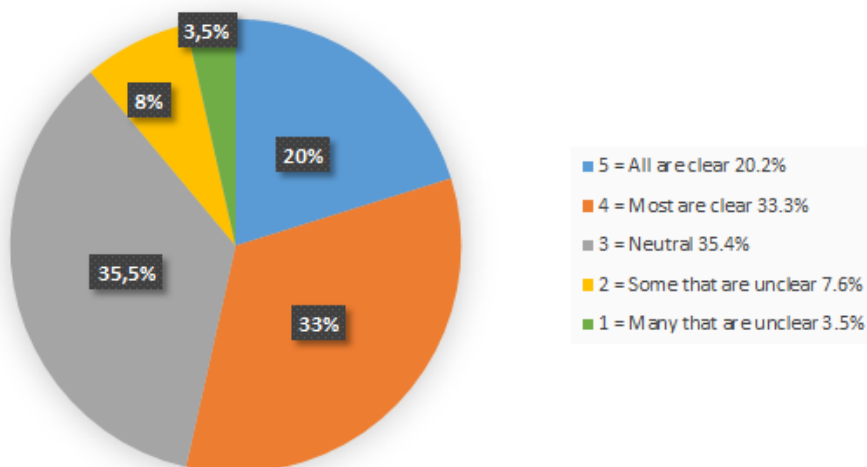
The first one asked the respondents on whether or not the current headlines made it clear what information that could be found under each section. About 3,5 times as many respondents considered the headlines to be clear, compared to those who did not. Roughly 50%, compared to 14,5%.

The second question asked the respondents about whether or not they found the current abbreviations or acronyms on the webpage to clear, something that had been mentioned in some of the qualitative interviews. Roughly 5 times as many respondents did not have a problem with the current abbreviations, compared to those who found them difficult to understand. Roughly 53,5%, compared to 11%.

“Do you think the headlines make it clear what information that you can find under each section?”



“Are there abbreviations or acronyms on the webpage that are unclear?”



4.2.2.5. Respondent actions in Face of Supplier Portal Issues

Questions asked:

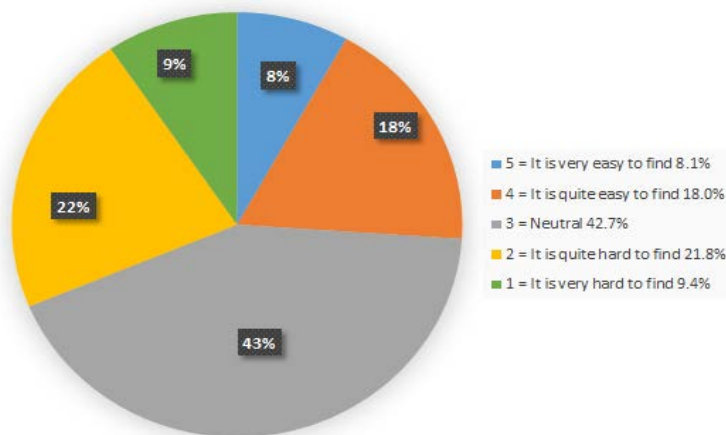
- “If encountering "Business problems" (general & commercial topics), do you think it is easy to find information about whom to contact on the Portal?”
- “If encountering "General IT problems" with the Portal or its underlying Business Systems, do you think it is easy to find information about whom to contact on the Portal?”
- “If you encounter a problem with the Portal you would prefer to:”

As we wanted to investigate and validate the actions that users took when encountering issues with the platform, and how accommodating the current design was for solving issues, we decided to ask three specific questions related to what the user preference would be in the face of an

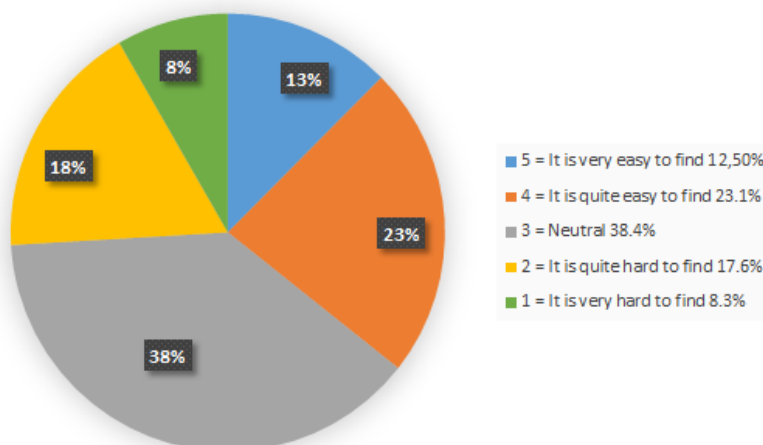
encountered issue, and whether or not the respondents found it hard to find contact information when encountering issues. When encountering issues related to business or commercial topics, 31% found it to be quite hard or hard to find information about what to do, or whom to contact when encountering this type of problem.

Finding information related to technical issues with the Portal or its underlying Business Systems, which as exemplified in “4.2.1.1” are the most used features of the Portal, was considered quite hard or hard by 26% of the respondents.

“If encountering "Business Problems" (general & commercial topics), do you think it is easy to find information about whom to contact on the Portal?”

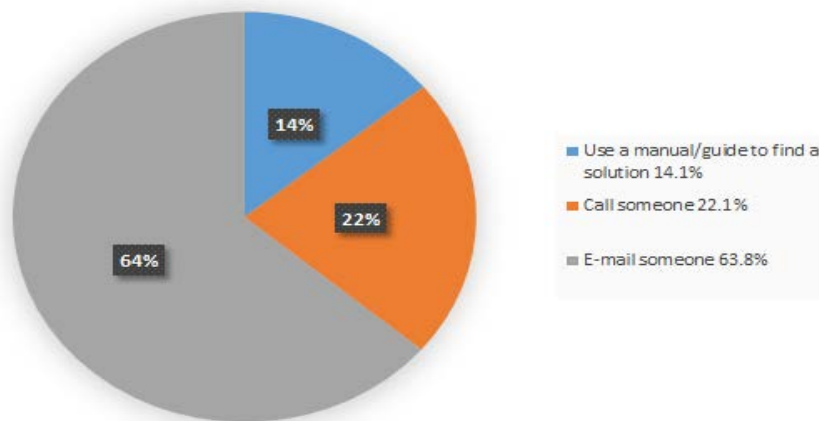


“If encountering "General IT Problems" with the Portal or its underlying Business Systems, do you think it is easy to find information about whom to contact on the Portal?”



When encountering a problem or issues with the Portal, the vast majority of respondents preferred to e-mail someone (63,8%). 22% preferred to call someone and 14% of the respondents stated that they would prefer to use a manual or guide to solve their problem.

“If you encounter a problem with the Portal you would prefer to”:



4.2.3 Satisfaction

4.2.3.1. Respondents Opinion on Portal Mobile Usage

Questions asked:

- “How important would you consider it, to be able to use the Supplier Portal and its underlying Business Systems on a mobile device or tablet?”
- “If it’s important for you. What functions would you like to be able to use on a mobile tablet?”

As we aim to measure how available the system is and how it can be made more available for its users, we decided to ask two specific questions connected to mobile usage, as a way to validate and add to our qualitative findings.

When including all respondents in the ages of 18-55+, 18% of respondents considered it very important to be able to use the Portal and all the Business Systems on a mobile device, whereas 17% considered it to be quite important.

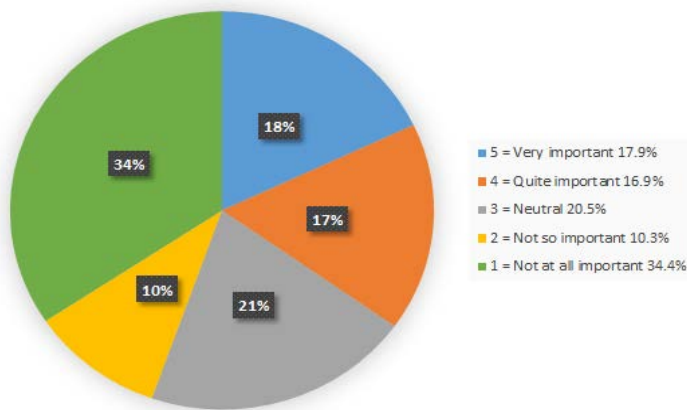
When only including respondents between the ages 18-44, the amount of respondents who find it to be very important rose to 24% and the group who considered it quite important was 15%,

whilst when studying the selection of respondents aged 18-34, 30% considered it to be very important and 13% quite important.

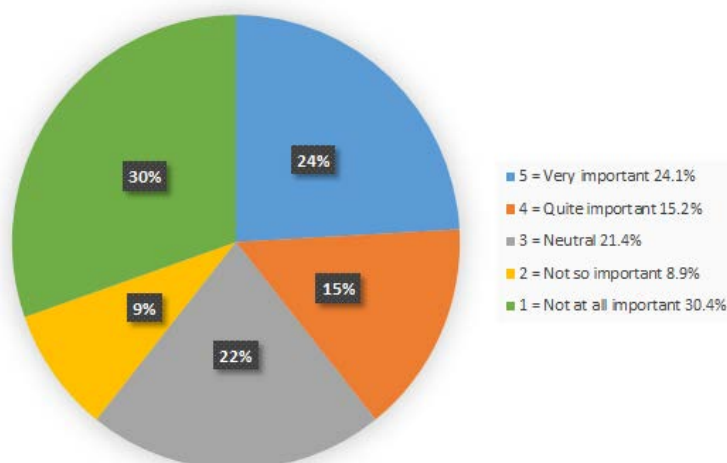
A follow up question on which functions of the Portal that would be most important to be able to use on a mobile device was also included in the quantitative study. The business system were considered the most important feature to be able to access and work in, on the respondents' mobile devices. The other functions ranged between around 20% for the News section, to a bit over 40% for being able to look at performance.

“How important would you consider it, to be able to use the Supplier Portal and its underlying Business Systems on a mobile device or tablet?”

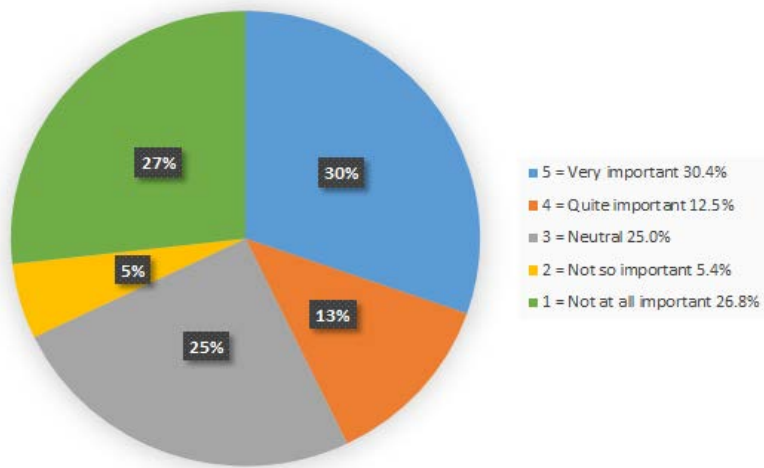
Age group: 18-55+ (Important (4-5) = 34,8% | Not Important (1-2) = 44,7%)



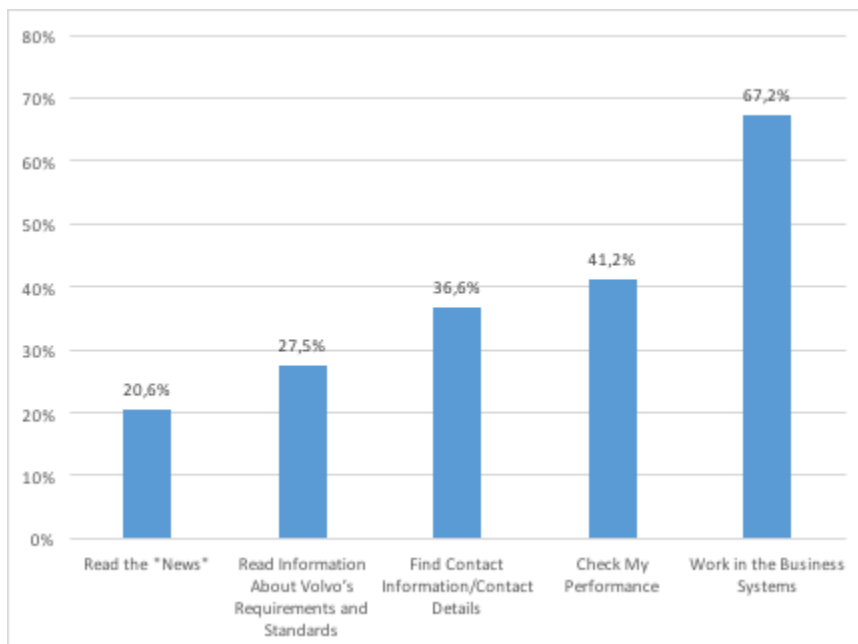
Age group: 18-44 (Important (4-5) = 39,3% | Not Important (1-2) = 39,3%)



Age group: 18-34 (Important (4-5) = 42,9% | Not Important (1-2) = 32,2%)



“If it’s important for you. What functions would you like to be able to use on a mobile tablet?”



4.2.3.2. Capturing Additional Feedback from the Respondents

Questions Asked:

- “Do you have any recommendations for improvement, which you would like to see in the platform or in any of its underlying Business Systems in the future (it can be for new functions, improvement of current functions, etc)?“
- “Would you like a system on the Portal where you could give feedback and suggestions to Volvo for improvements?”

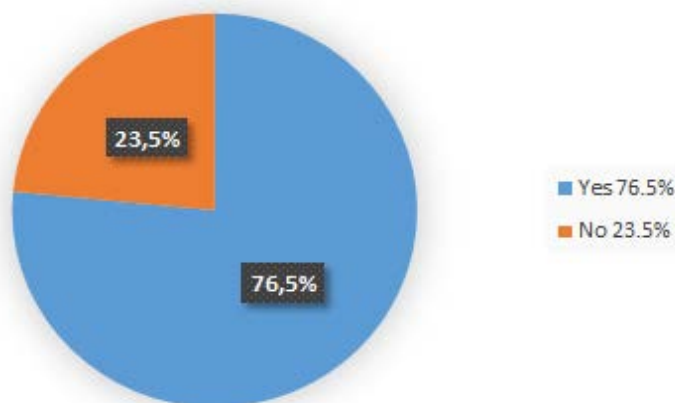
Related to the opportunity to capture additional feedback from the users, we decided to ask two questions. In the first one we asked the users to give additional feedback and recommendations for future improvements to the Portal and its underlying Business Systems through free-text forms. In total we received 61 elaborate responses as complementary findings. These findings could be summarized to cover the following opinions:

- Simplify navigation of Portal. Make the interface more user friendly.
- Improvements needs to be made to many of the Business Systems. Especially to make it easier to search and find relevant information within them. Also, more functionality could be built in that simplifies processes for the suppliers, e.g. exporting and sharing data.
- Much more contact information to key Volvo personnel should be displayed. Especially to personnel with specific information and knowledge related to different expertise areas.

Additionally, we decided to ask for the opinions of the respondents, to have a system where they could give their feedback on improvements related to all aspects of their mutual operations with the case company. Something that had been highlighted in the qualitative interviews as a way to improve the operations of both the suppliers and the case company.

The vast majority of the respondents (76,5%), expressed that they would have appreciated such a system.

Would you like a system on the Portal where you could give feedback and suggestions to Volvo for improvements?



5. Analysis

5.1. Efficiency

5.1.1. Respondents Usage Levels of the Portal

The vast majority of users seem to visit the Portal at least a few times per week and spend a quite short amount of time per session (under 15 minutes per session). Since the Portal is used as a work tool by its users, it is not so strange that they spend short amounts of time in it. In contrast to social media, news outlets, or other such digital systems, where the users more freely spend their time, a work tool is only used to efficiently solve a task at hand.

Therefore, it is reasonable to believe that the structure and navigation of the Portal should promote efficient use, meaning that users can perform intended tasks in an as efficient way as possible, with easy access to the most used features.

5.1.2. Information and Features that are Difficult to Understand & Hard to Find

Both the qualitative and quantitative studies highlighted similar findings on which information or features that were difficult to understand and hard to find. Thus, one should adhere to these coherent findings as they seem to be valid for increasing the Usability.

The emphasis in the qualitative interviews was that information was hard to find within the Business Systems of the Supplier Portal, and that the functionality within these systems could be developed, so that it would become easier to find, and make use of relevant information within the systems. Examples of this would be the ability to have more search variables, being able to display more data at the same time, being able to cross-reference data and having faster navigation options in the datasets. This relates to Tidwell's (2011) idea that by understanding what the users needs to learn, good interaction design can then help the users with solutions for sorting out specific information, filtering out redundant information, getting an overview, making general assumptions, finding general interconnectedness and compare data.

It was also stated that relevant contact information was very hard to find when encountering issues, whether technical or business related, and that information was not updated sufficiently. This meant that users today contacted their first point of reference within the case company, for help where to turn next. As the employees within the case company often lacked, or had a hard

time finding this information as well, much time and resources were now being spent by both the employees of the case company and the employees of the supplier companies to solve arisen issues, due to the lack of relevant contact or help information within the Portal.

The quantitative findings highlighted similar aspects and added a lot of complementary findings on information or functionality that was perceived as difficult to find. Firstly, it was believed that many of the Business Systems were troublesome to find, as they were perceived to be nested too far down within the hierarchy levels at many times, even though they were used on a daily basis, or for several times a week. Secondly, the quantitative findings accentuated that it was hard to find relevant contact information and find the right contact person at the case company. And lastly, the quantitative findings highlighted that users had issues to find important documentation related to many aspects of their and the case company's mutual operations.

It is interesting to notice that much of the information and documentation that was believed to be missing by the users, actually exists within the Portal. As the information do exist, the problem is probably instead that the information is hard to find for the users.

Additionally, it is remarkable that 25% of the users who considered it to be relevant to them, did not know where to find the system for tracking invoices, a major feature of the Portal.

Related to this, and the issue of finding relevant contact information in the Portal, it seems that much resources could be saved by simplifying the navigation and content structure of the Portal, so that important information and features could be found more easily. Also it could be a good idea to place resources for self-help, such as manuals and training guides, in a visible way, as this could also decrease the amount of time and resources spent on error handling, and since a large group of the respondents would even prefer this as their main option for problem solving.

5.1.3. Respondents Views on Redundant Information and Unnecessary Features

The quantitative survey seemed to validate the qualitative findings, that the current platform did in fact not have too much information and text on the pages. This was an important finding, since too much text and information will take up working memory in the brain and incur a cognitive burden (Hinman, 2012).

The problem that was highlighted by respondents, regarding the content of the Supplier Portal, was that it was not updated properly. And that a lot of old and redundant content existed within

the Portal, as well as that the information could be structured in a better way. The fact that a lot of the content was redundant and outdated can relate to the issues of users not knowing what information that actually exists within the Portal. It could be, that this lack of a helicopter perspective affect also the case company. Meaning that the navigation and structure of the information within the Supplier Portal is so incoherent and complex that even employees responsible for the management of the Portal have a hard time knowing which information that actually exists within it, and if information can be removed or should be updated. In that case a simpler structure of the information, and a simpler hierarchy and navigation within the Portal, most probably would benefit the case company just as much as it would the users.

One such topic, which had been emphasized in the empirical findings was the current “e-library section” which included a vast amount of pages in total. A simplification of this section and the portal in general, could probably contribute to a great increase in the Usability of the Portal.

5.1.4. Efficiency of Portal’s Search Function for Finding Relevant Content

According to (Tidwell, 2011) search functions are useful for helping a user to identify specific information in a big set. As many of our findings have touched upon the issue of finding specific information within the Portal, and that there are issues with the current search function e.g. the display of the results and the response time, we decided to ask our respondents about how useful they found the current search function to be. While more users considered it to be more useful than not (32,5% versus 9%), the most interesting aspect was that a whole 41% had never used it all. This may be due to the fact that users do not find the feature, which today is displayed solely through a very small icon in the periphery of the design, or that they do not need it.

The qualitative and quantitative findings therefore provided contradictory responses of how useful the search function was, where the qualitative interviews highlighted that the function was not very useful and the quantitative findings that it was more useful than not. Possibly the disparity could be explained by the qualitative interviews being with respondents that considered it to be not useful, or by careless responses in the quantitative survey, or the fact that qualitative interviews can map and identify findings that a quantitative survey cannot, because it involves deeper reflection from the respondents.

The quantitative findings can therefore still highlight that the search function needs to be displayed in a more visible way as many of the respondents never used it. Or it may highlight that despite the navigational issues that many of the respondents have encountered, experienced

users have learned to navigate the interface and therefore do not need the search function, while new users might.

5.2. Effectiveness

5.2.1. The Most Common Use of the Portal & Information and Features to Display First

The tasks that the users performed most often varies greatly between users, where for example, some Business Systems are more popular as they are related to specific work-roles and responsibilities. Most respondents of the qualitative study emphasized the need to have quicker access to the Business Systems (Respondent 1-4), rather than having to click down through several sub-pages. Business System 2 and Business System 6 are used more than the others, where over 50% of respondents in the quantitative study used these respective systems at least once a week. However as many Business Systems seem to be very important, and since features with similar characteristics should be displayed in proximity to each other (Wickens et. al. 2004; Cooper et al, 2007; Tidwell, 2011; Norman, 2013), it is indicated that the Business Systems need a prominent position on the Portal - grouped together, preferably on the start page, as emphasized by the qualitative responses. According to Saffer (2006) the preferable way of displaying items is through alphabetical order, since it allow for the user to make choices in a faster and more accurate way. The Business Systems should therefore be structured in alphabetical order. The users wish to be able to create their own quick links on the start page, as was expressed by Respondent 1 and 3, is also supported by theory (Tidwell, 2011) and it should probably be a feature that is available on the Portal, as this help could enable the users to complete their tasks, without having to spend a lot of time finding the information in a subpage in the Portal, or in worst case forgetting where to look for it.

Furthermore, the information regarding all the Business Systems is not something that is needed every time a system is used, and therefore this information can be separated from the link to the system itself, as this does not facilitate an effective achievement of tasks. Related to this we received a finding by the experienced Portal user Respondent 1, who stated that information about all business system should be available to everyone, and not just those who have access to a system. This could probably facilitate for the users wishing to have access, to know what accesses they need in order for them to perform their tasks.

5.2.2. Functionality and information that is missing in the Portal

Another problem that hindered the effectiveness was that it was believed to be problematic to track team and project performance, where a dispersion of information to various people in a supplying company made the task of overseeing a project very complex. This is greatly related to the findings of Sanders et al (2011), where supplier performance can be increased by improving the sharing of information. Respondents in both the qualitative and quantitative study wanted to have more information communicated through the Supplier Portal about their operations, information many receive today by email, where an increased amount as well as more updated information in the Portal is highly likely to save resources for the Volvo Group. This since there are meetings scheduled to brief the suppliers of the same information, which instead could be communicated through the Portal. By sharing more information on the Portal, rather than providing the information at meetings, processes can be made more Effective for both suppliers as well as for the Volvo Group. However, in the qualitative study users overall found that there were important information missing in the Portal, whereas only 11% of respondents in the quantitative survey felt that there were some or a lot of information missing. This discrepancy may be due to the format of the study, where respondents in this type of quantitative study may be less inclined to spend time contemplating on the question, providing undeliberate answers rather than truly deeming the content to be flawless (Buchanan, 2000).

As previously stated, the ability to sort important business data in the Portal was considered to be important, something that is not done with ease today. Also to be able to break down one's performance more comprehensively could enable the users to better understand it, thus being able to more completely perform their tasks.

Further, as mentioned before the possibility to export data from the Supplier Portal should be developed, something that was accentuated repeatedly, as there are no simple or useful tools for data exporting today. This could have a profound effect on both the Efficiency and Effectiveness for a user, since a lot of manual labour has to be performed at the moment, rather than having an automated feature.

5.2.3. Business Related Updates Communicated Through the Portal

As discussed in previous section, empirical findings have highlighted that more information should be communicated through the Supplier Portal and it should be made more accessible.

This, since it could lead to great improvements to the processes of both the case study company and the supplier companies.

The qualitative interviews provided input that the users wanted to be able to sort the news that was relevant to them and that news that they receive should be targeted more to their specific work roles. The quantitative study further show that news containing updates about the Business Systems, news about changes to the documents in the Supplier Portal, and news about changes to contact details are the most important to be displayed. Approximately 15% of users said that news were of no value to them, indicating that the rest of users to the very least attributed some value to the news section.

5.2.4. Comprehensibility of Navigational Sections and Headlines

There were diverging opinions to whether or not the headlines in the Portal were unclear in both the qualitative study as well as the quantitative study. In the qualitative study there were several respondents who believed that the headlines needed to be changed and be made clearer. In the latter little more than 50% of the respondents answered that the headlines were at least quite clear, and where little less than 15% respondent that they were at least quite unclear. For the acronyms used in the site, the same pattern emerged, however even more tilted in the favour of clear. As the number of users on the Supplier Portal is quite high, even the low percentage of users believing that the headlines and acronyms used in the Portal is unclear add up to a significant number of users. Therefore efforts to increase clarity could increase the effectiveness for this group of users. As argued by Cooper at al. (2007), headlines and navigational sections should make use of clear and comprehensible language, and actually avoid acronyms, abbreviations, jargon and specialized vocabulary if possible. As a significant number of users consider there to be some unclarity at the moment, a suggestion to improve Usability could be to make such sections clearer by explaining and writing out concepts. This will be especially useful for new users.

5.2.5. Respondent Actions in Face of Supplier Portal Issues

Since most respondents in the qualitative study experienced problems quite frequently with the Portal, the importance of providing quick and understandable remedies are essential in order for the users to be Effective in their work. However, as mentioned before most respondents did not know that the answer to some of their queries actually already existed on the Portal, indicating that the Portal could be made more user-friendly and information could be displayed in a clearer fashion. Rather than e-mailing or calling a contact that might not have the information - and thus

being redirected, a greatly onerous process - the contact information for technical contacts should be more readily available on the Portal, in combination with explained solutions to common problems being clearly listed on the Portal.

In the quantitative study the respondents found it harder to find the right contacts for business problems than for technical problems, where 30% found it either hard or impossible to find the former and 25% for the technical issues. Again when considering the large number of users that make use of the Portal, the number of users that find it hard to find the right contact information is high. Thus, any improvement leading to a reduction of the problems would have great potential in saving resources for both suppliers as well as Volvo Group.

Most of the respondents stated that using e-mail would be their preferable way of communicating with Volvo Group when encountering a problem, highlighting the need of having updated contact information easily accessible on the Supplier Portal, considering the cost savings potential. The same is true for both contact phone numbers as well as for manuals or guides, as updated and readily available information should be of great value.

Furthermore, the complexity of the Portal itself create a problem for new users as the more experienced users have to train their less experienced colleagues in how to use the Portal, something that require a lot of resources of the suppliers' companies. A simpler and more user-friendly Portal would not only mean that new user can learn it quicker, but also save Volvo Group a lot of time since they will receive less queries, both from new users as well as more experienced ones.

5.3 Satisfaction

5.3.1. Respondent Opinion on Portal Mobile Usage

When conducting the qualitative interviews a pattern emerged, where the youngest respondent (Respondent 3) was the most interested in being able to use the Portal on a mobile device, and where younger colleagues of Respondent 1 & 2 had expressed similar wishes. This correlation persisted in the quantitative study where the younger respondents seemed more eager to be able to use the Portal and the Business Systems on mobile devices. The difference in interest were quite large, where only 18% of the total number of respondents, spanning all age groups, considered it to be “very important” to be able to make use of the Portal and the Business Systems on a mobile device. This is in stark contrast to the age group 18-34, where 30% of respondents considered it to be “very important”. When including those who believed it to be “quite important” as well as “very important” the gap was a bit smaller between the group consisting of all the respondents and the age group of those between 18-34, however it remained quite large. This difference show that mobile use is becoming increasingly important as the younger generations will take over from the older. However, the numbers of users that would make use of the Portal on their mobile devices could already today be considered large enough to have at least parts of the Supplier Portal and its Business Systems made available for mobile devices.

According to the findings some functionality of the current Portal is considered more important to be adapted for mobile usage, where the Business Systems e.g. are considered important by 67% of the respondents. As all functionality of the Portal is considered important to be adapted for mobile by at least a minimum of 20% of the respondents (a number that is likely to increase over time) all parts of the Supplier Portal should perhaps at some point be adapted for mobile use. If taking the decision to adapt the Portal for mobile usage however, it is important to remember that completely new experiences for solving the same issues and work tasks may have to be created, as there are substantial differences in terms of Usability when designing for a computer and when designing for a mobile device (Hinman, 2012). However, as mobile adaptation becomes increasingly important to the users, the Usability of the Portal will to a greater extent be determined by its adaptation to mobile devices. Therefore, an update of the Portal and the Business Systems should be mindful of the design limitations for mobile devices, and how the Usability is improved on such devices.

5.3.2. Capturing Additional Feedback from the Respondents

As the aim of the quantitative study was also to provide complementary findings, in addition to validating or contradicting earlier findings, we decided to include a question related to subjective preferences of the users, thereby relating to the level of Satisfaction the users have with the Portal. As a result of this, we received over 60 responses about how the Supplier Portal could be improved. When coding the subjects of these responses, it was obvious that they touched upon several aspects that had already been identified in both the qualitative and quantitative interviews. Emphasizing the importance of these findings. For example the respondents expressed that they would like the navigation of the Portal to be simplified and made more user-friendly. Furthermore, they touched upon on how the different Business Systems could be developed within the Portal, e.g. making it easier to search and find relevant information within them, and gave suggestions for how the functionality of the Business Systems could be developed in detail. Examples of this would be more functionality to filter through and sort data, more opportunities for cross-referencing data, easier ways to export data, etc. Lastly, they asked for contact and help information related to their business areas to be displayed more visibly, since when they encountered issues or problems now, they did not know where to turn for help or information.

As many issues have been identified with the current Portal, and with business processes and operations that ultimately relate to the Portal, there has been an evident need for suppliers to be able to give their suggestions and feedback to the case company on improvements. Something that was also accentuated in both the qualitative interviews and the quantitative study. In the latter it was a vast majority of the respondents, 76,5%, expressed that they would like such a system. The benefits of this type of system could extend to everything from suggestions how to improve the Portal to how to improve the mutual business between the supplier and Volvo. However, these subjects can overlap, where improvements to the Portal also can simplify communication between the entities, as previously discussed in this chapter.

Further, great gains can be made for Volvo where they can see that suggestions for improvements can be generalized, and thus potentially also save resources for other suppliers and themselves. However, to encourage the systems use, Volvo need to provide feedback on the suggestions and show their interest in the suggestions, otherwise there is a risk that fewer suggestions will be posted.

6. Conclusion

This study's aim was to look at how Volvo Group's Supplier Portal could be changed to be made more usable and better fit the needs of its users. In order to investigate these topics we have made use of the concept of Usability, as defined by the International Organization for Standardization (ISO 9241-210, 2010), which divides the concept into the three subcomponents Efficiency, Effectiveness and Satisfaction. By connecting this concept of Usability to the *Context* in which the users are making use of the Portal, and the *Activities* that they perform in it, as well as theoretical contributions on how to increase Usability in relation to *Natural Human Capacities*, this thesis provide findings that will increase the Usability of the Volvo Group Supplier Portal for its users.

By making use of a mixed-method, the research provided both abundant as well as detailed findings that enabled a greater understanding of what improves Usability in this particular context. Further by making use of this method the research can circumvent some of the worst deficiencies that are associated with qualitative and quantitative studies, such as careless responses for the latter (Meade & Craig, 2011).

Our identified key findings, which will have a significant impact on the Usability of the Supplier Portal, have been derived through several different ways.

Firstly, significant findings are of course findings that have been attributed great importance by a large number of users, as improvements in the area is then likely to have an impact for a large part of the user base. Furthermore, similar responses to open questions by respondents is likely to carry importance, especially in the cases where the answer is stressed multiple times in the study. In addition some identified findings carry significant importance for only a small number of the respondents, but as these findings would improve the work processes of these users significantly, and not impede on the usability of other users, they have been included as suggestions in our recommendation. Lastly, important findings may have appeared as a result of the codified feedback of only a few of the respondents, but have been considered important due to their strong correlation to the identified best practices in theory, something that also validates that the chosen theoretical framework is valid in the context of this study.

6.1. Efficiency

In general it is obvious that a main preference of users is to be able to perform their work tasks in an as Efficient way as possible. The Supplier Portal is a work tool that should be simple and fast to use. Our design recommendations must therefore aim at making it as efficient and simple as possible. Features and information should be made easy to find through an easily interpretable order, and information should be easily identifiable by clear headlines. Our recommendation is

therefore that the case company should explain acronyms or abbreviations that currently exist in the Portal, as well as explaining complex concepts thoroughly.

As the users believe that information is too hard to find at the moment, and even ask for information that already exists in the Portal, it is evident that the navigation and structure of the Portal must be simplified. This is especially true, since users that are forced to repeatedly shuffle back and forth between screens to achieve their goal will become even further disoriented and frustrated, and have their Efficiency and productivity drop significantly (Cooper, et. al, 2007). It is thus obvious that an important course of action should be to remove a significant amount of pages within the Portal. As the users have also complained that much of the information on many pages are redundant, outdated or that some pages contain no relevant information at all, the design could probably be improved by consolidating the relevant information on a much fewer amount of pages. This would make it easier for the users to navigate the interface and find the information they are looking for since users have an easier time to make choices from one larger page of information or options, instead of two smaller pages where the same information has been separated, as long as the system do not cause an information overload (Hick, 1952; Hyman, 1953; Saffer, 2006).

After analysing the Portal in the light of these findings we suggest that a great deal of pages are removed in the Portal completely, which would simplify the structure.

In relation to these findings, another very important action should be to improve the navigation. There are currently a large amount of menu options, and important information or features may exist far down within the hierarchical levels, on subpages. As we have been able to get findings on which features or what information that is most important, and since as mentioned much information can be consolidated, we recommend that the total number of menu options is decreased to simplify and improve the navigation. In addition to this the data has highlighted that the different Businesses Systems are the most used features of the Portal. Since the Business Systems today are spread out within the Portal, often far down within the hierarchical levels, we suggest that all Business Systems are placed together under one specific menu option, furthest up in the hierarchy. This would facilitate for users to reach them in an as fast way as possible. As there are quite a few Business Systems, we also suggest that they are displayed in alphabetical order, something that is not done today, but which could decrease the small but recurring cognitive load of finding a specific system (Saffer, 2006).

In addition to gathering all the Business Systems under one specific menu option, we recommend to do the same for all the different training manuals, guides and help information. This kind of information is today spread out in many different places of the Portal and many respondents do

not even seem to know that such information exist at many times. Gathering all such information under one clear and visible menu option will increase the availability of the information and to a great extent increase the Usability.

The results of the quantitative study also indicated that as many as 25% of the users that claimed to that the system for tracking invoices was relevant to them could not even find the system. Whether or not all of those users actually need the system, or if some respondents have been careless in their responses is unclear, however it seem to indicate that the feature should be more readily available, as the Usability for the users, who need the system but cannot find it, would increase a lot.

As the Portal contain a lot of pages, and a lot of information and features, the empirical findings highlighted that it would be beneficial for the users to have the ability to create their own shortcuts and favourites. We therefore further recommend that the case company develop a feature that is placed visibly on the start-page, which would allow users to save quick links to important information.

As the Business Systems are the most used part of the Portal, improving the Efficiency in this area will have a great impact of the overall Efficiency of the Portal. At the moment users are impeded in their work and have to spend much more time than necessary when working with the Business Systems. But if the ability for users to add, analyse and share the information was developed, the performance of both the case company and the suppliers would most likely increase.

We therefore suggest that the case company develop functionality that would allow the users to filter and sort data through common filtering options, something that was suggested by several respondents as well as recommended by theory (Tidwell, 2011). These filtering parameters could for example be: alphabetic order, numerical order, by date or time, by physical location, by category and tag, and by most used (Tidwell, 2011).

Users should furthermore be able to display more data at the same time as they have experienced that it is hard to oversee large datasets. Meaning that they have to scroll back and forth a lot, or move between different screens within the interface and losing track of the initial data. A process that in itself is very slow today, and could be developed for faster navigation within the datasets. At the moment the users also believe that the functionality for cross-referencing data and finding interconnectedness is not good enough, it should therefore be developed as it can help the users take more informed decision, which should improve their operations with the case company.

Lastly, better ways to export and share the information is highly asked as these tasks are very time consuming and onerous today.

All data systems within the portal should therefore have added functionality for export to the most common computer work systems for data handling, something that was requested by the respondents. The implementation of these changes to the Portal and the Business Systems would make the use of the portal significantly more Efficient.

6.2. Effectiveness

As many of the empirical findings have touched upon the issue of being effectively able to deal with arisen issues, and finding either self-help or contact information for help and support we believe that a visible Help Section displaying this information could greatly reduce the frustration that many users experience with the Portal when encountering issues, something that occur quite frequently. This section should include information about whom to contact when encountering a problem, both for business issues or technical related issues. It should also include all the training manuals and guides, so that users can solve their problems themselves instead of contacting personnel at the case company. And lastly it should contain a FAQ segment where the case company can gather all common questions and issues that are experienced by their suppliers. All these actions would probably greatly increase the Usability of the Supplier Portal, and decrease the time and resources that are spent by suppliers and the case company today in looking for the right person to contact to solve problems. It would also greatly assist new users of the Portal, since they would have a clear section to turn to, when trying to learn the Portal and its different features. This would greatly decrease the frustration that suppliers can feel when having to spend time and resources on training their new employees in how to use the Portal and the Business Systems. However, this is contingent on that the information in the Help Section is updated continuously so that the users can trust that the content displayed on the Portal is correct.

In addition to this we also suggest that the case company develop their current features for communicating updates and news, and start communicating more relevant news. When asked which news or updates that the users found most important, from a very wide and diverse range of choices, the users considered news or updates related to changes to the Business Systems, as well as changes to documents in the Portal, to be the most important. As many users express problems with knowing whether or not information in the Portal is updated and relevant - forcing them to contact personnel at Volvo and wasting time for both themselves and the case company -

developing the current news/update module could greatly improve the Usability of the Supplier Portal. The new module should be able to communicate news to specific users segments, which mean that they always take part of news relevant to them and that important news for them do not get lost in an information overload. Also, the case company will have to implement processes for always communicating updates or news about changes that are made in the Portal. This way users would always know that the Portal always contain the latest and most relevant information, something that is needed to accurately perform their tasks. Such an improvement would also mean that the users do not have to spend time cross-referencing and checking information, or contacting Volvo personnel for clarification. These measures to improve the information sharing, in combination with encouraging the use of the Portal by sharing more information, could greatly increase the Effectiveness for the users, and the make the Portal overall more useful as a communication channel.

As many users had expressed the issues of tracking team and project performance within the Portal, we also suggest that the better functionality for gathering, reading and sharing information related to business projects is developed. At the moment, there is great complexity in overseeing all the documentation and the progress of projects for both Volvo personnel and the suppliers' employees. This means that much time is now spent on gathering, sharing and checking information for relevance, where much time is spent in meetings for communication around mutual projects. Better functionality for tracking and communicating around project progress could save much time and resources, reduce frustration and increase the outcome of all mutual project between suppliers and the case company, as better information sharing through Supplier Portals have the possibility to increase performance (Sanders et al, 2011).

6.3. Satisfaction

The adaptation the Supplier Portal for mobile device usage should be initiated as soon as possible, as this type of increased availability of the Portal is considered to be very important by large portions of the younger age groups and thus is very likely to be increasingly important in the future. While the users considers certain features to be more important to adapt to mobile devices than others, the adaptation of the entire Portal should be initiated at some point, as a large group of the users still find the mobile adaptation of all the documents, contact information and information to be important.

It is also evident that the users would like to be able to give feedback through the Portal to Volvo Group on their mutual operations. Considering the amount of suggestions that has been made in this thesis to improve Usability, implementing such functionality in the Portal could help Volvo Group to proactively develop functionality based on the users' preferences and needs. Thus, creating their own user-centred design approach and feedback loop. This would enable that small incremental improvements could be carried out continuously, instead of waiting too long and incur heavy costs and problems for the users. However, in order to maximize the benefits that the feedback can provide, the suppliers must feel that this function is being promoted by Volvo, and that interest is taken in their suggestions. This is important given that suggestions can be related to general resources savings, and if they can lead to a greater interchange between Volvo and their suppliers, the potential gains can be great.

6.4. Summary of our Recommendations

Based on what is stated in this conclusion and to answer the research question:

“How can Volvo Group’s Supplier Portal be changed to be made more usable and better fit the needs of its users?” we would recommend that the case company take the following actions:

- Make sure that all information and content on the portal is updated to include the latest relevant information, so that users can always trust that the content is relevant.
- Remove pages with old or irrelevant information. Also consolidate information on fewer pages.
- Decrease the number of menu options and place important features far up in the hierarchy for easy access, such as the Business Systems and important contact details.
- Create an easily accessible help area containing all the manuals, guides, important contact information and FAQ. This would enable users to solve more problems and issues by themselves and reduce the time and resources spent by both the case company and the suppliers.
- Implement functionality for users to be able to create favourites/shortcuts to important information/features in the Portal.
- Place all important features and sections in recognizable order, such as alphabetical order.
- Develop the business-systems with functionality that make it easier to add, analyse and share information and data.
- Developing functionality that enable the case company to better communicate news and updates
- Develop functionality for tracking project progress.
- Adapt the Supplier Portal for mobile devices.
- Create a user feedback-loop by implementing a system for recommendations.

6.5. Theoretical Implications and Suggested Future Research

This thesis has widened the understanding of how the Usability can be increased in the context of Supplier Portals used by manufacturing firms in their communication with suppliers. As this study is a single case study, the strength is that it can provide a quite extensive list of suggestions to the case study company on how they can improve Usability for their Supplier Portal. The context of what exact features that are increasing the Usability is individual to each context, however there are findings that most likely have a general applicability in a wider context and probably many findings that can be applicable in similar settings when investigating similar companies in the same industry. What findings that are the most generally applicable could be investigated in a larger study, involving many case companies. Such a study would increase the generalisability of the findings presented and contribute to a greater understanding of the subject and how Usability changes in various company contexts. Another potential area of research is to investigate if there is a difference between various industries in what increases the Usability for the users in the particular context of a Supplier Portal.

The theoretical implications of this study may not solely be limited to how changes to the Supplier Portal can increase the Usability of the Portal the users. The findings in this thesis show that there are areas where suggestions aimed at increasing the Usability of the Portal can have wider implications to not only the suppliers' business, but also on the business of the Volvo Group. These areas where the Usability implications and the business implications for the supplying firm and Volvo Group overlap, should be very interesting to investigate for their potential to save resources. As such it would be interesting to perform a study attempting to measure how much resources that can be saved for both the suppliers as well as the case study company by making improvements to a Supplier Portal.

One main constraint to this study was the time that was available to the researchers. A measure that most likely would increase the Usability of the Supplier Portal further is to examine how changes made to the Portal has affected the Usability in a subsequent study, and then update the Portal again based on the findings of this new examination.

Furthermore, as preferences for how Usability can be improved is highly likely to be changed over time, where some findings presented in this study can prove to be less applicable in the future. Therefore, it would be intriguing to investigate if the preferences of how to improve Usability is changed over time, where a study conducted in the future might render different results than this study.

7. References

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8. Appendix

8.1. Qualitative Questions

Efficiency

Q1. *How often do you use the Supplier Portal? -...And for how long would you usually say that you usually visit the Supplier Portal per session?*

Q2. *What tasks do you find the hardest to carry out when using the platform? What is the hardest things to understand with this Portal?*

Q3. *Are there any parts of the Portal where there is too much text/features and it is hard to find the most important things? Can you suggest any such information/features that should be removed?*

Q4. *What do you think about the headlines? Which are good, which are bad? Which headlines would have changed, and into what?*

Q5.. *What is your opinion of the search function if you try it?*

Effectiveness

Q1. *What are the most common tasks you do at the Portal? And what information/what features do you think should be on the first page? (Meaning, what information do you want to see the first of all. What is most important?)*

Q2.. *Are there any things that you wish you could do, that you cannot do today on the Portal?*

Q3. *Are you receiving updates through the Portal - on changes in Volvo Group that impacts your business - Yes/No? Please elaborate.*

Q4. *If you encounter a problem with the Supplier Portal or any of its systems. Do you know where to turn to for a manual or a guide, or what do you do?*

Satisfaction

Q1. *Would you like to be able to use the Portal on a mobile device or tablet? Do you have any need for this? What functions would be most important for mobile?*

Q2. *Now, to recap. What is your general opinion of the Portal? Please take the time to describe a few things that you like about it, and what you dislike about it. What changes would you like to see?*

8.2. Quantitative Questions

Screening Questions

Q1. *What is your age?*

- 18-24
- 25-34
- 35-44
- 45-54
- 55+
- I prefer not to specify

Q2. *What country do you work in?*

Q3. *What is your main role within your company?*

- Sales & Marketing
- Finance
- Quality
- Logistics
- Engineering
- Production
- Manufacturing
- Management
- Customs
- I prefer not to specify

Efficiency

Q1. *How often do you use the Supplier Portal?*

- Once or Twice a Month
- Once a Week
- Several Times a week
- Once Every Day
- Several Times per Day

Q2. *How much time do you spend on average per visit?*

- 0-4 Min
- 5-14 Min
- 15-30 Min
- 30+ Min

Q3. *What information have you found particularly hard to find?*

Free-text form

Q4. *Do you know where you should go in the portal to track invoices?*

- Yes
- No
- Not Relevant for My Position

Q5. *Do you think there is too much information/text on the pages in the Portal (in general?)*

- No, it is Fine as it is Now
- It is Mostly Fine
- Neutral
- Sometimes there is too much text/information
- Yes there is often too much text/information

Q6. *How useful do you think the search function is for finding information in the Portal (the function in the upper right corner)? ‘*

- Very Useful
- Quite Useful
- Neutral
- Not So Useful
- Not Useful At All
- Never Seen/Tried It

Effectiveness

Q1. *What features/functions do you use at least once a week?*

- Information Library
- Business System 1
- Business System 2
- Business System 3
- Business System 4
- Business System 5
- Business System 6
- Business System 7
- Portal Guide
- Contact Us Section

Q2. *Do you think that there is important information that is missing in the Portal?*

- No, All the Information I Need Exist in the Portal
- Most Information Exist Within the Portal
- Neutral
- Yes there is Some Information Missing in the Portal
- Yes, there is A Lot of Important Information Missing in the Portal

Q3. *If you think there is important information missing, could you please specify what information?*

Free-text form

Q4. *What information would you like the news sections to contain?*

- Changes to Documents within the Portal
- Changes to Navigation/Information Structure
- Changes about Contact Details
- Changes in Volvo Business Systems
- Changes to Standards
- Information about Plant/Logistics disruption
- The News section is of no interest to me

Q5. *Do you think the headlines make it clear what information that you can find under each section?*

- Yes, they are Very Clear
- They are Quite Clear
- Neutral
- They are Quite Unclear
- No, they are Very Unclear

Q6. *Are there abbreviations or acronyms on the Portal that are unclear?*

- All are Clear
- Most are Clear
- Neutral
- Some that are Unclear
- Many that are Unclear

Q7. *If encountering "Business problems" (general & commercial topics), do you think it is easy to find information about whom to contact on the Portal?*

- It is Very Easy to Find
- It is Quite Easy to Find
- Neutral
- It is quite Hard to Find
- It is Very Hard to Find

Q8. *If encountering "General IT Problems" with the Portal or its underlying Business Systems, do you think it is easy to find information about whom to contact on the portal?*

- It is Very Easy to Find
- It is Quite Easy to Find
- Neutral
- It is quite Hard to Find
- It is Very Hard to Find

Q9. *If you encounter a Problem with the Portal you would prefer to?*

- Use a Manual/Guide to Find a Solution
- Call Someone
- E-mail Someone

Satisfaction

Q1. *How important would you consider it, to be able to use the Supplier Portal and its underlying Business Systems on a mobile device or tablet?*

- Very Important
- Quite Important
- Neutral
- Not so Important
- Not at all Important

Q2. *If it's important for you. What functions would you like to be able to use on a mobile tablet?*

- Read the news
- Read about Volvo's Requirements and Standards
- Find Contact Information

- Check My Performance
- Work in the Business Systems

Q3. *Do you have any recommendations for improvement, which you would like to see in the Portal or in any of its underlying Business Systems in the future (it can be for new functions, improvement of current functions, etc)?*

- Free-text form

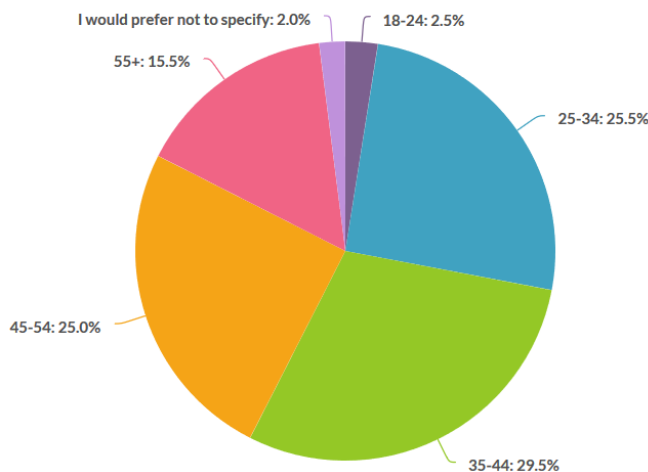
Q4. *Would you like a system on the Portal where you could give feedback and suggestions to Volvo for improvements?*

- Yes
- No

8.2.1 Results of Quantitative Study

Screening Questions

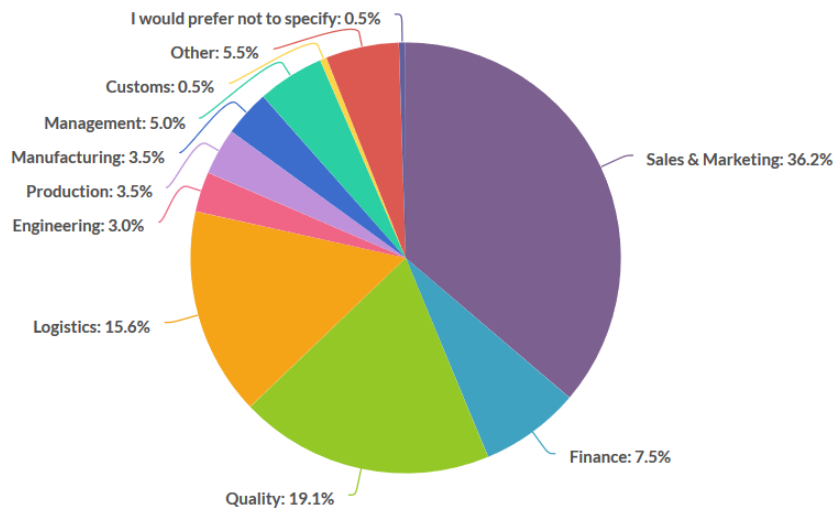
Q1. What is your age?



Q2. What country do you work in?

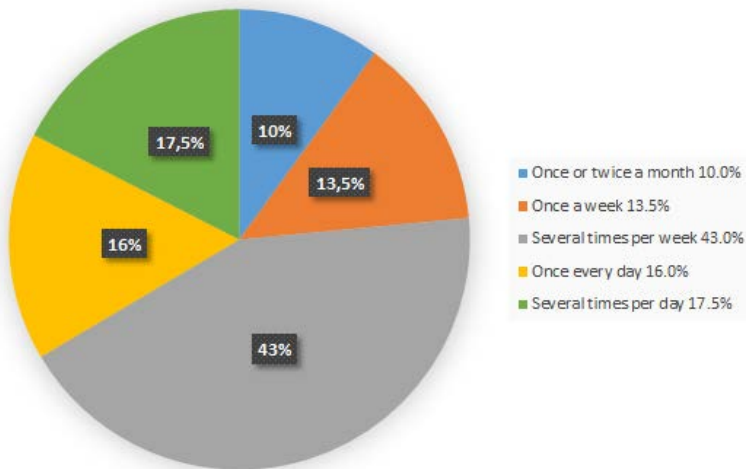
31 different countries were represented, with the largest user bases being located to Sweden and the US. All large markets for Volvo Group are represented in the sample. For confidentiality reasons the specific countries are not disclosed here.

Q3. What is your main role within your company?

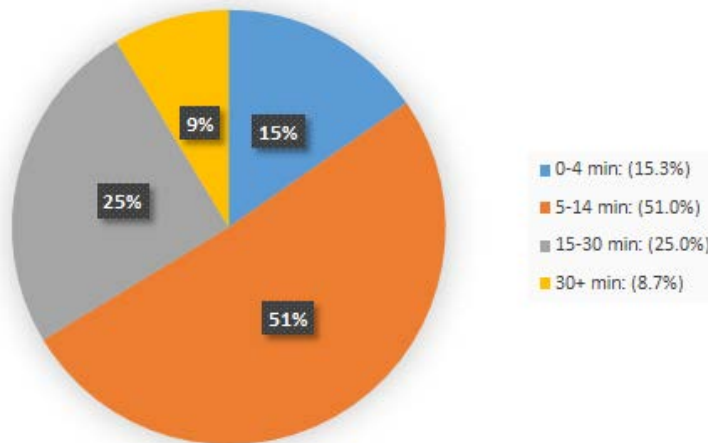


Efficiency

Q1. How often do you use the Supplier Portal?



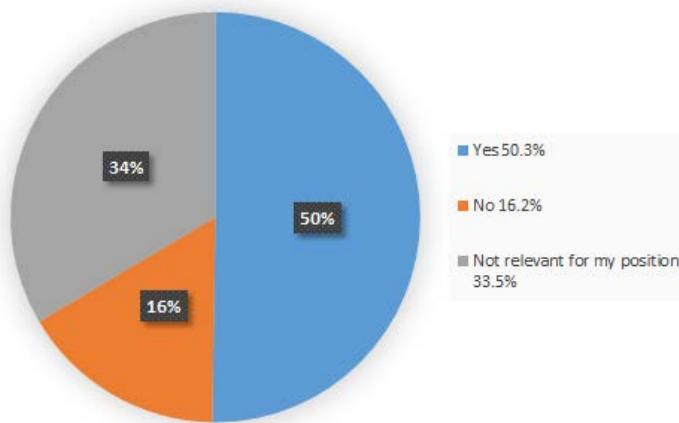
Q2. How much time do you spend on average per visit?



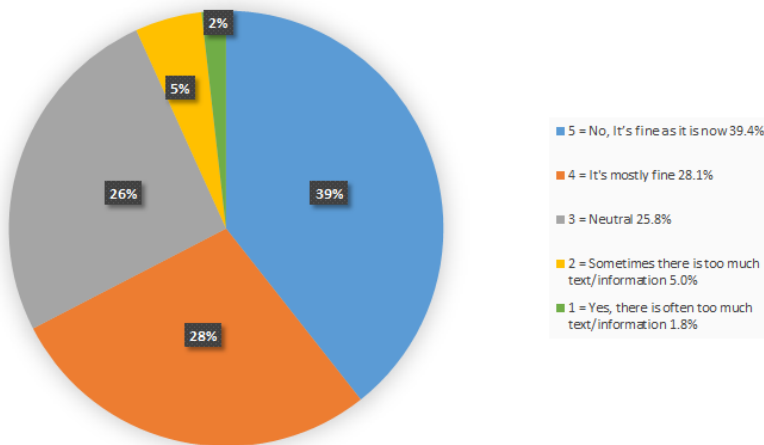
Q3. What information have you found particularly hard to find?

The responses touched upon the same topics, namely that it was hard to find some of the Business Systems, as they were nested far down within the hierarchy levels. That it was hard to find relevant contact information. And that it was very hard to find important documentation on drawings/models and on the specific standards and rules that the suppliers must adhere to.

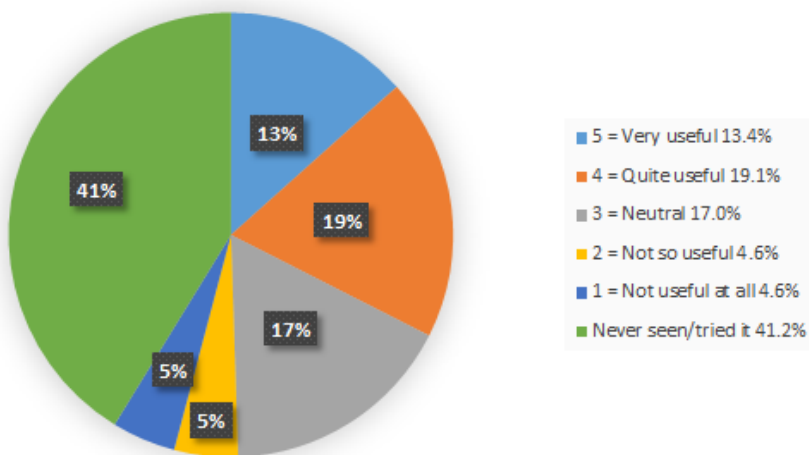
Q4. Do you know where you should go in the portal to track invoices?



Q5. Do you think there is too much information/text on the pages in the Portal (in general?)

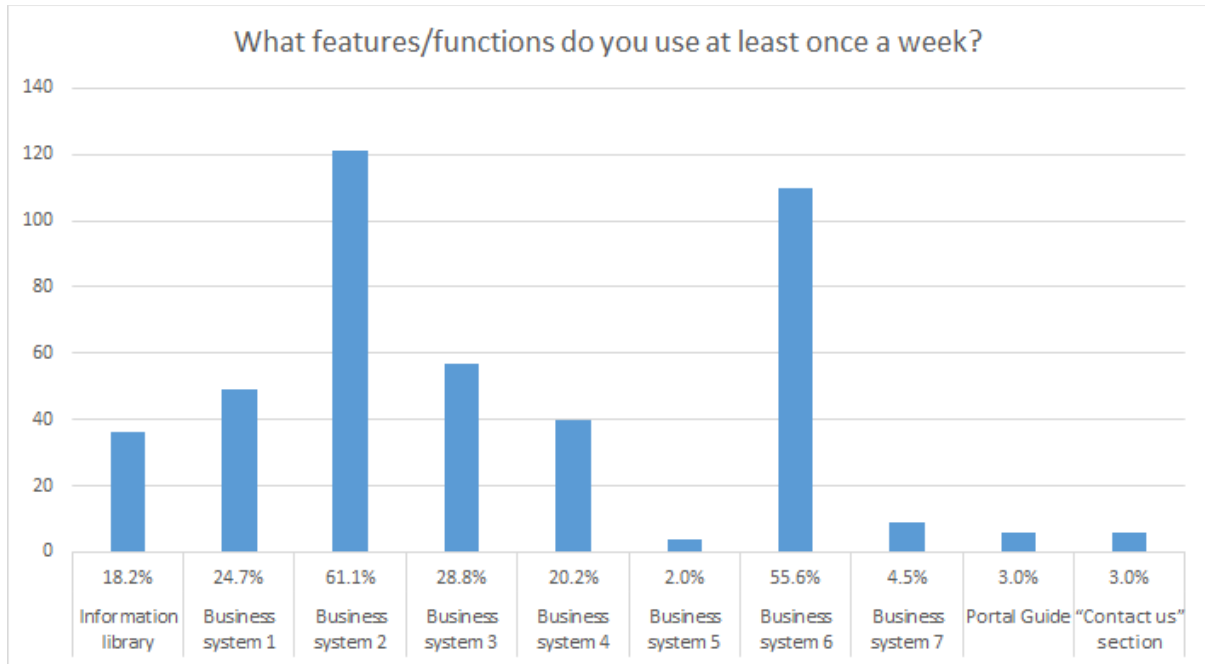


Q6. How useful do you think the search function is for finding information in the Portal (the function in the upper right corner)?

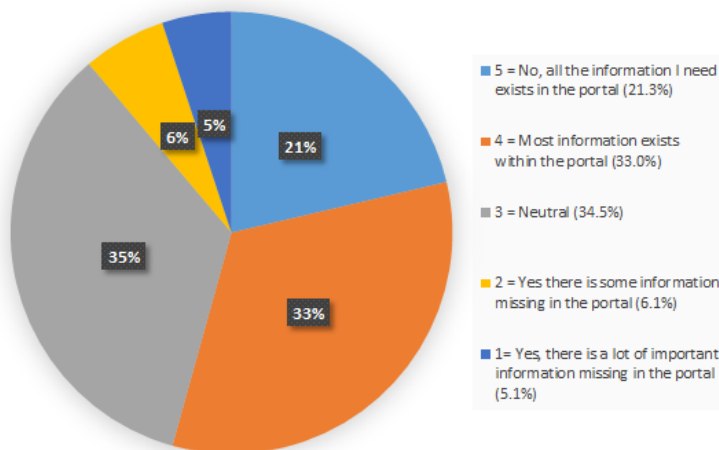


Effectiveness

Q1. What features/functions do you use at least once a week?



Q2. Do you think that there is important information/text that is missing in the Portal?

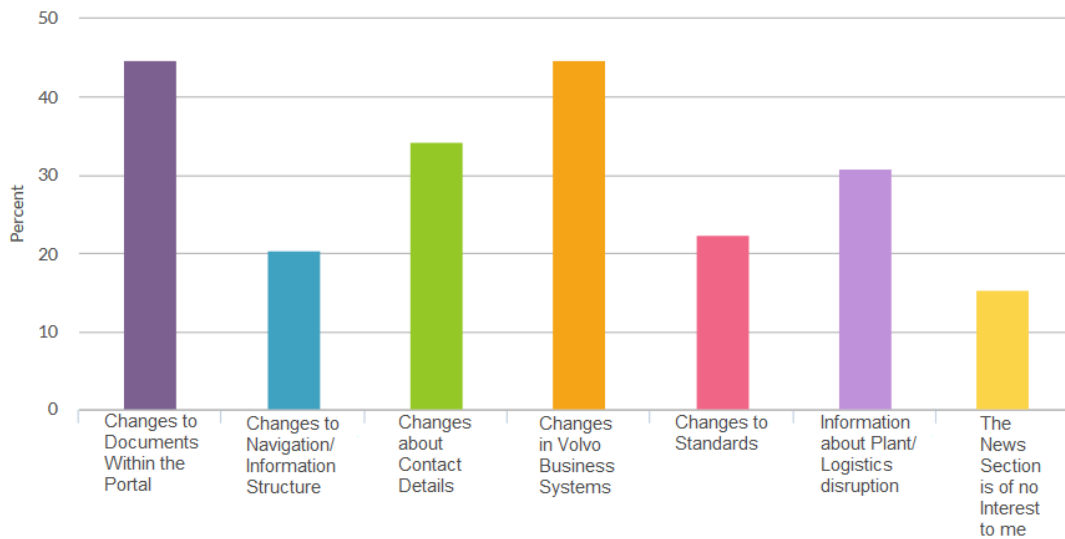


Q3. If you think there is important information missing, could you please specify what information?

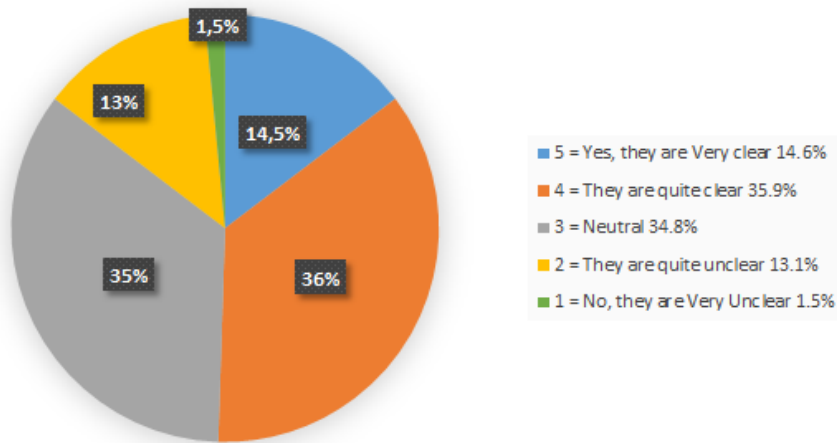
The users did exemplify some information that is currently missing in the Portal today and that should be added by the case company, information related to the mutual operations of the suppliers and the case company, such as documentation relating to quality, logistics and model prints.

Also, when the users had the opportunity to state information that they thought was missing in the Portal, they requested a lot of information and features that already exist within it. For example: specific forms and documents related to the suppliers' operations, contact details to key personnel for certain encountered issues that actually do exist, and specific information in the Business Systems that help inform the users of the case company's requests.

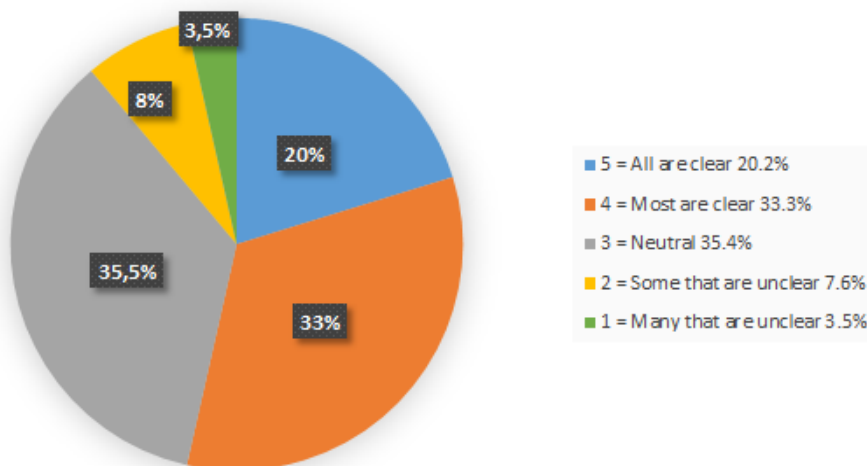
Q4. What information would you like the news sections to contain?



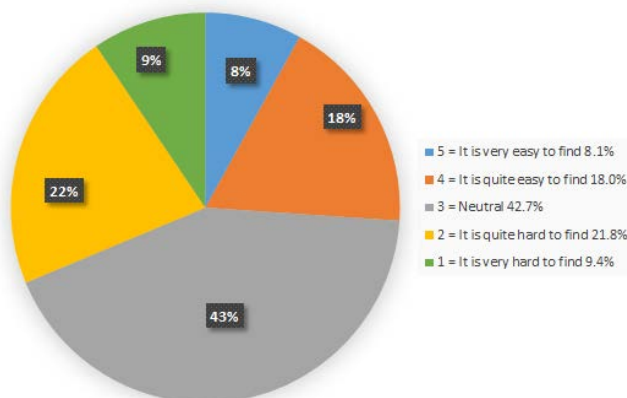
Q5. Do you think the headlines make it clear what information that you can find under each section?



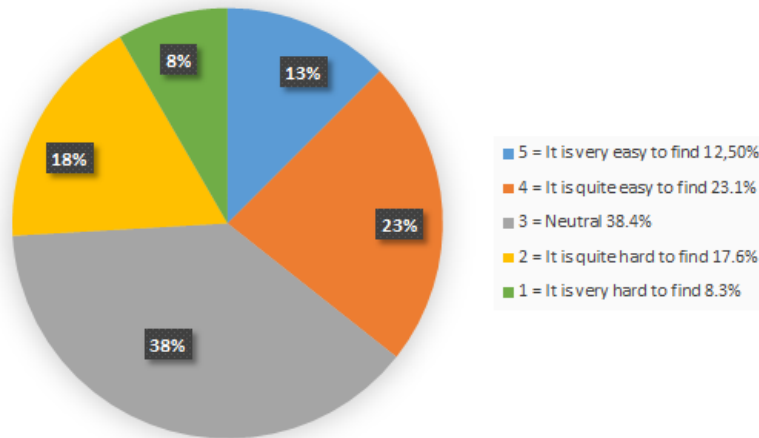
Q6. Are there abbreviations or acronyms on the Portal that are unclear?



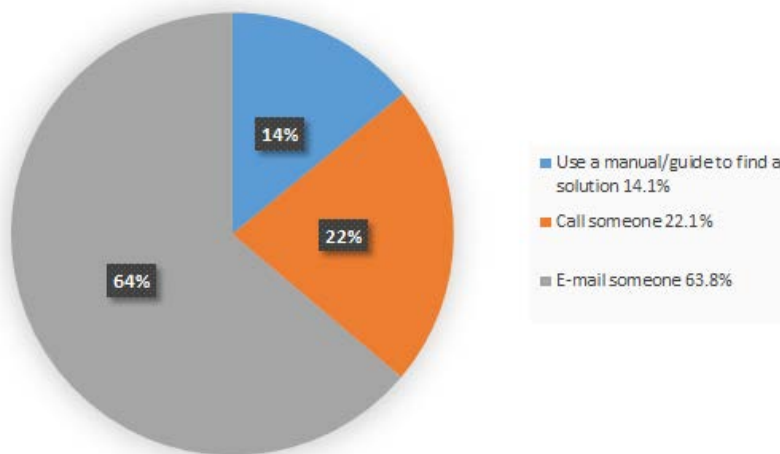
Q7. If encountering "Business problems" (general & commercial topics), do you think it is easy to find information about whom to contact on the Portal?



Q8. If encountering "General IT Problems" with the Portal or its underlying Business Systems, do you think it is easy to find information about whom to contact on the portal?



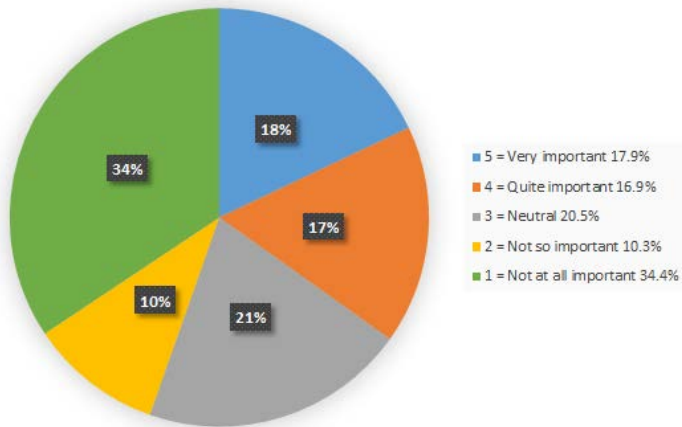
Q9. If you encounter a Problem with the Portal you would prefer to?



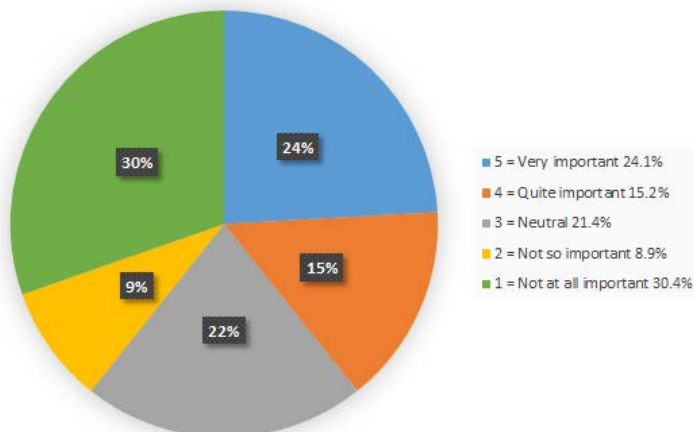
Satisfaction

Q1. How important would you consider it, to be able to use the Supplier Portal and its underlying Business Systems on a mobile device or tablet?

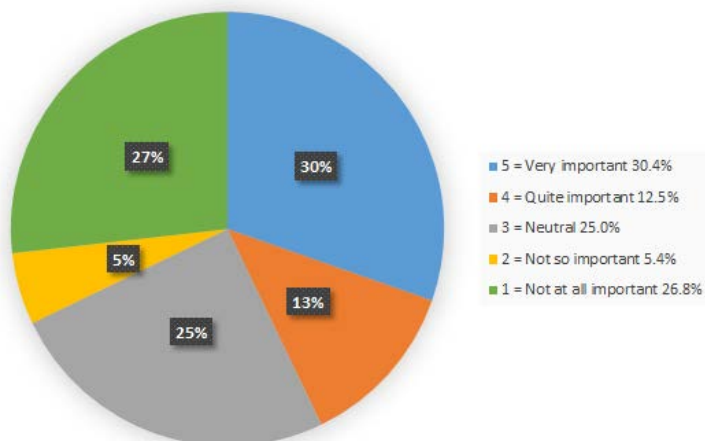
Age group: 18-55+ (Important (4-5) = 34,8% | Not Important (1-2) = 44,7%)



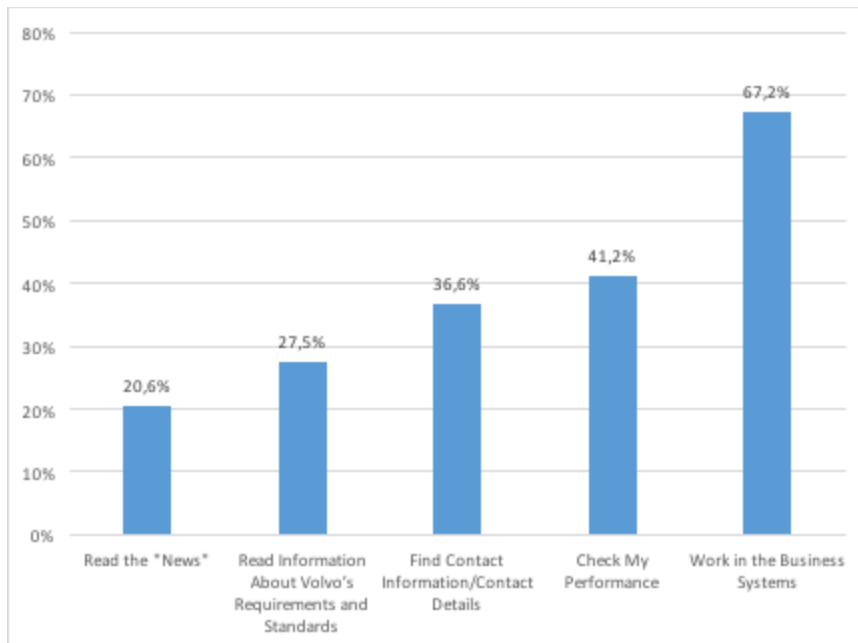
Age group: 18-44 (Important (4-5) = 39,3% | Not Important (1-2) = 39,3%)



Age group: 18-34 (Important (4-5) = 42,9% | Not Important (1-2) = 32,2%)



Q2. If it's important for you. What functions would you like to be able to use on a mobile tablet?



Q3. Do you have any recommendations for improvement, which you would like to see in the Portal or in any of its underlying Business Systems in the future (it can be for new functions, improvement of current functions, etc)?

The findings could be summarized to cover the following opinions:

- Simplify navigation of Portal. Make the interface more user friendly.
- Improvements needs to be made to many of the Business Systems. Especially to make it easier to search and find relevant information within them. Also, more functionality could be built in that simplifies processes for the suppliers, e.g. exporting and sharing data.
- Much more contact information to key Volvo personnel should be displayed. Especially to personnel with specific information and knowledge related to different expertise areas.

Q4. Would you like a system on the Portal where you could give feedback and suggestions to Volvo for improvements?

