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The New Economy - Knowledge Investments

Enterprises intangible investments - the new source of growth

Master's thesis in Mathematical Sciences

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Abstract

Economic-based growth is increasingly becoming dependent on the wide range of intangible investments, known as *knowledge-based capital (KBC) investments*. Its rapid asset size growth has called for transparency in the various components that embodies KBC investments in order to gain greater knowledge concerning their structure.
As economies approach the requirements of becoming defined as a developed economy, their capital investments rate decreases while KBC investment components such as knowledge, software, organisation and competence skills increases. There are recorded cases where intangible investment has outgrown capital investments such machinery and equipment, thus the growing importance for the interpretation of KBC investments in order to aid policymakers to ease the transition of the emerging knowledge-based economy.

The purpose of this thesis is to explore and increase the comprehension concerning the field of- and the various components that are associated to KBC investments. With the accumulated knowledge the study aims to identify and create a measurement for the various components that are defined as KBC investments in order to give a glimpse into the new economy of Sweden. Moreover, an objective of this study is to assess the potential contribution of KBC investments to the labour productivity for Swedish firms.
The fundamental results of the investigation is obtained through multiple surveys created by Statistics Sweden. The targeted population is represented by enterprises that together represent the Swedish economy. Thus the result represents descriptive information from the enterprises perspective.

The main conclusion of this thesis was that there is a weak indication of positive contribution of KBC investment to labour productivity. Further, there are branch of industries where the relationship between the KBC investments and labour productivity are stronger, hence the interaction effect. Unfortunately, more data collected over time is needed and crucial to determine if the contribution is consistent, and if the relation between KBC investments and labour productivity is significant and therefore be included in the production function. Accumulating data across different time points will illustrate the progression of the KBC investments the Swedish economy.

The study is financed by Statistics Sweden.

Keywords: *Intangible Investments*, *Knowledge based Capital (KBC) Investments*, *Economic Growth*

Preface

First and foremost, I wish to express my sincere gratitude to my supervisor Hans-Olof Hagén, Senior Advisor at National Accounts, Statistics Sweden, for his guidance and support throughout my master's thesis, and more importantly, for granting me this opportunity and encouraging me to pursue a career at Statistics Sweden.
I want to thank Hans-Olof Hagén for providing the data, advice and assistance concerning the economical parts of this study. I would also like to express my gratitude to my examiner, Professor Rebecka Jörnsten, Gothenburg/Chalmers University, for sharing her valuable time and expertise regarding the field of mathematical statistics. I am thankful for her valuable inputs and the countless of hours she dedicated to me.

Finally, I would like to thank my family and friends for their understanding and support during the course of my master's thesis. To my mother, Mahnaz, who has dreamt of this day more than I have, to finally see me graduate. Her tremendous support has always been my source of light. To my brother, Nima, for his support and tough love, although sarcastic concerning my academic path, he has been a great idol to me. Lastly, to my grandfather, who unfortunately is not with us today, to witness this day.

Pasha Hashemi, Gothenburg 2016

Acronym list

KBC	Knowledge based Capital.
FDB-database	Firm database
OECD	Organisation for Economic Co-operation and Development

Table 1: Acronym list

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Chapter 1

Introduction

1.1 Background

Tillväxtanalys (state-owned authority) has by the request of the government in their regulation letter been ordered to examine databases and methods with a view to build a starting point for the analysis of *intangible investments*, referred to as *knowledge-based capital* (KBC) investment and its contribution to Sweden's economic development (Tillväxtanalys, 2014).

The broad range of KBC components and its escalating assets size is obtaining a growing portion of the economic growth which has sparked debate. Institutions are demanding better overview and data access to the various shapes that goes under KBC categories. The underlying reason is the growing importance of the interpretation of KBC investments. Research has increasingly shown signs that economic growth is driven by KBC investments, indicating that traditional capital investments are deteriorating (OECD, 2013). It is, therefore vital to follow the development of KBC assets in order to develop a growth politic that is well adapted and stable to the new conditions and the "new economy." Hence the need to enhance the expertise surrounding KBC assets and the discussion regarding more precise measurement tools for the collection of KBC components and the statistical methods needed to examine KBC assets.
This case well identifies Sweden's industry; it has in the last decade experienced a significant transformation due to technical advances domestically but also due to the development in the world market (Tillväxtanalys, 2014). Knowledge-based dynamics are increasingly characterising the industry, thus the gravity to follow the development of KBC investments.

KBC assets exhibit greater risk than traditional investments, such as physical or financial assets (OECD, 2011). It is, therefore vital to examine the trend of investment patterns to be prepared for future challenges in the shape of regulation that addresses the potential problems of KBC assets, but also considering key policy reforms necessary to stimulate the KBC assets in areas where development is needed. To a further extent, one can also explore the relationship between the distribution of KBC assets and post economic crisis, to assess if the accumulation of KBC assets has a connection to the post-crisis. It is vital for policymakers to comprehend ongoing and future challenges. The acknowledgement of the growing KBC assets must be addressed.

Markets are displaying imperfections due to intangibles which in turn complicates the allocation of innovation and ideas to where they evolve most efficiently. It is imperative to acknowledge that the distribution of tangible assets will inherent increased challenges due to the difficulty of allocating intangible assets sufficiently (Andrews and de Serres, 2012). Nonetheless, its potential to innovation, productivity gains and ultimately its contribution to the economic growth is of importance to examine. To maximise the potential of intangible assets to its fullest extent, policymakers must through regulation redistribute labour and capital to their most productive work.

1.2 Purpose and Aim

To get accustomed to the new trajectory of economic growth it is imperative to improve the identification of KBC components to enhance the database for KBC investments and their influence on Sweden's economic growth. Grasping the role of KBC assets to modern economies is still weak, and further research is demanded to adopt growth policies that are well accustomed to new circumstances.

Tillväxtanalys concluded in their report (Tillväxtanalys, 2014) that the current database for the KBC investments in Sweden is not sufficient enough and that the quality of the existing database compiled internationally exhibit such flaws that the comparisons at international levels are not reliable, both period wise and comparisons between countries. As a consequence, the analysis of the KBC investments and its contribution to the economic growth will display incorrect information and therefore be misleading. The existing established approximations are based on macro approximations, and they build on the lacking of empirical evidence. Besides, they do not represent accurate descriptive of the distribution of KBC investment of the enterprises. Furthermore, the data sources that are available and sufficient for international comparisons are limited to R&D and software which represents a small portion of KBC components, thus further strengthening the fact that further research is needed to identify additional components when analysing the contribution of KBC investments to the economic growth.

The report (Tillväxtanalys, 2014) concluded that focus for the identification and accumulation of the vast range of KBC components should be implemented with the help of enterprise enquiry, implying that focus for the approximations of the KBC investments should be performed from a micro perspective to obtain an increased precision. To the known knowledge of SCB, Sweden is the first OECD member to develop a method for the data accumulation in microform, from the firm's perspective. Thus the project obtains its aim, with the identification, created measurements and gathering of the following KCB component types:

- Knowledge
- Software
- Organisation
- Competence
- Marketing

the objective is to examine the expenditures on KBC investments per branch of industry and its relation to the labour productivity per branch of industry. To achieve this, measurement for the KBC components will be created. Furthermore, it is convenient to examine if the KBC investments positively influence the enterprises' economic results.
With the assistance of the gathered data, the implementation and assessment of the following tasks are to be fulfilled:

- establish measurements for various types of intangible investments
- examine determination factors for each investment type
- examine the expenditures on KBC investments per branch of industry
- study the relation between the KBC investments and the labour productivity
- analyse the contribution of KBC investments to enterprises' economic results

This objective is to be executed with the cooperation of Statistics Sweden (SCB)

1.3 Research Question

The goal of this thesis is to identify components that according to theory is regarded as KBC components, create measurements and collect the KBC investments. With the accumulated KBC investments an additional goal is to evaluate its distribution in the economy's branch of industries. The distribution will illustrate the discrepancies in the investment force for the Swedish economy. Furthermore if possible it will be essential to this project to determine whether it is possible to state that intangible investment in the form of KBC investments has a positive impact on the labour productivity and the results of the enterprises in the form of profitability and growth.

It is known that KBC investments that develop new products and processes are beneficial but what are their estimated worth individually; per branch of industry in Sweden? In the long run, the accumulated annual data regarding KBC investments will display the actual trends that the Swedish economy is exhibiting and the trend pattern of each industry.

1.4 Limitations

The project that I have been assigned to is to be carried out at Statistics Sweden (SCB) in Stockholm. The accumulated data contains vital information, and due to the secrecy of the data, the project is to be executed at SCB headquarters.
Since this project is time limited focus will be to fulfil the defined objects with the assistance of the data in the best possible way. The analysis will be executed through software provided by SCB, called *SAS*. The SAS programming will enable this project to examine the different KBC components and its deployment between the various industries.

The intention of this project is not to cover the definition of KBC investments as a new phenomenon or to describe how the broad range of KBC investments can have a beneficial impact on the enterprises or the economy as a whole. It already exists papers on the topic, but rather to illustrate the distribution of the broad range of KBC investments in Sweden and to assess the investment force of the KBC investments per branch of industry. Moreover, if they have a beneficial impact on the labour productivity of enterprises and therefore the economy as a whole. The study will only briefly cover the KBC investments, its broad definitions, their importance to the economy and the companies.

The proposed research method is new and still in its embryo; thus the accumulation of the KBC components will derive from surveys. The surveys are from 2015, and earlier data sets are not available to examine. The data is restricted to the private sector and companies with less than ten employees are excluded in these type of surveys because they are too small to implement the investments and practises considered in the surveys.

1.5 Methods

To set the project in the right direction, research will be a crucial part to expand the knowledge of the subject and fully grasp KBC investments. By assessing relevant information from journals, articles and literature studies on previous work that covers KBC investments, the base for the topic will be enhanced.
Due to the lack of empiricism in the established macro approximations and the failure to account for the research that exists in the microdynamics within the different KBC components, SCB perceives that the quality of the approximations is insufficient to give validated information concerning Sweden's KBC investments. Therefore further study will be done to develop new methods that will explain the KBC investments and its spread in the economy. The current proposal is that the generation of KBC investments shall be focused from the perspective of the enterprises; obtained through business surveys. Also, the

development and modification of new methods are imperative to assess the data. The accumulated data is to be combined with the registry data of enterprises economy to achieve the sought results.

Stakeholder

This project is a collaboration with Statistics Sweden; department of investments, R&D and IT. Statistics Sweden will provide the supervision and data needed for the project. The intention of this study is to shed light on the new developing economy.

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Industrial partner: Hans-Olof Hagen, Statistical Central Bureau
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1.6 Thesis Outline

The study starts with a theoretical framework, where it investigates the prerequisites to intangible investments, known as KBC investments; structured by three parts. It pursuits to define the various KBC investments and explore their attributes according to previous developed hypothesis.
Once the categorisation of KBC investments is established, the next part continues to discuss and assess the difficulties in the accumulation of KBC investments. The characterisation of KBC investments are presented and its discrepancies across them, to further comprehend their complexity.
The last part proceeds to further discuss the increased implications to understand KBC investments due to the rapid progression of its asset allocation and its contribution to the economy, hence the importance of KBC investment.
The chapter will further explore the theory to the productivity function and the measurement methods to assess labour productivity for firms.

Supporting the theoretical framework, the study will present the research methodology and its applications to illustrate a glimpse into the ”new economy” of Sweden. The section will present and explain the opted methods to answer the presented objectives of the research.
Following the methodology, the thesis will present and discuss the obtained results of the data. Lastly, it will further discuss future recommendations concerning the KBC investments.

Chapter 2

Theoretical Framework

2.1 Prerequisites to Intangible Investments

The importance of *intangible investments*[1], also known as *intellectual capital*, and its interpretation has increasingly attained wider identification due to its escalating growth in size (OECD, 2011). Research has displayed tendencies that the economic growth is increasingly driven by intangible investments (Tillväxtanalys, 2014; OECD, 2013). According to figure 2.1, there even exist economies where intangible investments are exceeding investments in capital that are measured through physical capital investments and work; indicating the deterioration of investments in capital and further implying that it has a smaller influence on *growth accounting*[2] where technical advances have obtained a much greater portion. The figure shows that the user trend of intensifying intangible investments is most common in the developed economies, even though discrepancies exist between the developed economies. Moreover, the set of intangible assets across economies exhibits large differences (Andrews and de Serres, 2012).

The trend pattern spawned the core for the thesis *Measuring Capital and Technology: An expanded Framework* (Corrado C., 2004), where they set out to develop growth accounting in order to enhance the framework of investments and obtain a greater knowledge regarding the various components that embodies intangible investments. Furthermore, they investigated how to integrate intangible investments to the traditional models as well as proving its importance through empirical approximations. They suggested that investments should be treated in an expanded framework to better cope with the *intertemporal choices*[3] that economic players do. The conclusion was that activities with the aim of increased future production with the purpose of increasing returns should be perceived as investments. In turn, this would improve the analysis of the national accounts (Corrado C., 2004).
Their thesis (Corrado C., 2004) was used as an important reference by governmental institutions and it induced further research on the subject of intangible assets. The findings displayed a trend in intangible investments, with the consensus that many economies exhibit stagnated or even a shrinkage of capital investments as intangible investments were swelling (Corrado C., 2012; Tillväxtanalys, 2014).

The Organisation for Economic Co-operation and Development (OECD) has opted to categorise intangible investments as *knowledge-based capital (KBC)*. Institutions have chosen to adapt to this reference and so this thesis will (OECD, 1993).

[1] Asset that has no physical embodiment, unlike tangible assets.

[2] Growth accounting derives from economic theory and measures the contribution to the economic growth through various factors. It consists of labour- and capital factors which explain the total output. An unexplained factor component is defined as technical advances and represents all the changes in growth that cannot derive from changes in other specified factors. It is known as multifactor productivity.

[3] The ability of choices that will affect future options.

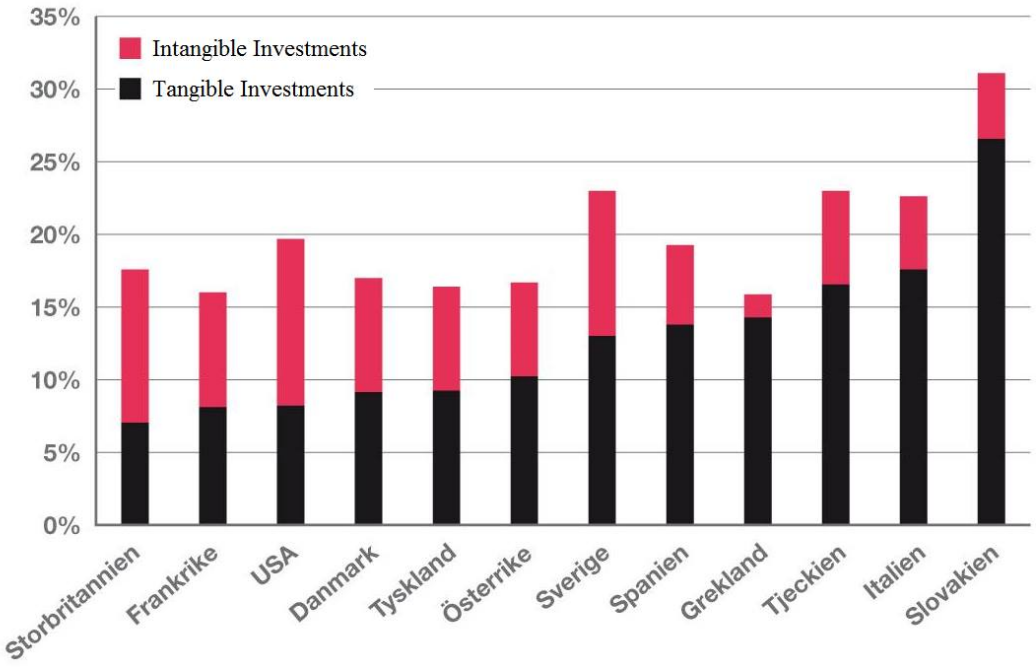

Figure 2.1: Tangible and Intangible investments year 2006 (percentage of GDP)
(Tillväxtanalys, 2011) p.38

2.1.1 What categorises as Knowledge-based capital

While capital investments are normally associated with physical capital investments or work, KBC investments are on the contrary not physical, nor do they have any financial embodiment. They are a result of business investment and often characterised as being not ”owned” by the company in the same manner as machinery or properties. Furthermore, knowledge associated assets connected to service dynamics are bound to the employed workforce of the firm. Hence, KBC is a reference to expenditures on assets that are associated with knowledge in the shape of increased competence that will induce increasing future revenues. They are categorised as spending and not perceived as investments that are included as capital in the production function.
Corrado et al. (2005) suggested that all resources with the purpose to increase future consumption should be entitled as an investment in order to simplify the assessment of national accounting.

The following table 2.1 presents the framework that is still fundamental when discussing KCB components. The KBC components enable a wide range of opportunities for companies and are steadily turning into the dominant form of business investments (OECD, 2013).

Table 2.1: Framework for intangible assets

Name of group	Type of knowledge capital
Computerised information	Knowledge embedded in computer programs and computerised databases
Innovative property	Knowledge acquired through scientific R&D and nonscientific inventive and creative activities
Economic competencies	Knowledge embedded in firm specific human and structural resources, including brand names

Source: (Corrado C., 2005) p.23

Computerised information

Computer information contains factors such as software and databases. Software consists of software development and software education for employees.

Innovative property

Innovative property contains trademarks, scientific- and non-scientific R&D; both privately and public, design, business expenditures for product development and more. Further, copyrights and patents are also categorised under innovative property.
Investments in innovation are closely connected with KBC investments because many of these activities fall under the same category, but KBC activities are not to be associated with investing in new machinery or layouts, but investing into new developments of machinery or layouts.

Economic competencies

Economic competencies contain marketing, market development, brand equity, brand building, organisation- and management development. It also refers to market investigations, organisation development, and employee education. Investments in the shape of education and training are also called human capital (Tillväxtanalys, 2014). Employee education with the purpose to increase efficiency and productivity in established organisation is regarded as knowledge capital and not innovation-based activities. On the other hand, the fulfilment of a new organisation is viewed as both a KBC activity and an innovation activity.

As stated by Corrado et al. (2005), expenditures due to company activities with the goal to increase future revenues and increase future production should be treated as investments. Therefore categorised groups in 2.1 on page 7 was further developed to display the expected results from the various KBC activities that will affect the output growth; shown in the following table 2.2.

Table 2.2: Classification of the various forms of KBC and their effects on output growth

KBC asset type	**Mechanisms of output growth for the investor in the asset**
Computerised information	
Software (1)	Improved process efficiency and ability to spread process innovation more quickly. Improved vertical and horizontal integration.
Databases (2)	Better understanding of consumer needs and increased ability to tailor products and services to meet them. Optimised vertical and horizontal integration.
Innovated property	
R&D (3)	New products, services and processes, and quality improvements to existing ones. New technologies.
Mineral explorations (4)	Information to locate and access new resource inputs - possibly at lower cost - for future exploitation.
Copyright and creative assets (5)	Artistic originals, designs and other creative assets for future licensing, reproduction or performance. Diffusion of inventions and innovative methods.
New product development in financial services (6)	More accessible capital markets. Reduced information asymmetry and monitoring costs.
New architectural and engineering designs (7)	New designs leading to output in future periods. Product and service quality improvements, novel designs and enhanced processes.
Economic competencies	
Brand-building advertisement (8)	Improved consumer trust, enabling innovation price premia, increased market share and communication of quality.
Market research (9)	Better understanding of specific consumer needs and ability to tailor products and services.
Worker training (10)	Improved production capability and skill levels.
Management consulting (11)	Externally acquired improvement in decision making and business processes.
Own organisational investment (12)	Internal improvement in decision making and business processes.

Source : (OECD, 2013) p.12

Besides the already mentioned KBC components, there exist components that are within the field of knowledge and defined as KBC but are absent from national accounting due to their complexity and difficulties to measure. The inclusion of these is perceived as vital to expand the comprehension of the altered economy (Andrews and de Serres, 2012).

2.1.2 Collection and Measurement of Knowledge-based Capital

KBC investments must have an improved transparency form in the same manner as other capital investments due to being a fundamental source for business success when firms spend on the various components that go under the definition as KBC. In reference to section What categorises as Knowledge-based capital (2.1.1 on page 6), spending on KBC assets have previously been labelled as expenditures but should be treated as investments given that the activity contributes to the future production for a time span longer than a taxable year. It will build a solid base and improve the estimations once the data access is widely improved. Earlier studies have demonstrated that firms expect the productive lifespan of KBC spending is to exceed at minimum two years (OECD, 2013).
Concerning the expenditures, one must develop a template that aids when deciding a reasonable portion of the expenses on the various shapes of KBC that should be regarded as an investment. Physical capital investments have a simple manner to determine the portion that is perceived as investment such as the time horizon of its depreciation (economic lifespan) for e.g., But one cannot assert the same with marketing budget for e.g., (Tillväxtanalys, 2014).
Hardware generally accounts for 20 % of the total costs when firms invest in integrating databases and organisational processes which mean that the remaining expenses are allocated for organisational altercations and not labelled as investments even though its weight is equally vital as hardware (OECD, 2013). It is, therefore essential to have empirical ground to describe the wearing of the KBC investments to estimate the accumulated KBC assets.

Currently, available data sources that are sufficient for domestic and international comparisons are limited to R&D and software (Andrews and de Serres, 2012). These represent only a fraction of KBC assets, thus adding to the importance of further expanding the horizon of KBC for the assessment of its contribution to the economy. Moreover, studies have shown that massive R&D investments do not characterise innovative firms. In the U.S business expenditure on KBC assets defined as non-R&D increased from 8.5 & to 11.2 % of value added whereas in R&D which rose from 2.3 % to 2.4 % of value added between 1995 and 2010 (OECD, 2013). The same pattern presents itself when examining France in the same time span; with business spending on R&D remaining constant at 1.9 % of value added while KBC assets defined as non-R&D increased from 7.4 % to 10.6% of value added. Moreover general private R&D does not exceed more than 20-25 % of the total private stocks of KBC (OECD, 2013). Hence innovation is not dependent on R&D but other components categorised as KBC (OECD, 2013).

Due to the complexity of KBC, the unsatisfactory established international framework concerning the accumulation of KBC which is built on the lacking of empirical evidence and the discrepancies regarding KBC assets across economies, comparable data for international comparisons exhibit flaws (Andrews and de Serres, 2012). Further, the focus is currently to collect the data at a aggregated level which only displays the pattern of the economy as a whole, such as the impact of KBC investments and the changes in the aggregated stock growth of KBC assets. Hence the assessment lacks information on a detailed version; explaining the distribution of KBC investments of the firms and the distribution of KBC based on the branch of industries (Tillväxtanalys, 2014). Figure 2.2 display the aggregate of tangibles and intangibles in the year of 2006 in Sweden. In addition, it includes the portion of Sweden's tangible investment in 1960.

According to Tillväxtanalys (2014), in Sweden, the databases for KBC assets lacks quality and consequently insufficient (Tillväxtanalys, 2014). It is, therefore hard to assess its contribution to the economy besides the aggregate which states the total contribution. Tillväxtanalys (2014) suggested that due to the complexity of the KBC components one should disassemble the aggregated data and examine it on a micro level (firm wise) in order to obtain improved approximations and better clearness. With the help of Statistics Swedens sample methods, extracting the KBC data with a focus on firms investigations, it is possible

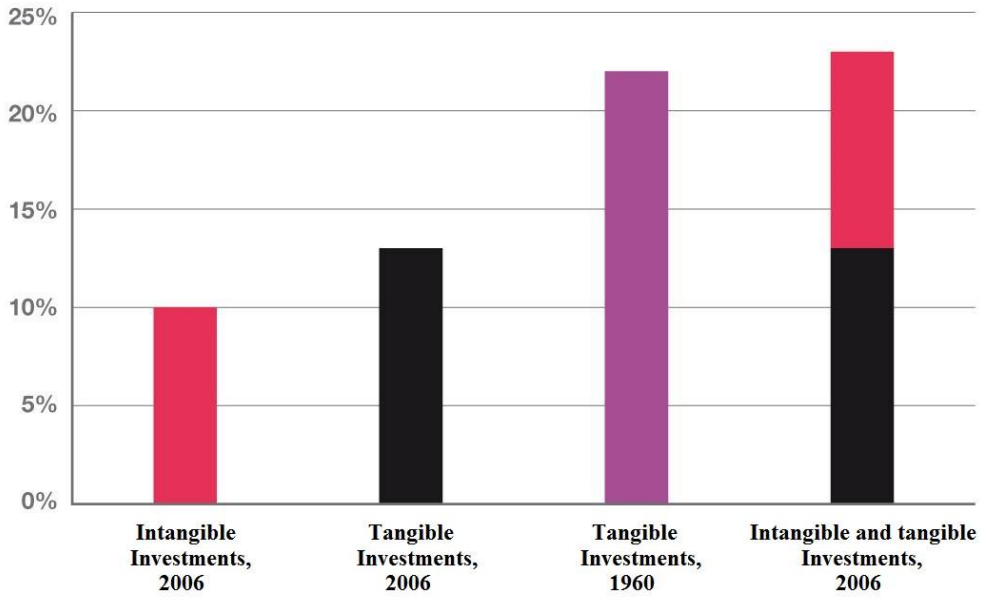

Figure 2.2: Tangible and Intangible investments in Sweden year 1960 and 2006 (percentage of GDP) (Tillväxtanalys, 2011) p.38

to build a time series data that would describe the distribution of KBC components and the changes over time from the firms perspective. Delivering the KBC data in microform would place the analysis of the approximation in a much wider context. The obtained information can reveal which sectors and branch of industries exhibit greater KBC investments, where competition policies need to be altered and the distribution shape between large and small firms. Furthermore, the analysis with the depth of microdata can reveal the direction of how these are affected by the taxation changes of KBC assets with annual accumulation. This would improve the established foundation of which policymakers can encourage the development in the best direction.

Prior to deciding which KBC activities should be perceived as investments, it is important to identify the expenses for the activity first. Moreover the expenditures must display the expenses for own produced services and expenses for the purchased services (Tillväxtanalys, 2014). Many KBC activities intertwine with one another. Hence one component might be included in another component, called double accounting and therefore it must be taken into consideration to avoid a double accounting. For e.g. investments in software with the objective of research will most likely be visible in both IT expenses and R&D expenses (Tillväxtanalys, 2014). Thus to measure it is a complicated task due to the appearance of the KBC assets. Below presents the numerous appearances that characterises KBC assets.

Visibility

KBC assets lack visibility as a consequence of not have any psychical realisation which makes it difficult to identify the origin of the component and to assess its value. Moreover, accompanied to the non-visibility is the difficulty to track the usage of the results (Tillväxtanalys, 2014).

Non-excludable

The spillover effect of KBC components enables others to take advantage of the benefits enabled by KBC components. It makes the KBC components non-excludable. Hence it becomes hard to control the ownership form of KBC investments and to identify its return as a cause of its attributes (Tillväxtanalys, 2014; Andrews and de Serres, 2012).

Non-rivalry

Nor are they defined as rivalry assets (non-rivarly) because the KBC components can be used, by multiple users. The multiple usages of a KBC component does not give rise to worse functionality or output.

Non-tradable & Non-separable

Furthermore, KBC assets are often characterised as being non-tradeable and non-separable. The former one is due to be created internally by the firms. It is, therefore hard for an external investor to substantiate the quality of firms KBC assets. The latter is because some KBC assets that are perceived as full value is firm specific. One cannot separate the asset from its original creator because it will lose part of its value.

Knowledge transferable

Lastly, KBC assets can be knowledge transferable through the incorporation of human capital given that the information is understandable (Andrews and de Serres, 2012).

Table 2.3 presents the features that define the KBC assets and the discrepancies between them. The KBC assets in the first two categories are fully non-rival and partly excludable. They are all separable from its generated origin without a loss of value. Furthermore, the transferability of knowledge can easily be encrypted when transferring the knowledge and therefore protected. Economic competencies on the other hand (contrast) have KBC assets that are mostly characterised by rivalry and excludability, such as investments in brands and human capital. These KBC assets contain attributes that add value to the corporate or individual incorporation and are therefore due to being firm-specific, hard to separate from the firm. Furthermore, the table displays that organisational structure is the KBC asset that is non-rival and partially excludable.

Table 2.3: The characteristics discrepancies across various classes of KBC assets

	Rivalry	*Tradable*	*Excludability*	*Separability*	*Knowledge transferability*
Computerised information					
Computer software	Fully non-rival	Not for own account software	Partial only	Separable	High (codified)
Computerised database	Fully non-rival	Not for internally created data	Partial only	Separable	High (codified)
Innovative property					
Scientific R&D	Fully non-rival	Outsourced R&D services and patents	Partial Only	Separable	High for patents/low for secrets
Creative property	Fully non-rival	Outsourced R&D services and copyrights	Partial only	Separable	High (codified)
Design	Fully non-rival	Outsourced design services and IPR forms	Low for visible products/High for workspace	Separable	High (codified)
Economic competencies					
Brand (equity)	Largely rival	Outsourced marketing services	High / Firm specific	Partly separable	Via transfer of firm ownership
Firm specific human capital	Largely rival	Outsourced training	High / Firm specific	Non separable	Via human capital mobility
Organisational structure	Largely non rival	Outsourced consulting services	Partial only	Non separable	Moderate / aspects difficult to codify

Source: (Andrews and de Serres, 2012) p.11

2.1.3 The importance of Knowledge based Capital

Taken together, the KBC assets are considered as strategic investments in the long run for the economy in the sense of economic growth and more importantly for the companies. Earlier studies regarding the growth account of economies show that KBC investments contribute 20% to 27% of labour productivity[4] growth for the European Union and the U.S. (OECD, 2013). The repercussions of post-crisis such as the European public debt and the financial crisis, combined with worsening macroeconomic settings have all added to the decline of economic condition in the OECD economies. Therefore to break free from the restraints set by the deteriorating conditions, developed economies are forced to search for potential new sources of economic growth elsewhere; implying that economies are even more dependent on enhancing the productivity level of its economy through innovation-based activities (OECD, 2013). Furthermore, research concerning post-crisis show that KBC investments have been strong and has not dwindled in the same portion as tangible investments; transforming into a crucial factor deciding the competitiveness of firms (OECD, 2013).

Policymakers understand that the increasingly growing intangible assets are a focal point to sustain a healthy economic growth and for innovation-based expansion, underpinned by a variety of KBC assets (Andrews and de Serres, 2012). Furthermore, to deal with the rising obstacles of the intangible assets, it is essential with reforms in the areas of taxation, competition, entrepreneurship, education and regulation, which all contribute to the development of the economy . A minority of economies are already exhibiting cases where intangible assets are outgrowing tangible assets (OECD, 2011).
The consensus among institutions is that KBC assets inherent features that encourage an increase in growth and productivity. In comparison to physical capital, the initial expense for KBC activity that will develop knowledge is not defined by additional expenses once the knowledge is applied again. It is also known that knowledge-based assets have a positive contagious effect that integrates into other parts of the economy, hence inflating growth further (OECD, 2013). Therefore it will give rise to an improved return to scale in production for firms and thus for the economy as well. Furthermore, to optimise the growth possibilities enabled by KBC assets is partly dependent on the ability to promptly reallocate labour and capital to their most productive use which in turn is dependent on the policies set by policymakers (Andrews and de Serres, 2012). Furthermore, the overcoming of this obstacle is accompanied by the redistribution of tangible assets, which is of equal importance given the inherent difficulties with KBC assets. It is thus beneficial for the government to contribute to the development of KBC databases to increase the quality of the approximations which will aid policymakers with the policy framework (Andrews and de Serres, 2012). As mentioned in section Collection and Measurement of Knowledge-based Capital (2.1.2 on page 9), the international data sources that are accessible for international comparisons exhibit cracks and only contain information for KBC components software and R&D. Current praxis adopted needs to be updated for an increased reliability regarding KBC components since the investments derived from different data sources and founded with the lack of empirical ground.

[4] A tool to measure the economic growth of an economy or company. It is the quota of goods and services produced by a worker.

2.2 Productivity

Growth models are continuously scrutinised as economies seek growth from various sources. It stresses the importance in studying productivity which is a vital tool to measure the efficiency of the production. It derives from the theories of economic growth.

"Productivity isnt everything, but in the long run it is almost everything. A countrys ability to improve its standard of living over time depends almost entirely on its ability to raise its output per worker"

Paul Krugman, The Age of Diminishing Expectations (1994)

Solow (1957) imprinted this subject with his research and proved that technological advances are imperative to economic growth, aside from inputs from capital and labour. He set out to describe that technical advances per worker would increase the aggregated production of an economy (Solow, 1957). His approach is still perceived fundamental behind economic growth, and still applied today through various shapes.
Countries growth rates will differ from one another due to differences in their factor accumulation (The quantity increase in the four factors used in the production of goods and services in an economy, consisting of capital, labour, land, and entrepreneurship) and productivity. Hence the efficiency level of a production is measured through the ratio of output to input (Weil, 2013)

History has repeatedly proved the incentives to study productivity which is a driving force to economic growth. The productivity growth is perceived to be the key for an improved economic growth and competitiveness in the long run. It measures the efficiency of firms production given its labour and capital inputs. This is known as the ratio between the output and input volume. An increase will enable firms to produce a greater output for the same output level. It gives information regarding the economy's productive capacity or utilisation of the capacity. The obtained information is used as an indicator for strategies regarding the economy growth. Furthermore, the assessment indicates the demand and inflationary pressures (OECD).

2.2.1 Production function

To understand how different factors influence the productivity, the common path is to measure it through a production function. Solow (1957) associated this the aggregated production function to productivity, see ((Solow, 1957), (Hulten, 2013)). The production function estimates the highest output value an economy/firm can obtain given its input combination. Hence, the function describes the relation between output and input.

$$Y = A\mathbf{F}(K, L), \tag{2.1}$$

where Y stands for the production function, linked to productivity (Hulten, 2013). The function measures the output of an economy/firm, given its input combination, labour (*L*), capital (*K*) and a factor denoted as the level of efficiency (*A*), known as *total factor productivity (TFP)*. It describes how efficient labour and capital is being used in the production function, such as technical advances stated by Solow (1957) (Solow, 1957). The capital accumulation (K), consists of physical capital, known as tangible capital, and knowledge capital, known as intangible capital.

$$K = K^{TAN} + K^{INTAN}.$$

where the capital stock of K^{TAN} is composed of physical assets, such as machinery, buildings, equipment, vehicles etc, while the knowledge stock of K^{INTAN} is composed of software knowledge, design, marketing, organisational know-how's etc (Jonathan Haskel, 2011). Furthermore, the function assumes a constant return to scale, implying that if the inputs would double, so would its output:

$$AF(\lambda \mathbf{K}, \lambda \mathbf{L}) = \lambda AF(\mathbf{K}, \mathbf{L}). \tag{2.2}$$

Return to scale describes the production increase in the long run given the input combination of a economy/firm. Hence it will explain the rate of the increase in the output. Note that return to scale only focuses on the relation between input and output. If a positive value of λ coefficient is obtained, it is implied an increasing return to scale. A negative value of λ coefficient implies a decreasing return to scale.

To study the *labour productivity*, the ratio of output to labour input, the function (2.1) is slightly modified by dividing *Y* by labour *L*:

$$\frac{Y}{L} = \frac{A\mathbf{F}(K, L)}{L}, \tag{2.3}$$

The relation between output per worker is of great importance when assessing the productivity. Equation 2.3 show that labour productivity is dependent on the ratio of physical capital-labour and the TFP (A). Logically, the productivity level will vary in different industries, sectors and in the quality of labour, across economies. For e.g., areas such as the manufacturing sector are more dependent on physical capital due to the reliance on machinery, unlike the service sector. The same pattern should present itself when comparing large firms to small firms, which produce larger quantities at smaller expenses compared to smaller firms. If labour productivity increases, it is insinuated that the output per worker has increased.
The quantity of labour is a standard measure across economies to study its influence on productivity, although labour hours, wages and the quality of employment will vary between economies.

2.3 Previous research

For years researchers have executed various research to examine the relationships between single KBC components and the total factor productivity. One of these elements is R&D capital, which Dilling-Hansen et al. (1999) used to estimate the effects on total factor productivity. They obtained data from Danish firms in a time span from 1987 to 1995. The measure for R&D capital was created by accounting for the problem that R&D activities can be included in other activities which would then lead to double accounting. Additionally, they used a depreciation rate of 20 percent to the investments. They found a positive output elasticity of R&D in the interval of 12 -15 %. Additionally, although it was not significant, they found that investments in R&D increased the factor productivity of labour and physical capital. Furthermore, the amount of funding from companies does not affect productivity directly. They also examined other factors, such as innovations, ownership control, and foreign ownership. They found that the number of large owners in the company does not influence the productivity of the R&D investments and that innovative firms do not exhibit higher productivity returns to their R&D investments. Interestingly, on the other hand, they found a positive effect on productivity from foreign ownership and that R&D capital the capital from R&D is more productive when compared to domestical owned companies (Mogens Dilling-Hansen and Smith, 1999).

Ortega-Argils et al. (2008) aimed to study the link between firms R&D expenditures and its productivity. With a database consisting of 1,809 US and European firms within the manufacturing and service industry between 1990 - 2008, they found that activities in R&D, labelled knowledge capital, has a significant positive impact on a firm's productivity. The results were consistent with previous works. Furthermore, the coefficients were more significant in the service and high-tech sectors than in the non-high tech manufacturing sectors. It is suggested that high-tech firms benefited more from R&D activities concerning the impact on productivity. Lastly, the results displayed a shift in favour of the service sector. (Raquel Ortega-Argils and Vivarelli, 2011)

According to Haskel (2012) KBC investments have a positive impact on other investments by increasing the return on other investments. It is illustrated through the positive co-movement of KBC investments and IT-investments by aggregated data. The same case iterates itself between economic growth and KBC investments (Jonathan Haskel, 2011). The illustration should be in an equivalent pattern when displaying the approximations on micro data. Furthermore, Haskel presents a production function where he includes intangible assets. His theoretical model approach is the premise to the applied model of this study, containing microscopic data and the estimated portions for the KBC investment.

Chapter 3

Methodology

3.1 Description of Data and Materials

The microdata (at firm level) utilised to examine KBC investments derived from the following surveys conducted by Statistics Sweden (SCB):

- ICT usage in firms 2014
- Expenditures in IT and marketing in firms 2014
- Community Innovation Survey 2012 - 2014
- Current status examination of organisational work and work environment in Swedish working life in 2015 (NU2015) by *The Swedish Work Environment Authority*

Furthermore, to accomplish the tasks presented in Purpose and Aim (section 1.2) and examine the patterns in the branch industries, Statistics Sweden provided *company data 2014 (FDB-database)* with added elemental information concerning their financial and economic data. A register containing all registered firms in Sweden from 2014. The characteristics consists of organisation identification number and elemental information such as:

- Net sales
- Value added
- Firm employees
- Wage costs
- Labour productivity
- Capital

Vital information concerning the companies financial and economic data was used when merging the FDB-database with the data sets generated from the survey respondents. It was implemented with the help of the organisation ID numbers of the firms. More importantly, the FDB-database was used to categorise the companies into branch of industries according to Swedish branch of industry (SNI) keys (SCB, 2007), described in SNI keys (section 3.1.2 on page 19). This is due to secrecy laws that prohibit Swedish Statistics to

present detailed information concerning companies financial- and economic data and to expose individual observations (organisation ID number) from data sets deriving from the surveys and the FDB-database.

During the process of this thesis, each survey (data set) was treated individually in combination with the FDB-database. The described procedures were implemented separately for each survey. New variables were created for the identified KBC investments with the help of newly established measurements. With the created KBC variables, the aim to describe the expenditures on the KBC investments per branch of industry was accomplished. Moreover, the relationship between labour productivity and the KBC investments was assessed, conditioned on the branch of industries. With the obtained results the indication question of KBC investments contribution to the economic results of companies were answered.

Once the assessment for each data set was accomplished, focus was shifted towards a merged data set, containing all four data sets. Each merge resulted in a smaller data set due to the random sample draws generated for each survey, resulting with different observations originating from the various surveys; not to allude the excluded observations mentioned in Missing Values (section 3.1.5 on page 21). Due to the lack of robustness in the quadruple merge, the results were omitted. This is discussed in Quadruple merge (section 5.3 on page 95).

3.1.1 Labour Productivity

An important target was to model the relationship between the KBC investments and the *labour productivity*. Given the supplied FDB-database containing financial and economic data of firms, the suggested method to estimate the labour productivity was to use the *value added per employee* in consideration of the various size differences of firms. Thus a more standardised result was obtained. Value added is perceived as the dependent variable and to obtain the labour productivity it was divided by labour, denoted as *L*.

$$\left(\frac{\mathbf{Y}}{\mathbf{L}}\right)$$

Value added is the net value added by a firm during a term. It is defined as the difference in the sold price of the product and the costs of producing the product ($VA = SP - PC$), where VA stands for value added, SP for sold price and PC for production costs. Hence it can be said that value added is sales subtracted by the expenses. An improved measure would have been to include the average working hours in the labour productivity to account for the discrepancies in the working hours in sectors and industries. Unfortunately, that information was not supplied.

With the help of the KBC investments, the inclusion of *capital per employee* and *labour*, the assessment of their contribution to the labour productivity for this study was evaluated. It was obtained through various plots and regression models, which subsequently indicated if there existed an increase in the labour productivity of firms. In turn, an indication of an increase in the economic results of firms was extracted; a target result of this study given in Purpose and Aim (section 1.2 on page 2) and Research Question (section 1.3 on page 3).

During the treatment process of each survey, firms that exhibited missing values in labour productivity were omitted from the research. It was due to measurement errors from the FDB-database obtained from the *Swedish tax agency*.

3.1.2 SNI keys

Swedish branch of industry (SNI) keys is used to classify companies according to the correspondent branch with associated companies with the same classification. Statistics Sweden stores the SNI classification, but *Swedish tax agency* implements the tabular gathering. The European version is called *NACE* and is identical with SNI in *department*, *main* group, *group* and *subgroup* categories (SCB, 2007). The SNI keys are shown in Appendix SNI Materials (section A.5 on page 110).

The classification will categorise observations into different branch industries which will prevent any sensitive information from exposure due to the visible crude information. Initially, the companies were classified into 69 categories based on the groups (three digit) SNI keys, but due to some groups exhibiting small sample sizes once merged with the FDB-database deriving from the surveys, the classification had to be made cruder. Hence the branch of industries was aggregated further and eventually classified into 9 categories based on the department (capital letter) SNI keys from SNI Materials (section A.5 on page 112). A short description of the branch of industries is given by figure 3.1.

Table 3.1: SNI keys (Branch of Industry Classification)

SNI Keys				
Capital intensive goods (1)	*Capital intensive manufacturing* (2)	*Labour intensive manufacturing* (3)	*Knowledge Intensive manufacturing* (4)	*Construction* (5)
Agriculture, forestry & fishing. Electricity, gas, steam & air conditioning supply. Water supply; sewerage, waste management & remediation activities.	Mining & quarrying, Crude petroleum, natural gas. Manufacturing such as Steel & metal, paper industry.	Manufacturing such as food, textiles, rubber & plastics, wood products.	Manufacturing such as machinery, communications & instrument industry.	Construction such as construction of housing, layout construction & other construction.
SNI Keys				
Trade (6)	*Capital intensive service* (7)	*Knowledge intensive service* (8)	*Labour intensive service* (10)	*Finance* (0)
Wholesale & retail trade; repair of motor vehicles & motorcycles. Transportation & storage. Accommodation & food service activities.	Transportation and storage. Education. Human health & social work activities.	Information & communication. Real estate activities. Professional, scientific & technical activities.	Administrative & support service activities. Arts, entertainment & recreation.	Financial & insurance activities. Other service activities.

3.1.3 Measurement Establishment

A key milestone for this thesis was to establish measurements for the KBC investments to enable the analysis of the KBC investments per branch of industry. It was mentioned in Purpose and Aim (section 1.2 on page 2). The creation process for the measurements was different for each KBC component due to the structure of each survey and the difficulty in extracting information concerning the KBC components in the best possible way. The extraction process of each KBC component and the created measurement linked to the KBC component will be described respectively in each survey section further on.

For some KBC components, the extraction of the invested resources perceived as investment was more straightforward while the other, the process was more complicated. The information that was supplied and highlighted in this section was the created measurement for KBC components *software development for own usage* in section 3.5.1 and *marketing expenses* in section 3.6.1, once the extraction was implemented. The request was to absorb the expenses the firms had allocated to the identified KBC component. It could only be done by extracting the *annual work unit*[1] of employees within the company entirely dedicated to the field of expertise; concerning the targeted KBC component respectively. One annual work unit is correspondent to one employee working full time with the targeted KBC component. The obtained number of staff working full time with the identified KBC component needed to be transformed into a monetary value to acquire the correspondence of annual work unit reflected as the expenditures of a firm distributed to the demanded KBC component. The believed answer was to locate Swedish firms operating in the manufacturing and service industry so that it was possible to extract the average net sales per employee for the KBC investments in the manufacturing and service industry, viewed as an expense if the firm would have bought the service instead of producing it themselves. Thus a cost for each annual work unit was found, and the total annual work unit of each firm could be multiplied to the extracted average net sales per employee.

Table 3.2: Average Net Sales per Employee

Service Industry	1895
Manufacturing Industry	1869

3.1.4 Sampling Weights

The structure and aim of each survey were different, such as the population from which the sample was drawn, the descriptive purpose of the study, the size of the sample and the enterprise participation. Moreover, each sample size deriving from a population will contain stratification in order to extract firms with different characteristics depending on the structural aim of the survey. Weights are then assigned to the observations to get an accurate representation of all Swedish firms. In other words, the sample weight will aid the research and sample back to the population from which the sample was extracted from for descriptive statistics concerning its population (for Digital Research and Education). It means that each observation from a stratum represents a weight to account for the total number of firms within each stratum. It is due to reason that some strata's will be over-represented and some under-represented. The weights will therefore further influence the impact of observations that are under-represented and decrease the impact of observations that are over-represented to obtain a correct representation of the population.
Weights are opposite to likelihood of being sampled. It represents the relation between total number of firms and the number of sampled firms within each stratum

$$Weights = \frac{N}{n}.$$

The assigned weights will account for this problem and aid the research when estimating the mean value

[1] Amount of employees assigned 100 % solely for specific assignments.

for each branch of industry. It is known as the *weighted arithmetic mean*

$$\bar{x} = \frac{\sum_{i=1}^{n} w_i x_i}{\sum_{i=1}^{n} w_i}.$$

It is important to point out that the assigned weights that derive from the stratification of the sub populations and from which the sampling were drawn from, does not sufficiently correspond to the industry branches this study examines. It was caused by the risk exposure of firms allocated to smaller sub-populations and therefore in violation between the agreement of Statistics Sweden and the business industry. Consequently, there might exist a discrepancy when sampling back to the population.

3.1.5 Missing Values

Observations that left the survey blank were omitted. Additionally, the data sets contained a portion of "empty" observations, known as *over coverage*, which was also removed. A case of over coverage are firms that have gone into bankruptcy during the selection time span of the sample for the survey.

Applicants that contain the response alternative "*do not know*," "*not relevant*" or simply left the sub-query *unanswered* are processed as missing values when SCB code the surveys and subsequently transformed into data sets. The outcome of this process are data sets with a great portion of observations containing missing values in various variables. There exist different types of missing data, understanding the theory of missing data and the background to the constructed surveys will aid in the decision making concerning the treatment of these. Omitting observations containing missing values can consequently risk deleting vital information, referring to other variables that the observations have responded to. Large corporations provide very critical information and cannot be excluded due to missing values since they have a greater influence on the results. More importantly, it can dramatically reduce the sample size by great numbers having observations exhibiting absent variables. Thus consequently it can affect the conclusion regarding the population, hence the bias. Moreover, the scenario outcome can harm the statistical power of the model and result with biased estimates regarding the parameters (Soley-Bori, 2013). Deciding on the best path that will subsequently result with the least possible biased estimates is complicated.
Observations, where missing values were recorded, were re-coded to zeroes, for both indicator variables and numerical variables. A discussed hypothesis behind a sub-query left as a non-response or responded with the response alternatives that subsequently recorded missing values was the logic that a firm had not made any pursuits within the enquired field. It is perceived as a negative answer at Statistics Sweden and therefore recorded to zero, implying that the firm has not invested within the enquired field. In spite of the inequality in not having invested in software and not knowing is the rare likelihood of a scenario where the firm has invested in software and not having knowledge regarding it. Hence the probability that a firm leaving the sub-query unanswered or with the mentioned response alternatives is more likely associated with the scenario of not venturing in the enquired area. Considering the premise, and the size of the surveys, the consequences of the implemented treatment is considered as subtle.
The chosen implementation enabled the data set to remain intact by retaining the observations. It is believed that the assessment regarding the KBC investments and their distribution is more robust due to the chosen path. Consequently the selected path might have distorted the statistical analysis by the avoidance concerning the omission of missing values.

Regarding the FDB-database, observations exhibiting zero numerical value in the dependent variable, labour productivity, was considered as a incorrect value and therefore omitted. A firm should not be able to have zero labour productivity. A quest of this study was to assess the contribution of KBC investments to labour productivity which consists of value added. Having zero value added implies that the firm have not contributed to the GDP during the concerning year. Hence they should not participate in the survey in the first place, which leads to the belief that an incorrect value has been stored in the FDB-database for the concerning observations.
Furthermore, there exist a set of observations containing negative numerical values in the dependent vari-

able labour productivity from the FDB-database. When examined, the values showed to be in range with firms deriving from the same branch industry, when disregarding the negative sign. An accurate explanation is not available, but a premise is incorrect recorded values stored in the FDB-database. Thus, instead of deleting observations containing negative values in the dependent variable labour productivity and subsequently lose potential information, a negative constant is multiplied to the observations to obtain a positive labour productivity and risk removing observations with a measurement error such as a negative value.

3.1.6 Outliers

There are various ways to allocate *outliers*. Present literature show that there exist numerous approaches in the allocation of outliers, many with discrepancies amongst them. Furthermore, depending on the field of study, the procedures are different.
An outlier is an observation that deviates greatly from the rest, in such manner that one questions its value. It is the difference between the obtained value and its true value. It can arise through various errors, such as the human error, the accumulation error of the data or they can simply be intentional, thus questioning its reliability. The existence of highly influential or extreme observations can affect the inferences made concerning the error variance, the estimated slope and the power of statistical tests (Dahmström, 2015; Verbeek, 2012). One can then ask, what decides if a value should be perceived as extreme? If the population is not known, which observations should not be considered as valid data points, especially in the cases where the range of values is great? Thus it would be wise to examine the observations perceived as potential outliers or to find a logic case for their values.

The allocation and modification of extreme values are in some cases more straightforward given that the true population is known. The case applies to the dependent variable labour productivity, where the population is known and supplied by the FDB-database. The population derives from a heavy-tailed distribution. Hence it is normal that the data is positively asymmetrical concerning the various wide sizes of firms and their great discrepancies in their added value. Thus data points perceived as outlier can with likelihood still derive from the distribution. Omitting them can damage the results as a cause of lost information but including them, if they are correct can change the interpretation of the regression results (Verbeek, 2012).
Considering the explained facts, removing observations believed to be outliers can be damaging to the outcome of the research but regardless of the given information, observations with values considered too extreme were removed for the dependent variable, in fear of data error. Transformation procedures of the dependent variable helped to forge a more symmetrical distribution, a *log-normal* distribution which can only take positive values, accounted for the prior treatment of observations that exhibited zero or negative labour productivity, mentioned in Missing Values (section 3.1.5 on page 21). The pattern is analogous for the explanatory variables *capital per labour* and *labour* as they are supplied by the FDB-database.

Unfortunately the similar trend does not exist in the case of KBC investments. The accumulated data and the created measurements concerning the KBC components on micro level have never been implemented in Sweden; thus historic data concerning the KBC values is not supplied. It removes the possibility of identifying previous developments of the observations to spot deviations. Furthermore, the true population is unknown in this case. Thus the identification and deletion of outliers are therefore very sensitive given this study and its field of study when examining the KBC components. One needs to examine whether the data point is legitimate or not, account for the data source where the data derives from and other factors surrounding the nature of the data.
According to Cousineau and Chartier (2010), a criterion based upon z-scores is a good approach to identify the presence of outliers. By eliminating observations that exhibit values of a criterion based standard deviation far from the sample mean, one can remove both small outliers and high outliers. The approach is robust given that the existence of the outliers is a random process and that the data are assumed to follow a normal distribution (Cousineau and Chartier, 2010). *Alpha-trimmed mean* is an additional method and has a similar approach. It removes the outliers of the mean in order decrease the deviations.
If the data is assumed to derive from an unknown but asymmetrical population, an advantageous step would

be to transform the data in an attempt to suppress the appearance of outliers in the data Once this step is accomplished one can perform the procedures described above or even retain the data set once transformed, given that extreme scores have decreased.
In the case of KBC investments, the majority of firms had invested zero in the KBC components, which was reflected in the their heavy-tailed distribution. Thus most commonly used transformations will not work in this case and return empty values. The square root transformation was beneficial in order to suppress the heavy-tailed distribution and to retain observations who had not invested in the KBC assets. Thus the allocation of outliers, in the case of KBC investments, was assessed through the regression. By omitting observations perceived as potential outliers, one could compare the performance of the models, one being the exclusion of the possible outliers. If the latter model remains rigid, then the inclusion of extreme observations will be negligible. The assessment was done through diagnostic plots and the goodness-of-fit performance. Regrettably, in the case of KBC investments, the results were negligible, for all surveys due to the large data sets at disposal.

The opinions and suggestions concerning the treatment of extreme values are broad. Regardless of the chosen path, an important note is that the smaller the sample, the greater the influence will the outliers inherit (Cousineau and Chartier, 2010). Thus in this case, with a rather large sample, the outliers will not affect the measurements in a significant manner.

3.2 Econometric method

Each survey was assigned an econometric model[2] containing data deriving from the specified survey. Explanatory variables *capital per labour* and *labour* were supplied by the FDB-database and therefore included in each assigned regression model, with the assistance of the matching possibilities of the survey observations and their existence in the FDB-database containing their financial data.

Following the model Production function (section 2.3 on page 15), the estimation that was used for econometric purposes was the *ordinary least squares*.

3.2.1 Ordinary Least Squares

Ordinary least squares (OLS) is a regression model seeking to explain the summary relationship between the dependent variable and the explanatory variables. Basically, it aims to capture the correlation between the dependent variable and the explanatory variables.

$$y_i = \beta_0 + \beta_1 x_i + \epsilon_i, \qquad i = 1, \cdots, n, \tag{3.1}$$

where β_0 known as the intercept and β_1 the slope. Further ϵ_i is independent random variable, where $\mathrm{E}(\epsilon_i = 0)$ and $\mathrm{Var}(\epsilon_i = \sigma^2)$ (Rice, 1995). In the case of multiple regression, matrix formulation simplifies the multiple regression formulation.

$$\mathbf{y} = \mathbf{X}\boldsymbol{\beta} + \epsilon, \tag{3.2}$$

where $\boldsymbol{\beta} = \{\beta_0, \beta_1, \cdots, \beta_{p-1}\}'$ and $\mathbf{X}$ is an n $\times$ p matrix, $\mathbf{X}_{n,p}$ = $\begin{pmatrix} 1 & x_{1,1} & \cdots & x_{1,p-1} \\ 1 & x_{2,1} & \cdots & x_{2,p-1} \\ \vdots & \vdots & \ddots & \vdots \\ 1 & x_{n,1} & \cdots & x_{n,p-1}. \end{pmatrix}$

The common approach is to choose $\hat{\boldsymbol{\beta}}$ that will minimise the sum of squared deviations for the fitted model

$$S(\boldsymbol{\beta}) = (\mathbf{y} - \mathbf{X})'(\mathbf{y} - \mathbf{X}) = \sum_{i}^{n} (y - \mathbf{x}_i\boldsymbol{\beta})^2 \tag{3.3}$$

For each *i* adds to the deviation between the true observation y and $\boldsymbol{\beta}$. The square avoids positive and negative deviations from becoming nullified in the summation (Verbeek, 2012).
Taking the derivatives of $\boldsymbol{\beta}$ and solving for $\boldsymbol{\beta}$, the following expression is obtained

$$\hat{\boldsymbol{\beta}} = (\mathbf{X}'\mathbf{X})^{-1}\mathbf{X}'\mathbf{y} \tag{3.4}$$

Examining the last expression for $\hat{\boldsymbol{\beta}}$, $\mathbf{X}'\mathbf{y}$ represent the vector of pairwise covariances between the independent explanatory variables x_j and the dependent variable y, while $\mathbf{X}'\mathbf{X}$ is the covariance matrix among the independent explanatory variables. Hence $\mathbf{X}'\mathbf{X} \sim \mathbf{Cov}(\mathbf{X})$. In the ideal scenario, where the explanatory variables are not correlated, $\hat{\boldsymbol{\beta}} \sim \mathbf{Corr}(\mathbf{X}, \mathbf{y})$. This implies that each β_j reveals how each x_j contributes to y. If the explanatory variables would be correlated, then $\mathbf{X}'\mathbf{X}$ would not be diagonal and all x's would influence the β_j.

[2] Statistical applications to economic data with the aim to describe economic relations

To conclude if the OLS is the optimal regression model to explain the correlation between y_i and x_i, one can assess if the linear model fit, through the OLS fits the data. Through the *residuals*, the quality fit can be assessed:

$$\hat{\epsilon}_i = y_i - \hat{\beta}_0 - \hat{\beta}_1 x_{i,1} + \cdots + \hat{\beta}_{p-1} x_{i,p-1}, \qquad i = 1, \cdots, n$$

Basically, it relies on the relation between the error term ϵ_i and x_i, where x_i is known. If the error term, ϵ_i, is independent random variable and normal, then subsequently the estimators and the intercept will be normally distributed. Hence under the normality assumptions, the hypothesis testing of the estimators and the intercept are valid.
Below presents the assumptions concerning the least squares:

I The model specification is correct and describes the relationship of y and x

II $\mathbf{E}[\epsilon \mid \mathbf{X}] = 0$; exogeneity is existent which implies that the explanatory variables are not correlated with the error term. Hence the error term is considered to be independent.

III Constant error variance : Var[$\epsilon \mid X$] = $\sigma^2 \mathbf{I}_n$. The assumption implies the error term is constant and does not rely on x; known as *homoskedasticity*.

IV Uncorrelated errors : $cov[\epsilon_i, \epsilon_j] = 0$.

V Normality: $\epsilon \mid X \sim \mathbf{N}(0, \sigma^2 \mathbf{I}_n)$. It assumes that the errors derive from a normal distribution.

In conclusion, the assumptions state that the error terms are considered to be uncorrelated, with a distribution of mean zero and a constant variance (Verbeek, 2012; Rice, 1995). If the assumptions are violated, then one must apply alternative methods to the data to suppress the violations so that the assumptions can hold for the least squares.
As mentioned, with the aid of the residuals ($\hat{\mathbf{e}} = \mathbf{Y} - \hat{\mathbf{Y}}$) one can assess the model fit ($\hat{\mathbf{Y}} = \hat{\boldsymbol{\beta}}\mathbf{X}$) The diagnostics are easiest to evaluate through plots of the residuals and the model fit, which optimally should display no relation amongst them.

3.2.2 Model Description

Focusing on the production function 2.3 on page 15, below presents the estimated equation using the *ordinary least squares* (section 3.2.1 on page 24). An explanation behind the explanatory variables and their structure is provided below, as the section proceeds.

$$\begin{aligned} \ln(\mathbf{Y}/\mathbf{L}) = \alpha + \gamma_1 \ln(\mathbf{K}/\mathbf{L}) + \sum_{j=1}^{p} \beta_j \sqrt{(\mathbf{KBC}_j/\mathbf{L})} + \mathbf{B} \\ + \gamma_2 \ln(L) + \gamma_3 \mathbf{Z} + \sum_{j=1}^{p} \psi_j \sqrt{(\mathbf{KBC}_j/\mathbf{L})} * \mathbf{B} \\ + \gamma_4 \ln(\mathbf{K}/\mathbf{L}) * \mathbf{B} + \gamma_5 \ln(L) * \mathbf{B} + \epsilon. \end{aligned} \tag{3.5}$$

Note that the model includes an *interaction* term which will be explained in Interaction effect (section 3.3.1 on page 27). A short description of the explanatory variables involved in equation 3.5 will be given by table 3.3, for a better outline. Since the primary focus of this study was to identify KBC investments according to the theoretical framework, create measurements and subsequently generate variables describing the KBC investments, the explanatory variables that are defined as KBC investments will be given a more detailed

presentation once their section with the relevant survey is covered, ICT usage in firms 2014 (section 3.5 on page 32), Expenditures in IT and marketing in firms 2014 (section 3.6 on page 35), Community Innovation Survey 2012 - 2014 (section 3.7 on page 38) and Current status examination of organisational work and work environment in Swedish working life (2015 by *work Environment Authority*) (section 3.8 on page 41).
Worth highlighting is the variable transformation concerning the KBC investments in equation 3.5. A majority of the sample observations from each survey exhibited zero investments in the respective KBC component. The values still contain descriptive information concerning the Swedish economy and its pattern for the KBC investments. Therefore the square root transformation was applied to the KBC investments in order to retain the observations exhibiting zero investments and to enforce a more symmetric distribution. A figurative motivation is presented in 4.2 on page 52, 4.7 on page 64, 4.10 on page 68, 4.13 on page 76 and 4.17 on page 85. The presented figures displayed that the KBC investments still take the form of a heavy-tailed distribution after the square root transformation, although reduced.

Table 3.3: Estimated Model

Estimated Model	
Y/L	Labour productivity (value added per employee)
K/L	Capital per labour. A firms total capital per employee
L	Labour, the employee pool of a firm
KBC_1	Total expenditure for software development for own usage per employee
KBC_2	Total expenses on software per employee
KBC_3	Total expenses on marketing per employee
KBC_4	Total expenses for innovation per employee
KBC_5	Total expenses on education and competence per employee
KBC_6	Total expenses re-organisation per employee
Z	Indicator variable for KBC investment (0 = Not invested, 1 = Invested)
B	Branch of Industry
$Interaction_1$	Interaction effect between KBC investment and Branch of industry
$Interaction_2$	Interaction effect between capital per employee and Branch of industry
$Interaction_3$	Interaction effect between labour and Branch of industry
$Interaction_4$	Interaction effect between KBC investment indicator and Branch of industry

Oddly each survey contained a small set of observations with zero *capital per labour* concerning the independent variable capital per labour in table 3.3. Given that the values are unreasonable, the problem lies with the FDB-database that have registered incorrect values for the concerning observations. On the other hand, in economic terms, firms might have zero capital during a current year. Therefore, the registered values for the observations would actually be correct. Transforming the variable into the logarithm will consequently present problems with zero values and subsequently with the regression model. Thus it was decided that observations containing zero capital per labour are probably associated with incorrect values registered in the FDB-database, and thus omitted. To compare the outcome, two estimated regression results were compared, one with the removal of observations containing zero capital per labour, and one were the observations were retained but with a value of one added to their capital per labour; enabling the log transformation. Table A.1 on page 103 presents the comparison of the outcome. Note that that branch of industry (0) acts like the baseline, known as the intercept. According to the table, the difference is barely noticeable. Due to the large sample size, the results were anticipated and will most probably be analogous in the other surveys. The removed observations will be referred to as *disputable values* in table 3.4 (page 32), table 3.5 (page 35), table 3.6 (page 39) and table 3.7 (page 41).
Furthermore, transforming capital per labour with the logarithm enhanced the relationship with labour productivity. The results are presented in figure 4.3 (page 53), figure 4.8 (page 65), figure 4.14 (page 77) and figure 4.18 (page 86). The pattern is analogous for the logarithm transformation on variable *labour*. The results are presented in the same figures as capital per employee.

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3.3 Model Selection

The goal of this study was to accumulate the expenditures on KBC investments per branch of industry in Sweden. Furthermore, an objective was to assess its contribution to the labour productivity of the economy, with the inclusion of additional independent variables, presented in Model Description (section 3.2.2 on page 25).

3.3.1 Interaction effect

Assuming that two independent variables interact in their contribution to labour productivity and that their effect is not additive, it can be intriguing to assess if there exist *interaction* effect amongst the independent variables. As previously mentioned, logically one can assume that KBC investment will be greater in size in certain branch industries depending on the characteristics of the KBC investment and the branch of industry. Interaction effect will interrogate if the interaction of a KBC investment and a particular branch of industry contributes to higher labour productivity. If the case is confirmed, it is implied that there exist interaction amongst the two independent variables. Moreover, the case will be analogous when assessing the variable *capital per labour* and *labour* with *branch of industry*; if interaction is existent.

Interaction is best detected and confirmed through conditional plots and regression models. For conditional plots, the branch of industry was chosen as the conditional variable. Thus several plots are obtained with each plot containing the labour productivity and the KBC investments, conditioned on each group of the correspondent branch of industry. Since the presented graphs did display that the relationship between the KBC investment on labour productivity was different given the branch of industry, one could thus state that interaction was indicated. Hence it was not possible to state that the relationship between labour productivity and KBC investments was independent of the categorical variable branch of industry. Next step was to include the indicated interaction term in the regression model. The following model equation is an example.

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_1 X_2 + \epsilon$$

where the last term is the interrogated interaction effect, which in this study is the product of the KBC investment, capital per employee and labour, conditioned on branch of industry; numerical variable and a categorical variable (Douglas A. Lind, 2010).

3.3.2 Coefficient of Determination

Goodness-of-fit is a model evaluation tool that analyses the performance of the estimated regression model and its fit to the observations. It describes the relations in the data and is known as the *coefficient of determination*, or R^2 and pronounced as r squared. A disadvantage with r squared is its failure to account for additional parameters that have no linearity with the dependent variable, thus the absent explanatory element. Hence it lacks the judgement to signal that an added parameter might decrease the overall fit of a model (Verbeek, 2012; Douglas A. Lind, 2010). A solution to this problem is the *adjusted* R^2 which corrects the variance estimates for the degrees of freedom

$$\bar{R}^2 = 1 - \frac{1/(N-K)\sum_{i=1}^{N} e_i^2}{1/(N-1)\sum_{i=1}^{N}(y_i - \bar{y})^2},$$

where K is the total number of explanatory variables in the model. By adding additional explanatory variables, the goodness-of-fit will add punishment to the measure which consequently might return a fit

that is worse in comparison if not adding the explanatory variable in question (Verbeek, 2012; Douglas A. Lind, 2010).

3.3.3 F-Test

The F-test can be used for model selection. It will test the null hypothesis that the estimators are equal to zero ($\beta_1 = ... = \beta_p$) against the alternative hypothesis that at least one estimator is not equal to zero ($\beta_j \neq 0$). The F-statistic is defined as

$$F_{obs} = \frac{(SS_T - RSS)/(p-1)}{RSS/(n-p)},$$

where SS_T is the total sum of squares, RSS the error sum of squares and p the total number of explanatory variables in the model. Under the null hypothesis the F-statistic will follow an F distribution with $p-1, n-p$ degrees of freedom.

Moreover, the F-test can be used for model comparison, known as *nested* model selection. Having a simple model nested within the interaction model of this study, which is the full model, it is possible to assess if the bigger model adds more descriptive information than the simple model. Hence it will test the null hypothesis that the additional terms are equal to zero

$$\beta_{p+1} = \cdots = \beta_{p+k} = 0,$$

against the alternative which states that at least one of the additional estimator is not equal to zero (Douglas A. Lind, 2010; Rice, 1995). The F-statistic is then defined as

$$F_{obs} = \frac{(RSS_{reduced} - RSS_{full})/(p-k)}{RSS_{full}/(n-p-1)} \sim F_{p-k,n-p-1},$$

where k represent the explanatory variables of the reduced model, including the intercept, and p for the explanatory variables of the full model, including the intercept.

Unfortunately concerning the F-test, according to (Mark van der Laan), large samples will enforce biased results due to obtaining statistical significant p-values, rejecting the null hypothesis. Moreover, given that the estimated model is not $\epsilon \sim$ N(0, σ^2), the F-test can be misleading.

3.3.4 Backward Elimination Method - Mallow's Cp

Backward Elimination method is an automated method to search through sub-models and their performance in order to select a final model, given a criteria. Unfortunately, it fails to examine all possible sub-models, with the full initial included parameters specified. Thus it can miss the optimal model.
The procedure of a backward elimination method starts with the full intended model, including all initial parameters (p_{full}). Sequentially it will reduce the full model by selectively eliminating one parameter at at time through tests, until there is a significant difference between excluding the parameter and including it. The comparison of the two models is assessed through the computed F test:

$$F_{obs} = \frac{RSS_{reduced} - RSS_{full}}{RSS_{full}/(n-p_{full})},$$

where $RSS_{reduced}$ is the error sum of squares from the reduced model. If $F_{obs} < F_{1,n-p_{full}}(1-\alpha)$, the reduced model where the selected parameter is excluded is not rejected. Thus the omitted parameter is per-

ceived to be zero. Sequentially the reduced model is set as the full model and the parameter of the reduced $p_{reduced}$ is set as p_{full}. The process is then iterated until the state where $F_{obs} > F_{1,n-p_{full}}(1-\alpha)$ occurs, implying that there is a difference in omitting the parameter and retaining it. Thus the null hypothesis is rejected that the parameter for the dropped variable is zero ($\beta_j = 0$), and the preferred model which includes the variable is selected. The process is then stopped.
An alternative to F-test as chosen criteria for model evaluation, when examining the exclusion of a parameter, is to use *criterion* based model evaluation, Mallow's Cp, while using backward elimination method. Criterion-based procedures, also known as information criterion, are alternative model selection methods. Basically, it investigates the estimators and the possible model according to a chosen criteria while focusing on the prediction *mean square error* (MSE). Mallow's Cp does not require normally distributed errors.

$$C_p = \frac{RSS_p}{\hat{\sigma}^2} + 2p - n$$

where $\hat{\sigma}^2$ is from the model containing all the predictors and represents the *mean square error (MSE)* of the model with all predictors. RSS_p corresponds to the residual sum of squares from a model with p explanatory variables. The criteria contains the fitted model and size penalty for the given amount of parameters. A smaller value indicates a better model. Thus by plotting C_p against p, the collected sub-models that are under consideration is presented and a chosen model can be found (Michael Kutner, 2004). It basically tries to find the optimal trade-off between the model fit and model size.

To conclude, the process swaps the F-test with Mallow's Cp, a information criterion, when analysing the potential exclusion of a parameter.

3.4 Categorical variables

As mentioned in 3.3, a goal of this study was to assess the expenditures on KBC investments per branch of industry in the Swedish economy. Moreover, once the assessment of KBC investments per branch of industry was highlighted, an attractive area was to assess the discrepancies across the branch of industries. Rationally one can assume that the branch of industries will exhibit different sizes of KBC investments, depending on the characteristics of the branch of industry, the amount of firms allocated to each branch of industry and their respective sizes. Thus it can be interesting to assess if there exist a difference between the branch industries, or which industry branches differ from the others given the KBC investments.

3.4.1 ANOVA

Analysis of variance (ANOVA) is a helpful tool used when assessing the comparison of class means for two ore more independent groups. It assumes the following:

- Observations follows the normal distribution
- Observations have equal standard deviation
- Observations are independent.

The test is used to examine if the mean KBC investments per group is equal in all groups against the alternative that at least one mean KBC investment of a group differs.

$$H_0 : \alpha_1 = \alpha_2 = \cdots = \alpha_I = 0,$$

where I equals the number of comparison groups. A *one-way layout* consists of independent measurements and a frequency of treatments, in this case, branch of industries. The statistic

$$F = \frac{SS_B/(I-1)}{SS_W/[I(J-1)]} \sim F_{I-1,I(J-1)}$$

is applied to test the null hypothesis, where **I** represents the groups (treatments) and **J** the sample size. SS_W stands for the sum of squares within the groups and SS_B for the sum of squares between the groups. Hence they represent the variation of the data within and between the treatments groups. Under the assumption of normal errors, $(I-1)$ and $I(J-1)$ represent the degrees of freedom for the F distribution (Douglas A. Lind, 2010; Rice, 1995) .

3.4.2 Bonferroni Method

ANOVA will conclude whether the sample means are different, but it will not show the paired groups that are different. The *Bonferroni* will present pairwise comparisons between the groups. The test will present groups that are significantly different from each other. Thus a more detailed comparison is obtained if the pairwise assessment is of interest. The Bonferroni method does not require any assumptions, and given this study and the structure of the surveys, the Bonferroni method was preferred over *Tukey's* method due to the requirements of equal sample size in each group for Tukey's method (Rice, 1995)

3.4.3 Kruskal-Wallis

Since ANOVA assumes normal distribution in the data, the test lacks strength when the data exhibits a heavy-tailed distribution. Furthermore the sample variance of each group exhibit big spread in their sizes. The pattern is similar for each survey. Therefore a non-parametric test, which assumes that the data does not follow any specific distribution, can be advantageous for comparison and to add power to the outcome. The Kruskal-Wallis test is a non-parametric test that pools together the observations to rank them. The following test statistic is used

$$H = \frac{12}{N(N+1)}\left(\frac{R_1^2}{n_1} + \cdots + \frac{R_k^2}{n_k}\right) - 3(N-1) \sim \chi^2_{\alpha:g-1},$$

where k is the number of groups and R_k is the sum of the ranks from group k. Under the null hypothesis, H is distributed as the chi-square with $g-1$ degrees of freedom, where g stands for the number of groups. Under the null hypothesis it tests if the mean ranks of the groups are equal, against the alternative that the groups do not have equal mean ranks (Rice, 1995; Douglas A. Lind, 2010).

H_0 : No difference in the groups
H_1 : There is a difference in the groups

3.5 ICT usage in firms 2014

The survey **ICT usage in firms** examines the information and communications technology (ICT) usage of firms in Sweden and the range of firms that have access to IT. It aims to describe the IT usage such as hardware and software, data- and telecommunication which expands into Internet/broadband and mobile. Moreover it contains information regarding the IT competence, expenditures for software- development and purchase and the usage of cloud services. The survey is implemented every year and firms that have an employee staff of 10 or more are included in the survey. Furthermore, all firms with an employee staff of 200 or more are included in the survey for an improved harmony with other surveys. The enterprises are classified into three sizes regarding their stock of employee staff:

- 10 -49
- 50 - 249
- 250

The survey is built on a mutual survey from the European Union with questions similar for all member states. Furthermore, recent ICT usage have expanded and accounts for the web presence and ordering via Internet of the firms. It also considers the IT skills of firms. In total the survey consisted of 39 questions, presented in section Survey - ICT usage in firms 2014 (A.6 on page 118) (SCB, 2015a).

The survey sample contained 4595 observations and had a total loss of observations of 16 %. Hence 3860 observations remained. Once merged with the FDB-database, 3847 observations remained. Accounting for the removed missing values and outliers in labour productivity and disputable values (3.2.2), 3720 observations remained, shown in table 3.4.

Figure 3.1 presents the distribution of firms participated in the survey, by branch of industry according to SNI Materials A.5 on page 112. Figure A.1 and A.2 on page 101 and 102 illustrate the labour productivity of firms who participated in the survey. According to the figure A.1, the known fact that the labour productivity derives from a heavy-tailed distribution was fortified. Thus since 3.2.1 computes the weight between the dependent variable and the explanatory variables, the logarithm transformation on labour productivity enhances the correlation by limiting the influences of extreme observations in the correlation between labour productivity and the explanatory variables. Transforming the labour productivity with the logarithm enhances the reflection of a normal distribution, slightly skewed.
The scatter plot A.2 (on page 102) contain a sample of 500 observations for an improved visual.

Table 3.4: Sample Size

	Size N
Sample	4595
Loss of observation (16 %)	735
FDB-database merge	13
Missing values	26
Disputable values	97
Outliers	5
Remaining total	3720

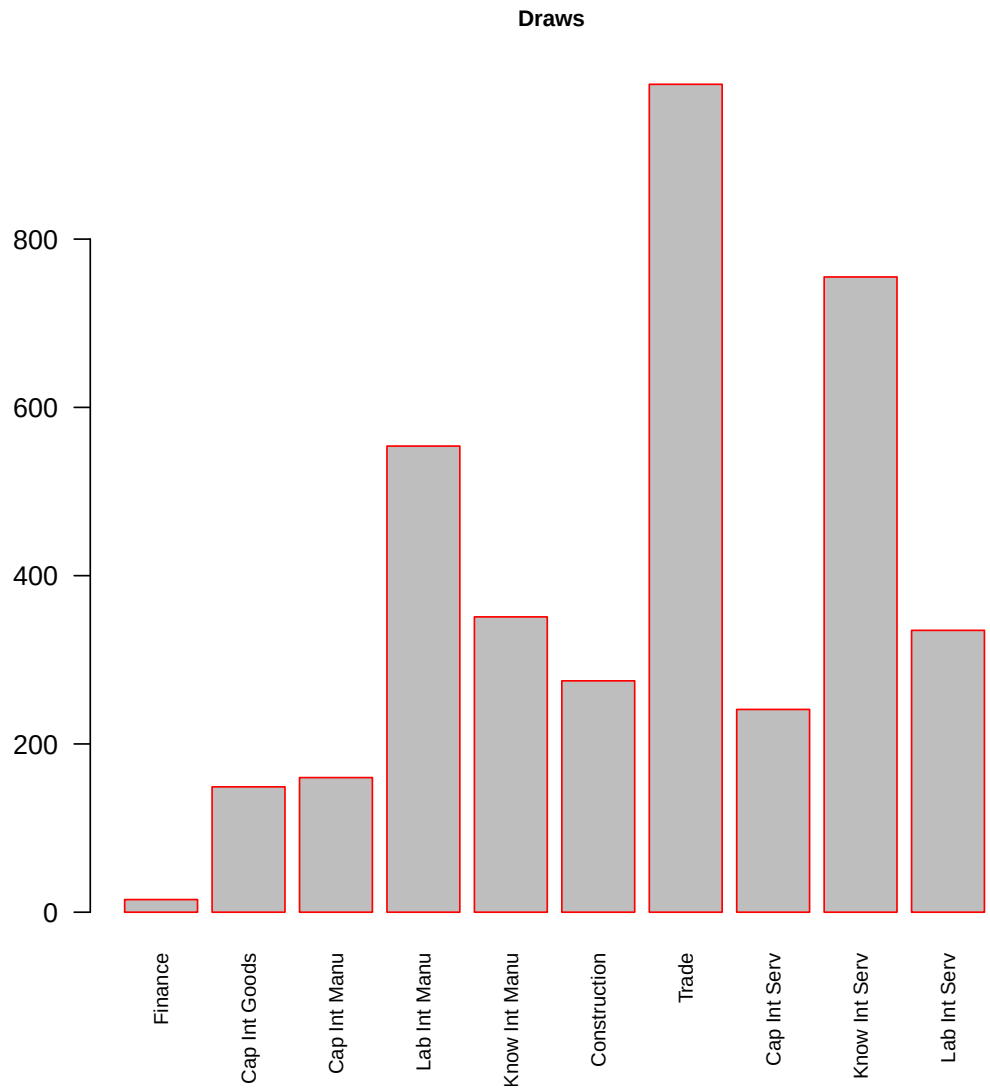


Figure 3.1: Survey participation Distribution by Branch of Industry

3.5.1 KBC Component - Total Expenditure for Software Development for Own Usage per Employee

Questions concerning *software development for own usage* was identified as a KBC component, allocated in section G in A.6 in page 118. Given that a company had employees working with *software development*, a new variable was created for their annual work units, implying that firms had own employees working with software development.

32. Did the company have own personnel working with software development, e.g. systems analysts or programmer during 2014? Exclude external consultants
    A. Yes
    B. No

33. Estimate the amount of annual work unit executed by own personnel that work with software devel-

opment during 2014?

Moreover, a variable containing the percentage distribution of annual work unit on software development that was allocated on software development for own usage in firms was extracted and transformed into units and multiplied to the variable containing the annual work units of software development, question 33. Thus obtaining the KBC component *software development for own usage*, containing the firm's annual work units allocated to the specific workload defined as the KBC component. In turn, the variable was divided by the number of employees of a firm, to obtain their *software development for own usage per employee*. To put a value on the annual work units employed for software development for own usage, the annual work units was multiplied with the average net sales per employee, corespondent to actual cost a firm had to spend (table 3.2 page 20) for each annual work unit elsewhere. The procedure returns the *total expenditure for software development for own usage per employee*.

34. Estimate the division for the annual work unit which was implemented by own personnel working with software development during 2014?
    A. Software development for the companys own purpose and usage
    B. Software development for external sales
    C. Other

3.6 Expenditures in IT and marketing in firms 2014

Survey *Expenditures in IT and marketing in firms* examines the expenses for IT and marketing for firms in the private sector. The survey is implemented every year and firms that have an employee staff of 10 or more are included in the population. Furthermore, the firms are divided into three size classes concerning their employee stock:

- 10 - 49
- 50 - 249
- 250

All firms with an employee staff of 200 or more are included in the survey for an improved harmony with other surveys. The IT expenses concern areas within technology, such as computers, telecommunication, and IT service. While marketing expenses is in the field of advertisement and marketing. Both main factors deals with the external- and internal expenses of the firms. In total the survey contained seven questions, all with sub-questions, presented in section Survey - Expenditures in IT and marketing in firms (A.7 on page 126). The survey sample contains 4414 observations, and the response rate was 83 % percent (SCB, 2015a). Hence 3664 observations remained. Aligned with the merge from the FDB-database, 3543 observations remained. Once the missing values and outliers were removed in the labour productivity, 3518 observations were remaining and with the disregard of disputable values (3.2.2), 3720 observations were disposable 3.5.

Figure 3.2 illustrates the participation of firms participated in the survey, by branch of industry according to SNI Materials (A.5 page 112).
The labour productivity of firms responded to the survey is presented in figure (A.4, 104 and A.5 on 104). The heavy-tailed distribution of labour productivity is presented and the logarithm transformation of the dependent variable. The transformation produces a log-normal labour productivity distribution, slightly skewed but when displaying a boxplot of labour productivity as a function of branch of industry, long-tailed distribution is still visible, greatly influenced by branch of industry *knowledge intensive service* and *capital intensive goods*.

3.6.1 KBC Components - Total Expenses on Software per Employee

KBC component *software expenses* was identified in section B in Survey - Expenditures in IT and marketing in firms (A.7 page 126).

Table 3.5: Sample Size

	Size N
Sample	4414
Response rate (83 %)	750
FDB-database merge	121
Missing values	22
Disputable values	97
Outliers	4
Remaining Total	3431

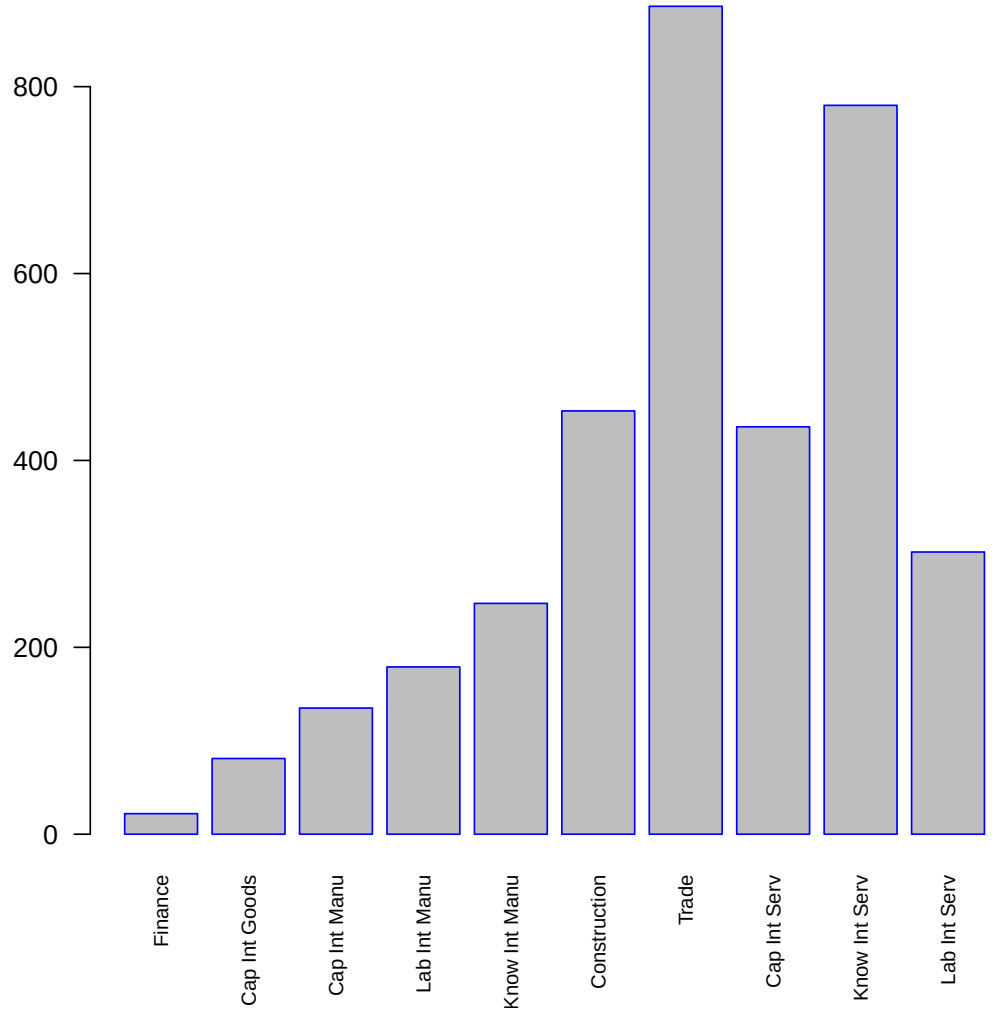


Figure 3.2: Survey participation Distribution by Branch of Industry

Due to the reason that firms today consider a portion of their software expenses as *costs* and other portion as an *investment*, both expenditures had to be identified.

4. How great were the expenses (thousands) (excl. leasing) the company had during 2014 for
   A. data equipment
   B. telecommunication system
   C. software

Therefore, given that a firm had expenditures on software or/and software investments, a new variable was created respectively containing the value of the *cost* or/and *investment* on software. The values were then combined for each firm and divided by the number of employees of a firm in order to obtain the *total expenses for software per employee*.

3.6.2 KBC Components - Total Expenses on Marketing per Employee

KBC component *commercial and marketing expenses* were allocated in section C in Survey - Expenditures in IT and marketing in firms A.7 on page 126, questions concerning commercial and marketing. The same pattern iterates itself here but with a slightly complicated touch. The expenses for commercials and marketing are shared by a portion perceived as *costs* and a portion viewed as an *investment*. The accumulation of both portions was necessary.

7a. How big were the expenses (thousands) of the company during 2014 for commercial and marketing?

Thus given that a firm had expenses in commercial and marketing, a new variable was created containing the estimated values. In turn, this variable was multiplied with a variable containing the estimated percentage share of the expenses in commercials and marketing that would generate revenues during a time span of more than a year.

7c. Approximately how big portion of year 2014 commercial and marketing going to generate?

The described steps acquire the variable *commercial and marketing expenses externally*.
Moreover, firms had to present their annual work unit for their employees working with *commercial and marketing*, to account for their internal expenses for commercials and marketing expenses.

7b. Approximately how much annual labour year for working with commercial and marketing was implemented during 2014 of own employee staff (Quantity of labour year)?

To put a value on the annual work units employed for commercial and marketing, the extracted annual work unit of a firm was multiplied with the average net sales per employee, correspondent to the actual cost a firm had to consume elsewhere for each annual work unit (3.2 page 20). The procedure returned the variable *commercial and marketing expenses internally*.

Once the procedures were implemented, the created measurements for variable *commercial and marketing expenses externally* and *commercial and marketing expenses internally* were added together for each firm and divided by the number of employees of the firm to obtain *total expenses on commercial and marketing per employee*, labelled as *total expenses for marketing per employee*.

3.7 Community Innovation Survey 2012 - 2014

The survey **Community Innovation Survey** (CIS) has its aim to describe the innovation-based activities in firms based in Sweden and the expenses of the firms for the innovation-based activities. The survey is implemented every second year and covers information concerning firms innovation-based activities in a time span of two years. The basis of the study is built on a mutual survey from the European Union where the fundamental questions are similar for all the member states of the European Union. Though for each survey round, each member state is allowed to include temporary questions according to a particular theme that is of importance during the period the survey is created.

Innovation is a reference to the various innovation-based activities the firms has developed/launched and distributed on product-, process, and organisational innovations and further innovations within marketing during a time span of three years. Concerning product innovation it represents a product/service with significantly improved components, materials or technical advances. Process innovation concerns alterations in the technique, equipment or softwares. Market innovations is a reference to the radical changes in a product design, pricing or promotion of the product and organisational innovation refers to a new organisational method that includes work organisation.

The firms must have an employee staff of 10 members or more within in specific industries in order to participate in the survey. The survey consists of two parts concerning the sampling from the population:

1. Firms defined in the following categories were all examined

- All firms with an employee staff of 200 or more
- All firms with 10 or more employees associated with industrial research institutes
- All firms with 10 or more employees included in the branch of industry of scientific R&D

2. Sampling selection of firms excluded from above

- Firms with a employee staff of 10-199 are stratified after size, branch of industry and regions in order to obtain a best possible representation

The accumulated data contained information regarding the expenses of the firms for their innovation-based activities concerning product- and process innovations. The survey included 33 questions with related sub-questions presented in section Survey - Community Innovation Survey 2012 - 2014 (A.8 page 131). The sample contained 9348 observations with a total loss of observations of 12.6 % (SCB, 2015b). Thus 8170 observations remained. Accounting for the FDB-database merge, 7780 observations remained and once the missing values and outliers were removed from labour productivity, 7724 observations were disposable, shown in table 3.6. The table accounts for the removal of disputable values 3.2.2 (page 25).

Table 3.6: Sample Size

	Size N
Sample	9348
Loss of observation (12.6 %)	1178
FDB-database merge	390
Missing Values	52
Disputable value	266
Outliers	6
Remaining total	7456

Figure 3.3 illustrates the participation of firms participated in the survey, by branch of industry according to SNI Materials (A.5 page 112).
The labour productivity of firms participated in the survey is presented in figure (A.8 (page 106) and A.9 (106). The heavy-tailed distribution of labour productivity is presented and the logarithm transformation of the dependent variable. The transformation produces a log-normal labour productivity distribution, slightly skewed but when displaying a boxplot of labour productivity as a function of branch of industry, long-tailed distribution is still visible, greatly influenced by branch of industry *knowledge intensive service* and *trade*.

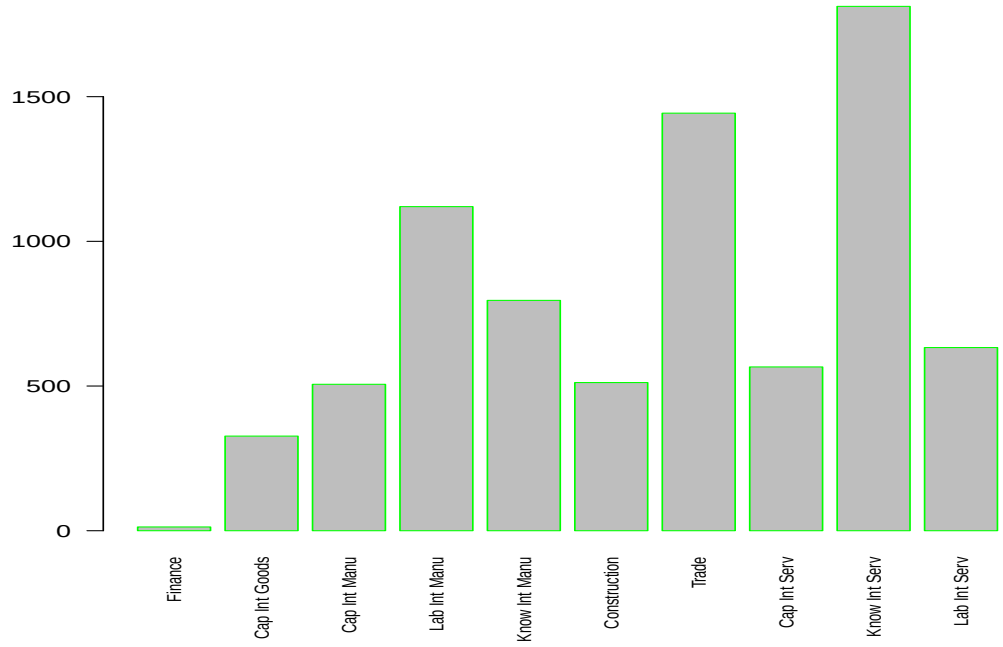


Figure 3.3: Survey participation Distribution by Branch of Industry

3.7.1 KBC Component - Total Expenses for Innovation per Employee

Questions regarding product- and/or process *innovation expenses* were the primary focus due to the definition of KBC investments. The questions were allocated in section E in Survey - Community Innovation Survey 2012 - 2014 (A.8 page 131).
The firms were asked to fill in their expenses they had for the various subgroups that go under the definition of product- and/or process innovation expenses. These subgroups represent expenses in R&D, machinery, software and knowledge to name a few.

15. How big were the expenses (thousands) during 2014 for
    A. Own R&D?
    B. Outlay on R&D?
    C. Purchase of machinery, equipment, software and real estate?
    D. Purchase of existing knowledge from other firms or organisations?
    E. All other innovation operation such as education, marketing introduction, design and other innovation activities?
    F. Sum of all innovation expenses given above

A variable represented each subgroup. The subgroups were then added together to obtain *total expenses for innovation* per firm. Subsequently, the KBC component was divided by the number of employees of a firm. Thus through the procedure, the obtained variable was *total expenses for innovation per employee*.

3.8 Current status examination of organisational work and work environment in Swedish working life (2015 by *work Environment Authority*)

The survey **Current status examination of organisational work and work environment in Swedish working life in 2015 (NU2015)** aims to describe the work environment in Swedish working life and the representation concerning the environment in organisational work. The questions are focused to apprehend a perspective into organisational work of Swedish firms by covering topics such as employee pool, employee contracts and the origination of the work employment. Moreover the flexibility of firms concerning teamwork, flexible hours and responsibilities. The education and competence of firms, cooperation with other organisations. Furthermore it covers work for environmental work of firms, its resources and goals and change management. The report for 2015 had not been published yet during the writing of this thesis (2016-05-20), therefore information regarding the survey, the sample size and the loss of observations is not included in here. The survey contained 63 questions, presented in section Survey - Current status examination of organisational work and work environment in Swedish working life in 2015 (NU2015) by *work Environment Authority* (A.9) on page 144.
The data set contained 773 observations and once merged with the FDB-database, 772 observations remained. With the missing values and outliers removed, 725 observations were disposable 3.7. Among the missing values were additionally observations with missing distributed weights. Moreover, considering the disregard of disputable values (3.2.2), 700 observations were disposable.

Figure 3.4 illustrates the participation of firms participated in the survey, by branch of industry according SNI Materials A.5 on page 112. It is important to point out that sampling frame concerning the survey derives from the sample set of *Community Innovation Survey 2012 - 2014* (3.7).
The labour productivity of firms participated in the survey is presented in figure (A.11, 108 and A.12 on 108). The heavy-tailed distribution of labour productivity is presented and the logarithm transformation of the dependent variable. The transformation produces a log-normal labour productivity distribution, slightly skewed but when displaying a boxplot of labour productivity as a function of branch of industry, long-tailed distribution is still visible, mostly influential by branch of industry *knowledge intensive service*, *capital intensive goods* and *labour intensive service*.

Table 3.7: Sample Size

	Size N
Sample	773
Response rate (- %)	-
FDB-database merge	1
Missing Values	46
Disputable values	16
Outliers	2
Remaining Total	709

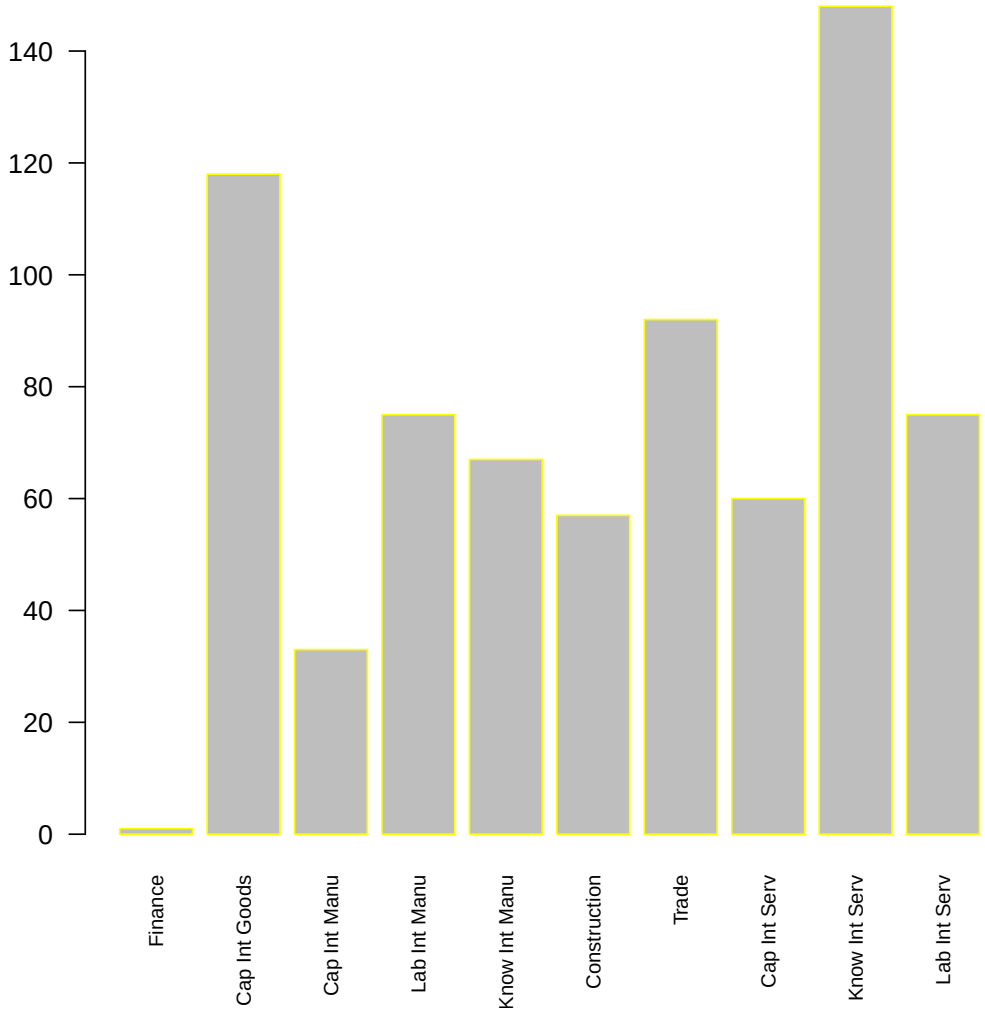


Figure 3.4: Survey participation Distribution by Branch of Industry

3.8.1 KBC Component - Total Expenses on Education and Competence per Employee

The steps to identify and extract the KBC components from this survey was more complicated compared to the other surveys. The section and questions associated with the KBC components shaped a data set with indicator variables due to the structure of the survey, with multiple choices presented in the selection. With the indicator variables, given the reported responses the firms gave, new variables had to be created, containing numerical measurements. Thus, given that a firm selected one of the options, an indicator variable was created and then transformed to a numerical value depending on the underlying question and what was perceived as reasonable.

KBC component *education and competence development* was allocated in section D in A.9 on page 144, with three questions concerning education and a three questions concerning competence development. The aim was to allocate the amount of resources firms placed on education and competence that should be per-

ceived as education investment. This is divided by internal investment, labelled as *internal education and competence investment as a percent of labour cost* and external investment, labelled as *external education and competence costs as a percentage of turnover*. Four questions were associated with internal investment and two questions were associated with external investment.

Internal education and competence investment as a percent of labour cost

Firms were asked to report the percentage share of the employee staff that had participated in education during paid working hours.

14. What percentage share of your co-workers did participate in education during paid working hours in 2015 ?
    A. 0 percent
    B. 1 - 24 percent
    C. 25 - 49 percent
    D. 50 - 74 percent
    E. 75 percent or more
    F. unknown

With the reported answers, an indicator variables was generated and given the indicator, a new variable was created containing the median value of each reported interval in decimal form. For ”unknown” the value became 0, thus obtaining the share of employees given paid hours for education and therefore absent from duties with pay to attend education.

Given that a portion of the employee staff had participated in education, the average days they had dedicated to this was reported.

15. Of those who participated in education, how many days on average did they dedicate ?
    A. less than a day
    B. 1 - 3 days
    C. 4 - 5 days
    D. 6 - 10 days
    E. More than 10 days
    F. unknown

With the indicator variable generated from the observation responses, a variable was created with the obtained values containing the median of the intervals. For the option ”*less than a day*”, the assumption was that a full time employee does not work half a day, therefore a decimal value of 0.3 felt more appropriate. Regarding the option ”*more than 10 days*”, numerical value of 15 was perceived as a reasonable length from the interval alternatives. Moreover, the values created for the average participation of education was then divided by the work days of a full time employee for a whole year, accounting for the weekends and holidays; returning the variable *education days* of employees.

The two variables created from question 14 and 15, share of employees that has been given paid time-of from their work for education and number of education days, were then multiplied to obtain variable *internal education investment as a percent of labour cost*.

Moreover, firms were asked the share of working hours during the year that was spent on organised competence development. Organised competence development is referred to work where the co-worker develops its competence during a sub operations.

19. What percentage share of working hours during the year contained organised competence development?
    A. up to 1 percent
    B. 1 - 3 percent
    C. 4 - 5 percent
    D. 6 - 10 percent
    E. if more than 10 percent, report the percentage during a year?
    F. unknown

From the generated indicator variables new variables were created containing the median value for the intervals, labelled *share daily learning*. For the alternative "if more than 10 percent report the percentage during a year", the range of reported values were great, therefore given that a firm reported a value between $[0\%, 15\%]$, the variable contained their true reported value which in turn was multiplied to the percentage to 0.01 in order to obtain the the numeric value. For firms with a reported value of $> 15\%$, a decimal value of 0.20 was set in order to remain within a proportional range.

Furthermore firms were asked to report the *share of the work force that had received on-the-job-training in order to improve their skills*. On-the-job-training is referred to as practice or education.

20. What percentage share of your co-workers received on-the-job-training in order to improved their skills?
    A. 0 percent
    B. 1 - 24 percent
    C. 25 - 49 percent
    D. 50 - 75 percent
    E. 75 percent or more
    F. unknown

From the generated indicator variables new variables were created with percentages where the values were converted to numerical values. The chosen values for the intervals were the median for each interval. The created variable was labelled as *share feedback*. Given that firms reported in question 20, they were asked to report *the percentage share of the working hours that had been on-the-job-training* during the year, labelled as *share on the job training*.

21. What percentage share of the working hours during the year consisted of on-the-job.training?
    A. up to 1 percent
    B. 1 - 3 percent
    C. 4 - 5 percent
    D. 6 - 10 percent
    E. if more than 10 percent, report the percentage during the year
    F. unknown

The interval options were converted to the median value except for the option "if more than 10 percent then report the percentage during a year". Firms who reported a percentage between the interval of $[0\%, 15\%]$ maintained their reported value while firms who reported a value $> 15\%$ obtained a value of 0.20 in order to remain within a proportional range. The created variables from question 20 and 21 are then multiplied together, percentage of co-worker who got education on the job multiplied with percentage of

work time they obtained the education on the job. Thus obtaining variable *internal competence development investment as a percent of labour cost*.

In order to obtain *total internal education and competence development investment as a part of labour cost*, the obtained variable *internal education investment as a percent of labour cost* (question 14 and 15), the obtained variable *internal competence development investment as a percent of labour cost* (question 20 and 21) and *share daily learning* (question 19) were added together. In turn the obtained sum was multiplied to wage costs of firms given from the FDB-database in order to acquire the percent of labour cost allocated for the investment. Thus the *total internal education and competence development investment as a part of labour cost* was acquired.

External education and competence development costs as a percentage of turnover

External education costs was also of interest, thus firms were asked to report the percentage share of their turnover that was represented by external education and competence development costs.

16. What percentage of your turnover were external educations costs ?
    A. no education costs
    B. up to 1 percent
    C. 1 - 2 percent
    D. 3 - 5 percent
    E. if more than 5 percent, report the proportion share in percent
    F. open amount, education costs in SEK
    G. unknown

From the created indicator variable with the recorded responses, a variable was generated containing the median value correspondent to the percentages in the question for the intervals. For the alternative mentioned ”if more than 5 percent report the proportion share”, the reported percentage was multiplied to 0.01 in order to obtain the numerical value in decimal form. For the alternative ”open amount in education costs in SEK”, things were a tad more complicated. The question sought to extract the percentage share of the turnover that was represented by external education costs and the reported figure only represented education costs in SEK. Therefore firms who reported with this alternative got their given value divided by the net sales (turnover) obtained from the FDB-database and the fraction of a thousandth in order to obtain the percentage share of their turnover that was represented by external education costs. Because observations had reported very large sums, the fraction was thousandth and not hundred in order to obtain more standardised measure in comparison to other alternatives. ”Unknown” was set to zero. Thus the percentage of *external education and competence development costs as a part of turnover* variable was obtained. To obtain the *external education and competence development costs as a part of turnover* in numerical values the variable was multiplied to firms *turnover* received from the FDB-database to acquire the external investment.

To obtain *total expenses on education and competence development* variable *external education and competence development costs as a part of turnover* and *internal education and competence investment as a percent of labour cost* were added together. Because the investment per employee is of interest, the quest was to divide the obtained value by the number of employee which should return *total expenses on education and competence development per employee* but the data set exhibited case problems with the number of employees assigned to firms. Thus for each observation where the divisor with the number of employees did not exist, the observations wage costs and net sales were removed and instead multiplied to average wage cost and average turnover obtained from the FDB-database. Hence the KBC component *total expenses on education and competence development per employee* was acquired.

3.8.2 KBC Component - Total Expenses on Re-Organisation per Employee

KBC component *re-organisation* was found in section K in A.9 on page 144, containing five questions; four questions concerning the *internal investment on re-organisation as a percent of labour cost* and one question concerning the *external investment on re-organisation as a percentage of turnover*.

Internal investment on re-organisation as a percent of labour cost

Given that firms had experienced considerable re-organisation (question 55), they were asked to report the number of employees responsible for re-organisation within the firm during 2015.

56. Approximately what size of co-worker are responsible for re-organisation during 2015 ?
    A. aggregated number
    B. unknown

Unlike the previous questions with generated indicator variables,a variable was created that recorded the actual number of employees that dedicated to re-organisation. From this a new variable was created with the same numerical value which the firms reported and the alternative ”unknown” was set to zero. The variable was labelled as *re-organiser*.

Moreover the firms were asked to report the number of work days on average that their co-workers had dedicated to re-organisation.

57. Approximately how many work days were dedicated to re-organisation ?
    A. aggregated days
    B. unknown

The treatment process was analogous to the previous question (56) and it obtained a variable labelled as *re-organisation days* containing the number of days on average. The variables obtained from question 56 and 57 were then combined in order to acquire the number of days on average the total number of employees dedicated to re-organisation. In turn this was divided by the number of employees each firm had obtained from the FDB-database and the estimated number of days a full time employee works during a year. Thus a variable is obtained that contain a standardised measure for total number of employees with the average amount of days during a full year dedicated to re-organisation per employee.

A possible consequence of re-organisation is that the employee staff of firms not fully dedicated to the re-organisation become affected due to education, participation of meetings or alternative work methods. These are perceived as time consuming and forces the employee to be absent while attending the mentioned scenarios, hence cost consuming for firms and subsequently of interest for this research due to being defined as knowledge transferable.

58. What percentage share of your co-workers have been affected by the re-organisation ? Include scenarios such as education, participation of meetings or alternative work methods.
    A. 0 percent
    B. 1 - 24 percent
    C. 25 - 49 percent
    D. 50 - 74 percent
    E. 75 percent or more
    F. not relevant
    G. unknown

The reported answers were recorded into indicator variables. The new variable created from the indicator variable contained the decimal median value of each interval while for the alternative *75 percent or more* a numerical value of 0.86 was perceived as a natural distance from the rest with respect to the given responses of that alternative. The other alternative not containing percentages was interpreted as 0. The variable was labelled as *re-organisation affected*.

Furthermore their average work days spent on re-organisation was requested, meaning that the employee had to be absent from its initial work assignments.

59. Approximately how many work days on average were dedicated to re-organisation for the other co-workers, thus being absent from their initial work assignment ?
    A. aggregated days
    B. unknown

The recorded responses of the aggregated days in the generated variable were then saved into a new variable, containing the additional indicator variable unknown, coded as 0; labelled as *re-organised affected days*. The variables obtained from question 58 and 59 were just as the previous two variables combined in order to acquire the number of days on average the reported percentage share of other co-workers dedicated to re-organisation. In turn this was divided by the estimated number of days a full time employee works during a year. In order to obtain *internal investment on re-organisation as a percent of labour cost*, the two combined variables obtain from the previous question were then multiplied to the wage costs of firms given from the FDB-database.

External re-organisation costs as a percentage of turnover

To acquire the external re-organistion costs, the firms were asked to report the percentage in their turnover represented by external costs for re-organisation.

60. Approximately what percentage of the firms turnover was represented by external costs for re-organisation during 2015?
    A. no external costs
    B. up to 1 percent
    C. 1 - 2 percent
    D. 3 - 5 percent
    E. if more than 5 percent, how great was the percentage
    F. unknown

From the recorded indicator variable, a new variable labelled as *share external costs for re-organisation* was created, containing the median value in numerical form. In turn this variable was multiplied to the net sales of firms received from the FDB-database in order to acquire *external re-organisation costs as a percentage of turnover*.

The *external re-organisation costs as a percentage of turnover* and *internal investment on re-organisation as a percent of labour cost* were then added together and divided by the number of employees of each firm in order to acquire the KBC component *total expenses on re-organisation per employee*.

Chapter 4

Results

4.1 Labour Productivity and KBC Investments

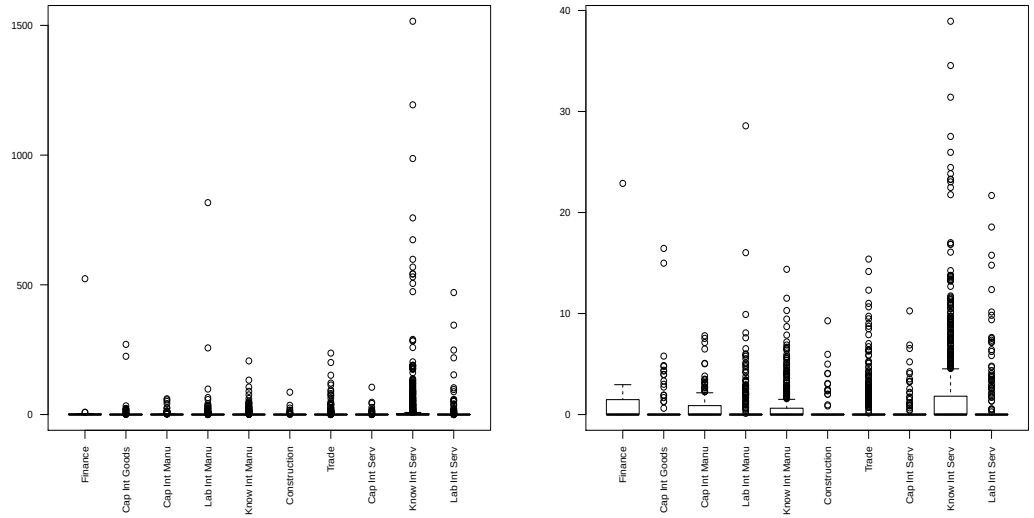
The thesis objective was to examine the association between labour productivity and KBC investments, whether KBC investments influence the labour productivity of firms. Is it possible state that there exist a significant relationship between KBC investments and labour productivity of firms?
Moreover, it was imperative to present the expenditures on KBC investments per branch of industry described in section SNI keys (3.1.2 page 19).

4.2 ICT usage in firms 2014

Figure A.3 on page 102 presents three plots; the total expenditure for software development for own usage per employee, the square root of the total expenditure for software development for own usage per employee and the distribution of the KBC component from the survey. According to the figure it is visible that the distribution of the KBC investment is heavy-tailed and since logarithm transformation is not possible due to the structure of the KBC investments mentioned in 3.1.6, section Outliers on page 22 and 3.2.2, section Model Description on page 25, the square root transformation is implemented in an attempt to suppress the heavy-tailed distribution.
The figures A.3 contain a sample of 500 observations from the survey for an improved plot, while for the presented histogram, the full data set is presented. According to the histogram, the KBC investment still takes the form of a reduced but not completely removed heavy-tailed distribution after the transformation.

4.2.1 Branch of industry assessment

Figure 4.1 present a boxplot of total expenditure for software development for own usage per employee as a function of branch of industries. Due to its heavy-tailed distribution, an additional boxplot is presented where the square root transformation is applied to the KBC component.
According to the plot, the KBC investment still takes the form of a heavy-tailed distribution, although reduced, with values perceived as extreme to represent firms who actually invested in the KBC asset; for all the industry branches. Most notably, the observations perceived as extreme derive from branch of industry *knowledge intensive service*. Moreover, there are indications of positive skewness in the data, towards high values.
Assessing the branch of industry comparisons, there seem to exist an indication of discrepancy in the KBC investment between the groups. Hence the indication that the industry branches differ in their KBC



(a) (b)

Figure 4.1: Left: Boxplot of Total Expenditure for Software Development for Own Usage per Employee | Branch of Industry. Right: Boxplot of the Square Root of Total Expenditure for Software Development for Own Usage per Employee | Branch of Industry.

investment. It appears that some groups exhibit higher variability than other groups.

Table 4.1 presents the analysis of variance (ANOVA) test. It compares the mean of the KBC investment per employee between the groups. The test rejects the hypothesis that the mean KBC investment per employee is equal in all industry branches. Moreover since the KBC investment sample follows a heavy-tailed distribution and contain unequal group variances, the table additionally presents a non-parametric Kruskal-Wallis test, which concludes the same as the ANOVA test.
Table 4.2 presents the Bonferroni post-hoc pairwise comparisons between the mean value of the groups. According to the table, the KBC investment in group *knowledge intensive service* is significantly different from all other groups except for *finance*. Based on the characterisation of the branch industry presented in 3.1 (page 19), the pattern can be perceived as valid. Moreover, KBC investments in *Construction* and *trade* are different from *knowledge intensive manufacturing*.

Table 4.1: Top: Anova summary. Bottom: Kruskal-Wallis

ANOVA Summary					
	Df	Sum Sq	Mean Sq	F value	Pr(>F)
as.factor(Bransch07_Crude)	9	1625.47	180.61	27.17	0.0000
Residuals	3809	25323.23	6.65		
Kruskal-Wallis Rank Sum Test					
	Chi-Squared	Df	P-value		
Kruskal-Wallis	211.8708	9	0.0000		

Table 4.2: Bonferroni method (post-hoc)

Branch of Industry		Branch of Industry		Branch of Industry	
1 - 0	0.910	8 - 1	0.000	5 - 4	0.029
2 - 0	1.000	10 - 1	1.000	6 - 4	0.049
3 - 0	0.405	3 - 2	1.000	7 - 4	0.260
4 - 0	1.000	4 - 2	1.000	8 - 4	0.000
5 - 0	0.159	5 - 2	1.000	10 - 4	1.000
6 - 0	0.315	6 - 2	1.000	6 - 5	1.000
7 - 0	0.275	7 - 2	1.000	7 - 5	1.000
8 - 0	1.000	8 - 2	0.000	8 - 5	0.000
10 - 0	1.000	10 - 2	1.000	10 - 5	0.481
2 - 1	1.000	4 -3	0.303	7 - 6	1.000
3 - 1	1.000	5 - 3	1.000	8 - 6	0.000
4 - 1	1.000	6 - 3	1.000	10 - 6	1.000
5 - 1	1.000	7 - 3	1.000	8 - 7	0.000
6 - 1	1.000	8 - 3	0.000	10 - 7	1.000
7 - 1	1.000	10 - 3	1.000	10 - 8	0.000

4.2.2 Interaction assessment

Figure 4.2 depicts a plot of the labour productivity against KBC investment, conditioned on branch of industry. Due to the information described in 3.1.6, section Outliers on page 22 and 3.2, section Econometric method on page 24, the transformations of the KBC investment and labour productivity are seen in the right plot. The conditional variable illustrates the discrepancies amongst the branch industries. Focusing on the right plot, where the transformations have made the detection of linear dependencies clearer, there exist a weak indication of linearity in several industry branches. *Knowledge intensive manufacturing* (4), *trade* (6), *capital intensive service* (7), *knowledge intensive service* (8) and *labour intensive service* (10) all exhibit a slight indication of association, while industry branches associated with manufacturing and construction who are more dependent on machinery do not display linearity. Hence one cannot state that there exist a clear relationship of increased labour productivity due to KBC investment in the groups, except for a weak indication. This should give rise to a debate whether accumulated data at future time points would present improvements in the relationship since investments will present themselves positive to the outcome first after a few years.
Moreover examining the differences between the groups, it is suggested that *interaction* between the factors exist since the impact on labour productivity due to the contribution of KBC investment varies depending on the branch of industry. Thus the combination of KBC investment and particular branch of industry contributes differently to labour productivity.
Additional to the scatterplots, figure 4.2 presents the computed mean for KBC investment per employee per branch of industry. *Finance* display the highest value followed by *knowledge intensive service*. One must take into account that the observation size of each group can exhibit great differences due to the sample selection and SNI categorisation. *Construction* is not coined with high levels of KBC investment, which can be understandable due to the characteristics of its branch. The chart pie which is to be read clockwise, display that the branch industry *finance* exhibits greater KBC investment in total value. Note that the numbers presented are in thousands.

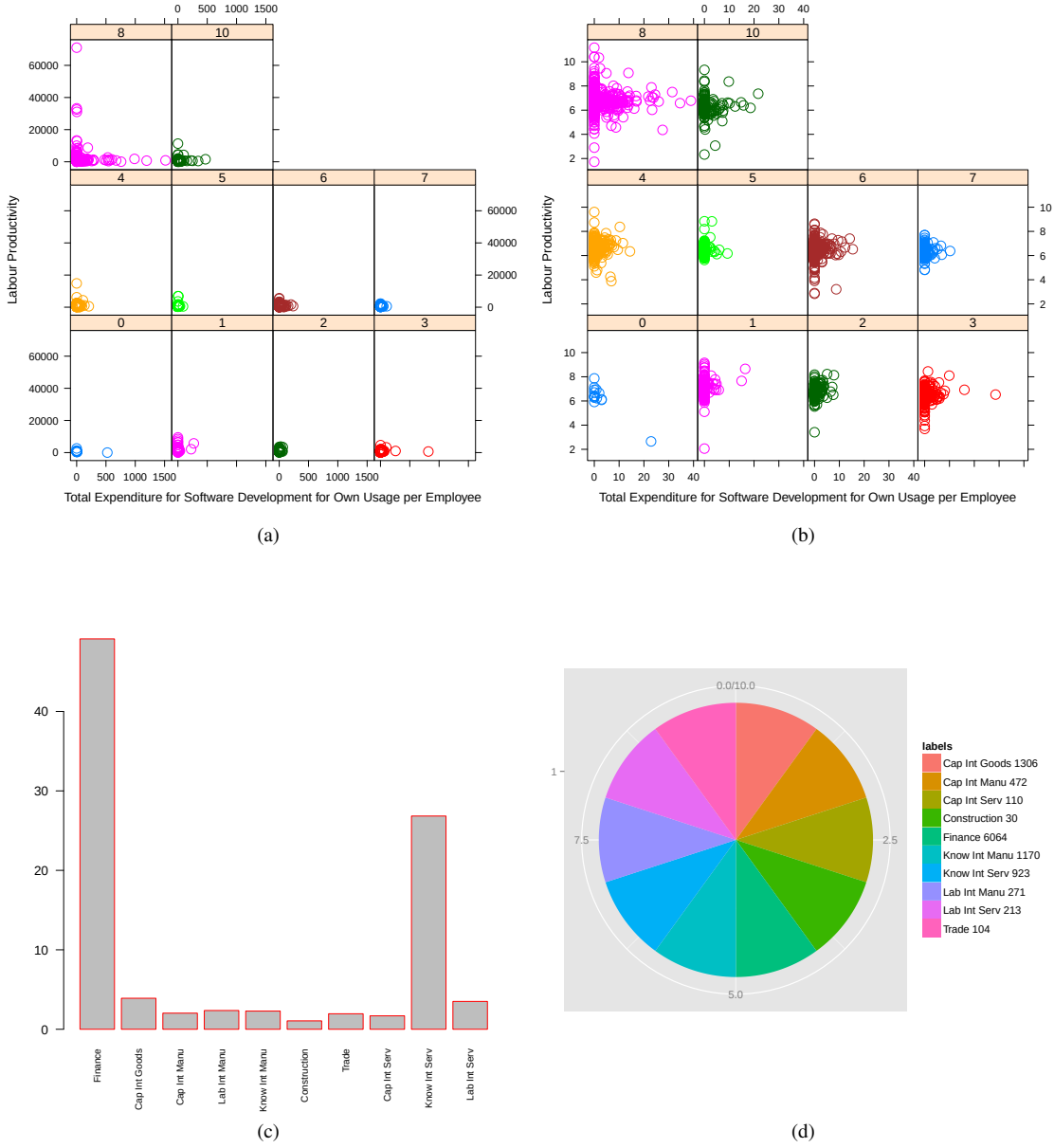
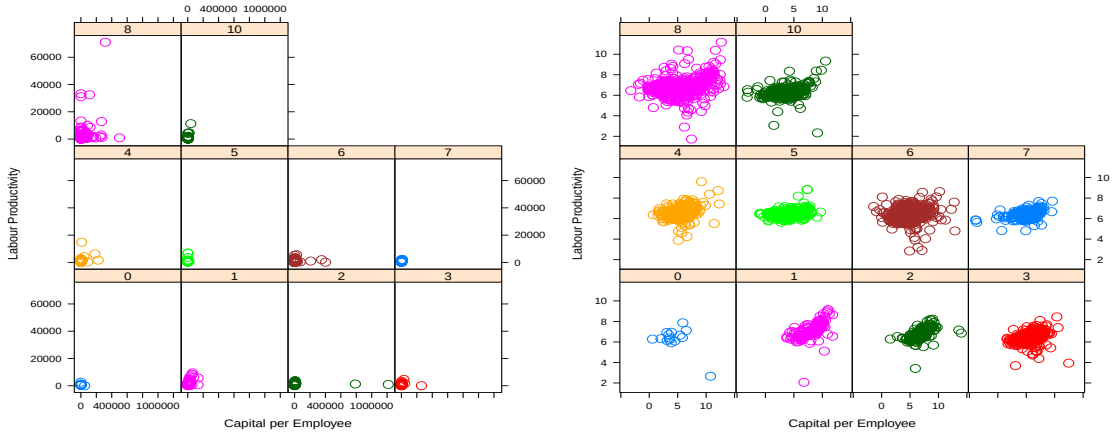
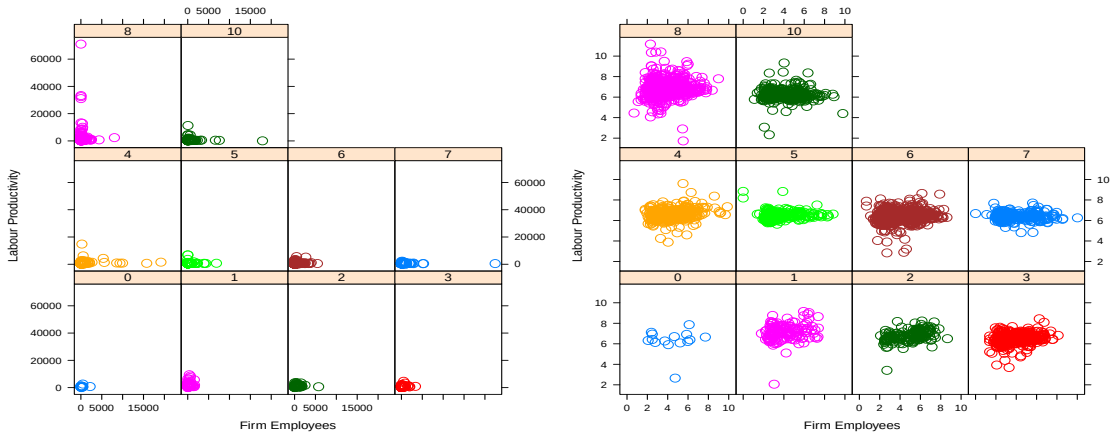


Figure 4.2: Top left: KBC investment per Employee VS Labour Productivity | Branch of Industry.
Top right: Square root of KBC investment per Employee VS Log Labour Productivity | Branch of Industry.
Bottom left: Distribution of the mean for Total Expenditure for Software Development for Own usage per Employee | Branch of Industry.
Bottom right: Distribution of the mean for Total Expenditure for Software Development for Own usage | Branch of Industry.

Figure 4.3 presents labour productivity against *capital per employee*, conditioned on branch of industry and labour productivity against *labour*, conditioned on branch of industry. As previously implemented for the KBC investment and labour productivity, analogous transformation for the explanatory variables *capital per employee* and *labour* are applied in order to make the detection of linear dependencies easier, shown in the plots.
According to the plots, association is existent in all groups, indicating a relationship between the explanatory variables and labour productivity. Logically capital per employee and labour should influence the labour productivity of firms.
In similar case of KBC investment, according to the plots there is a weak suggestion of *interaction* between the factor of *capital per employee* on the dependent variable, while for the factor of *labour*, the interaction effect is more blurry to not existent. Thus the impact on labour productivity due to the contribution of *capital per employee* varies, depending on the branch of industry, while for *labour* the contribution is constant across the branch industries.



(a) (b)



(c) (d)

Figure 4.3: Top left: Capital per Employee VS Labour Productivity | Branch of Industry.
Top right: Log of Capital per Employee VS Log Labour Productivity | Branch of Industry.
Bottom left: Labour VS Labour Productivity | Branch of Industry.
Bottom right: Log of Labour VS Log Labour Productivity | Branch of Industry.

4.2.3 Regression results

Table 4.3 presents the results from the estimated models. The estimated models consists of a interaction model and one without the interrogated interaction. According to the table the suggestions of interaction are further strengthened for factors *KBC investment* and *branch of industry*. The slope parameter is only not significant for branch of industry group *construction* (5). The intercept acts as the baseline of group *finance* (0). Moreover, the interaction effect for the remaining explanatory factors with the branch of industry are not significant. Thus according to the model, only the simultaneous influence of KBC investment and branch of industry contain interaction.
Slope parameter *KBC investments* has significant negative impact on labour productivity for both models, most likely to the underlying reason that investments will first have a positive impact after a few years.
Peculiarly *labour* and *capital per employee* is only significant for the model that excludes the interaction. This is interesting since the plots presented a linear relationship between the explanatory variables *capital per employee* and *labour* with labour productivity. Since the interactions appear to be weak, the inclusion of the interaction term can subsequently lead to a reduced significance for the main effects. However, while traditionally, it is preferable to include the main effects together with interactions, the interaction terms in this study have a meaning on their own. Thus it is considered to use them without the main effects.
The model that excludes the interaction finds that branch of industry *capital intensive goods* (1) is significant. Moreover according to the table, although very low, the adjusted R^2 value of the interaction model indicates a slightly better prediction of new observations.
Table 4.4 presents the model comparison of the interaction model and the simple model through a ANOVA test. Hence the simple model is *nested* within the interaction model (full model). The test examines if the bigger model adds more descriptive information than the simple model. Thus the null hypothesis tests if the additional coefficients are equal to zero, while the alternative hypothesis states that at least one of the additional terms is not equal to zero. The test rejects the hypothesis that the additional terms are equal to zero, stating that the interaction model fits better than the simple model, thus preferred since the interaction helps the model.
A concern with the results are related to the residuals departing from the normality assumptions. Thus the f-test and the t-test become uncertain. Moreover, large samples often will enforce biased results, rejecting the null hypothesis, which consequently implies that the measurements are uncertain 3.3.3 (page 28).

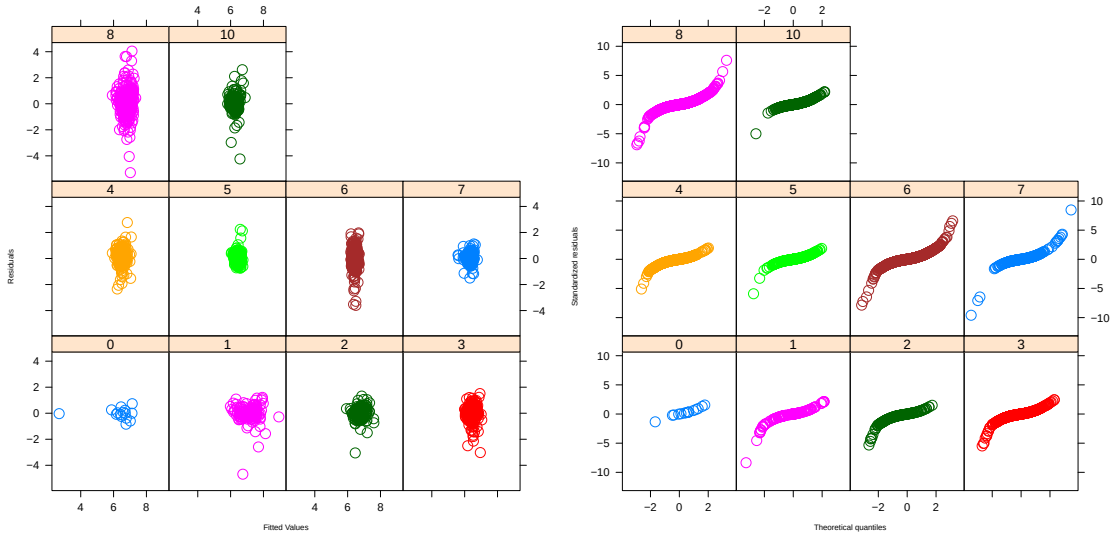
Figures 4.4 presents the diagnostics of the *interaction* model. According to figure (a), the residuals cluster towards the centre of the plot. They have a similar symmetry around the horizontal line with both positive and negative residuals. Hence there is no curvature in the residuals.
It is hard to conclude if the residuals have equal variance, as the fitted values increase they are clustered around centre with a wide spectrum of values for equal fitted values. According to the plot, constant variance is not strongly disproved.
Unfortunatly the residuals are not normally distributed which is mostly related to the heavy-tailed distribution of labour productivity. The values are associated with the presence of large residuals from branch of industry groups containing greater labour productivity. Consequently the departure from the normality assumptions causes uncertainties concerning the p-values for the individual coefficient estimates, since they can be incorrect due to the heavy-tailed error distribution.
A few outliers are visible according to the plot, most notable in group *finance* (0).

Table 4.3: Regression results between interaction and no interaction models

	Dependent variable:	
	Labour Productivity	
	(Inclusion of Interaction)	(Exclusion of Interaction)
KBC Investment	−0.220***	0.001
	(0.037)	(0.005)
Labour	0.051	0.030***
	(0.082)	(0.006)
Capital per Employee	0.152*	0.089***
	(0.092)	(0.004)
Indicator for KBC investment	−1.000*	0.507***
	(0.538)	(0.147)
Branch 1	−0.564	0.239
	(0.532)	(0.146)
Branch 2	−0.240	0.032
	(0.502)	(0.142)
Branch 3	−0.088	0.167
	(0.504)	(0.143)
Branch 4	0.219	0.188
	(0.502)	(0.144)
Branch 5	0.105	0.033
	(0.495)	(0.141)
Branch 6	−0.013	0.015
	(0.511)	(0.144)
Branch 7	0.290	0.417***
	(0.496)	(0.141)
Branch 8	0.082	0.037
	(0.502)	(0.143)
Branch 10	−0.069*	−0.008
	(0.037)	(0.035)
KBC Investment:Branch 1	0.265***	
	(0.042)	
KBC Investment:Branch 2	0.260***	
	(0.047)	
KBC Investment:Branch 3	0.243***	
	(0.039)	
KBC Investment:Branch 4	0.229***	
	(0.040)	
KBC Investment:Branch 5	0.262***	
	(0.052)	
KBC Investment:Branch 6	0.251***	
	(0.039)	
KBC Investment:Branch 7	0.243***	
	(0.048)	
KBC Investment:Branch 8	0.222***	
	(0.037)	
KBC Investment:Branch 10	0.230***	
	(0.038)	
Labour:Branch 1	−0.024	
	(0.088)	
Labour:Branch 2	0.041	
	(0.088)	
Labour:Branch 3	0.008	
	(0.084)	
Labour:Branch 4	−0.011	
	(0.084)	
Labour:Branch 5	−0.035	
	(0.085)	
Labour:Branch 6	−0.014	
	(0.083)	
Labour:Branch 7	−0.043	
	(0.084)	
Labour:Branch 8	−0.029	
	(0.083)	
Labour:Branch 10	−0.059	
	(0.084)	
Capital per Empl:Branch 1	0.106	
	(0.095)	
Capital per Empl:Branch 2	−0.011	
	(0.097)	
Capital per Empl:Branch 3	−0.058	
	(0.093)	
Capital per Empl:Branch 4	−0.048	
	(0.094)	
Capital per Empl:Branch 5	−0.091	
	(0.093)	
Capital per Empl:Branch 6	−0.109	
	(0.092)	
Capital per Empl:Branch 7	−0.065	
	(0.093)	
Capital per Empl:Branch 8	−0.056	
	(0.092)	
Capital per Empl:Branch 10	−0.069	
	(0.093)	
Constant	5.919***	5.784***
	(0.491)	(0.143)
Observations	3,722	3,722
R^2	0.257	0.220
Adjusted R^2	0.249	0.217
F Statistic	31.804*** (df = 40; 3681)	80.397*** (df = 13; 3708)
Note:		*p<0.1; **p<0.05; ***p<0.01

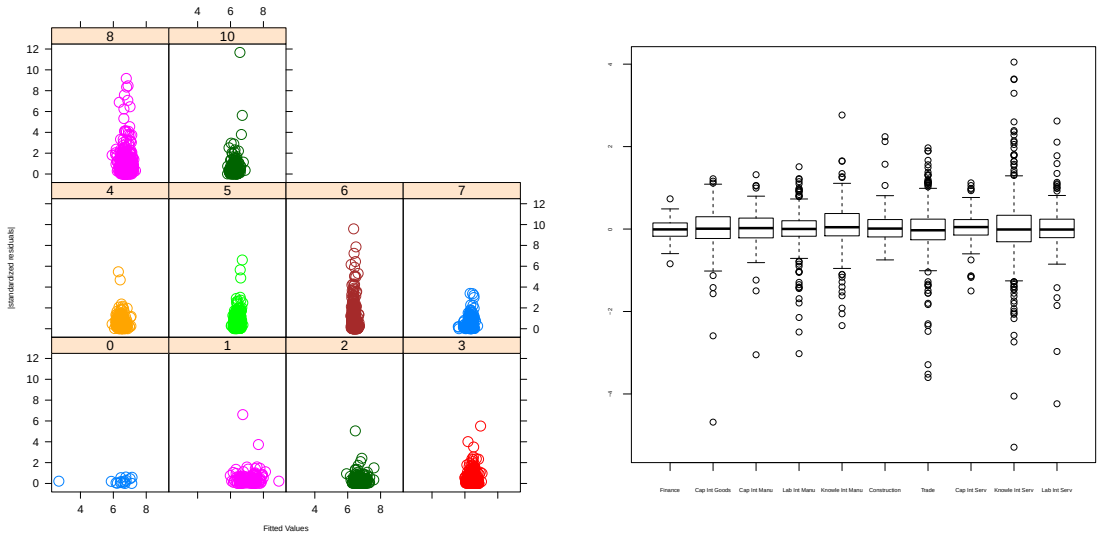
Table 4.4: Model Comparison

	Res.Df	RSS	Df	Sum of Sq	F	Pr(>F)
1	3681	1031.02				
2	3708	1082.28	-27	-51.26	6.78	0.0000



(a) Residuals vs Fitted

(b) Normal Q-Q



(c) Scale-Location

(d) Residual Boxplot

Figure 4.4: Diagnostic Plots of the Interaction Model

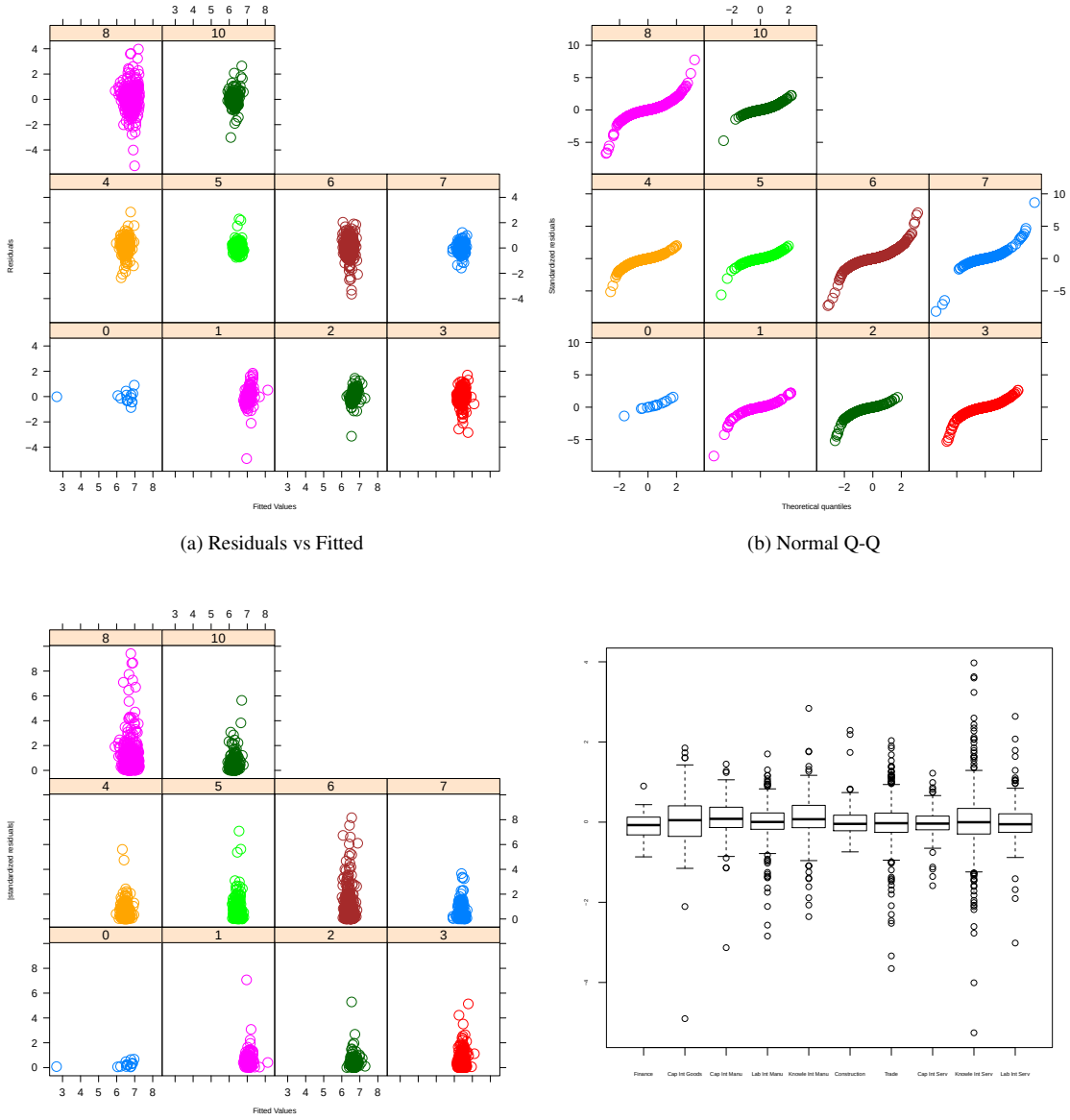
Table 4.5 presents the updated estimated model, which includes the interaction between the KBC investment and the branch of industry; where the interaction were proven to be significant in the previous model. Furthermore, it omits the interactions which were not significant. Excluding outliers barely impacted the model improvements; related to the large sample size, where the elimination of a few observation barely could influence the results.
Compared to the previous interaction model 4.3, variables *capital per employee* and *labour* are now significant and have a positive impact on the labour productivity, which is aligned with the scatterplots of the explanatory variables and the labour productivity. Moreover, the majority of *branch industries* are now considered to be significant.
According to the table, although still low, the adjusted R^2 value of the new model indicates a weak prediction of new observations.
Table 4.6 presents the model comparisons of the previous interaction model with the new updated interaction model. The updated model is *nested* within the full model. The test rejects the hypothesis that the additional terms are equal to zero, stating that the full interaction model fits better than the updated interaction model. As mentioned previously, large samples will often enforce biased results, rejecting the null hypothesis, implying that the measurements are uncertain 3.3.3 (page 28). Table 4.5 presents the diagnostic plot of the new model, with negligible improvements and analogous pattern.
The weak model improvements and results are associated to the lack of data points collected over a longer time span, where the actual contribution of investment is visible, since investments first influence the production output after a few years.

Table 4.5: Regression results for the updated model of interaction

	Dependent variable:		*Dependent variable:*
	Labour Productivity		Labour Productivity
KBC Investment	-0.201^{***}	Capital per Employee	0.091^{***}
	(0.025)		(0.004)
Branch 1	0.017	Indicator for KBC investment	-0.073^{*}
	(0.156)		(0.037)
Branch 2	-0.262^{*}	KBC Investment:Branch 1	0.258^{***}
	(0.156)		(0.032)
Branch 3	-0.435^{***}	KBC Investment:Branch 2	0.272^{***}
	(0.150)		(0.038)
Branch 4	-0.292^{*}	KBC Investment:Branch 3	0.229^{***}
	(0.152)		(0.028)
Branch 5	-0.279^{*}	KBC Investment:Branch 4	0.214^{***}
	(0.152)		(0.029)
Branch 6	-0.436^{***}	KBC Investment:Branch 5	0.245^{***}
	(0.149)		(0.044)
Branch 7	-0.448^{***}	KBC Investment:Branch 6	0.234^{***}
	(0.153)		(0.028)
Branch 8	-0.031	KBC Investment:Branch 7	0.220^{***}
	(0.150)		(0.039)
Branch 10	-0.423^{***}	KBC Investment:Branch 8	0.203^{***}
	(0.152)		(0.025)
Labour	0.031^{***}	KBC Investment:Branch 10	0.211^{***}
	(0.006)		(0.027)
		Constant	6.238^{***}
			(0.151)
		Observations	3,722
		R^2	0.238
		Adjusted R^2	0.234
		F Statistic	52.611^{***} (df = 22; 3699)
		Note:	*p<0.1; **p<0.05; ***p<0.01

Table 4.6: Model Comparison

	Res.Df	RSS	Df	Sum of Sq	F	Pr(>F)
1	3681	1031.02				
2	3699	1056.69	-18	-25.67	5.09	0.0000



(a) Residuals vs Fitted

(b) Normal Q-Q

(c) Scale-Location

(d) Residual Boxplot

Figure 4.5: Diagnostic Plots; new model

4.2.4 Backward Elimination Method - Mallow's Cp

Table 4.7 presents the results from the backward elimination method with the model selection criteria of *Mallow Cp*, using bootstrap re-sampling of 1000 iterations to assess the number of times the selection criteria prefers the parameters. The model selection method is performed on the same data set as the previous regression tests.
In comparison to the updated model 4.5 on page 58, the Mallow Cp disregards the parameters *KBC investment*, *capital per employee* and *labour*. In opposite manner to 4.5, it perceives the branch of industries to contribute to labour productivity. Most notably capital intensive goods and capital intensive manufacturing.
Moreover, on positive note, it finds the interaction between the factors relatively strong, most notably *capital per employee* and *branch industry*; strongly indicated by the scatter plots. It finds the interaction between *labour* and *branch of industries* capital intensive manufacturing (2), labour intensive manufacturing (3) and trade (6) to be strong. Further, the interaction between *KBC investment* and *branch of industries* finance, capital intensive goods and trade is accepted through half of the iterations. Hence the preference for the interaction model where the interaction between the factors contribute to labour productivity is preferred by the information criteria; while disregarding the main effects of slope parameters *capital per employee*, *labour* and *KBC investment*.

Table 4.7: Bootstrap with Backward Elimination Method - Mallow's Cp

	Dependent variable:		*Dependent variable:*
	Labour Productivity		Labour Productivity
KBC Investment Indicator	219	Labour:Branch 0	139
Branch 0	158	Labour:Branch 1	126
Branch 1	981	Labour:Branch 2	725
Branch 2	837	Labour:Branch 3	836
Branch 3	677	Labour:Branch 4	397
Branch 4	322	Labour:Branch 5	250
Branch 5	447	Labour:Branch 6	825
Branch 6	324	Labour:Branch 7	12
Branch 7	163	Labour:Branch 8	344
Branch 8	695	Labour:Branch 10	350
Branch 10	0	Capital per Employee:Branch 0	699
KBC Investment:Branch 0	592	Capital per Employee:Branch 1	1000
KBC Investment:Branch 1	495	Capital per Employee:Branch 2	996
KBC Investment:Branch 2	215	Capital per Employee:Branch 3	994
KBC Investment:Branch 3	289	Capital per Employee:Branch 4	999
KBC Investment:Branch 4	172	Capital per Employee:Branch 5	993
KBC Investment:Branch 5	179	Capital per Employee:Branch 6	962
KBC Investment:Branch 6	508	Capital per Employee:Branch 7	1000
KBC Investment:Branch 7	3	Capital per Employee:Branch 8	1000
KBC Investment:Branch 8	187	Capital per Employee:Branch 10	1000
KBC Investment:Branch 10	122	KBC Investment	0
		Capital per Employee	0
		Labour	0
		Observations	3,720

4.3 Expenditures in IT and marketing in firms 2014

The obtained result for KBC components total expenses for software per employee and total expenses for marketing per employee will be presented in two separate subsections in order to avoid confusion. The model selection assessment will be presented in a grouped manner.

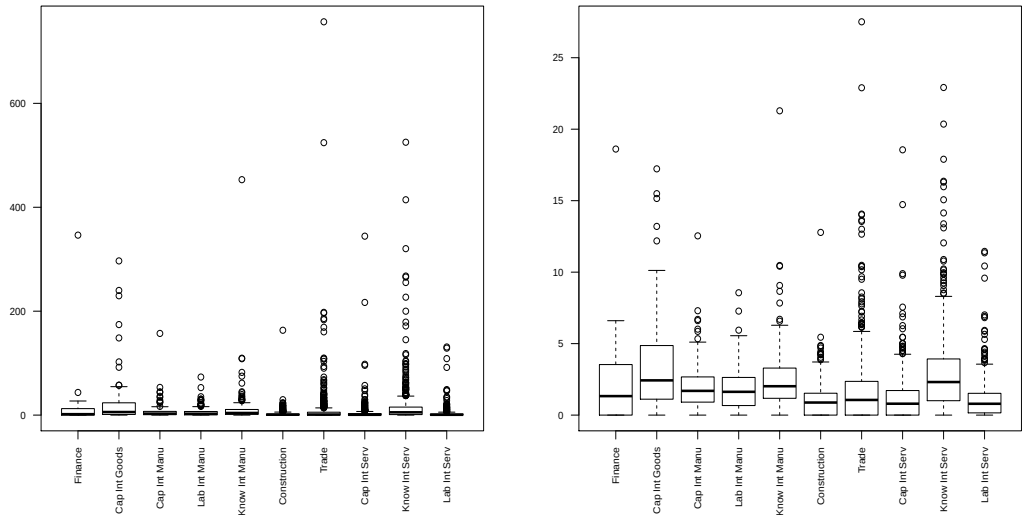
4.3.1 KBC Component - Total Expenses for Software per Employee

Figure A.6 on page 105 presents three plots; the total expenses for software per employee, the square root of the the total expenses for software per employee and the distribution of the KBC component from the survey. According to the figure it is visible that the distribution of the KBC investment is still heavy-tailed after the square root transformation has occurred in an attempt to suppress the heavy-tailed distribution, in accordance to 3.1.6 in section Outliers on page 22 and 3.2.2 in section Model Description on page 25.
The figures A.6 contain a sample of 500 observations from the survey for an improved plot, while for the presented histogram, the full data set is presented. According to the histogram the KBC investment still takes the form of a reduced but not entirely removed heavy-tailed distribution after the transformation.

4.3.2 Branch of Industry Assessment - Total Expenses for Software per Employee

Figure 4.6 present a boxplot of total expenses for software per employee as a function of the branch of industries. Due to its heavy-tailed distribution an additional boxplot is presented where the square root transformation is applied to the KBC component.
According to the plot, the transformation produces an improved and readable plot for the KBC investment per branch of industry, although slightly skewed for branch of industry *capital intensive goods* and *finance*. Nonetheless it is more symmetric. Values perceived as extreme are still found in the majority of the industry branches, most notably in *knowledge intensive service* and *trade*, representing firms that have greater weight in their investment in the KBC component. Thus the heavy-tailed distribution, although reduced.
Assessing the branch of industry comparisons, there seem to exist a slight indication of differences in the KBC investment between the groups, most notably *capital intensive goods* and *knowledge intensive service*. It appears that some groups exhibit higher variability than other groups.

Table 4.8 presents the analysis of variance (ANOVA) test. It compares the mean of the KBC investment per employee between the groups. The test rejects the hypothesis that the mean KBC investment per employee is equal in all industry branches. Moreover since the KBC investment sample follows a heavy-tailed distribution and contain unequal group variances, the table additionally presents a non-parametric Kruskal-Wallis test, which concludes the same as the ANOVA test.
Table 4.9 presents the Bonferroni post-hoc pairwise comparisons between the mean value of the groups. According to the table the KBC investment in group *capital intensive goods* is significantly different from all groups except for *finance* and *knowledge intensive service*. Moreover group *knowledge intensive service* is significantly different from the majority of the groups, except for *knowledge intensive manufacturing* and *finance*.



(a) (b)

Figure 4.6: Left: Boxplot of Total Expenses for Software per Employee | Branch of Industry. Right: Boxplot of the Square Root of Total Expenses for Software per Employee | Branch of Industry.

Table 4.8: Top: Anova summary. Bottom: Kruskal-Wallis

ANOVA Summary					
	Df	Sum Sq	Mean Sq	F value	Pr(>F)
as.factor(Bransch07_Crude)	9	1668.48	185.39	39.23	0.0000
Residuals	3508	16576.46	4.73		
Kruskal-Wallis Rank Sum Test					
	Chi-Squared	Df	P-value		
Kruskal-Wallis	403.6929	9	0.0000		

Table 4.9: Bonferroni method (post-hoc)

Branch of Industry	
1 - 0	1.000
2 - 0	1.000
3 - 0	1.000
4 - 0	1.000
5 - 0	0.042
6 - 0	1.000
7 - 0	0.216
8 - 0	1.000
10 - 0	0.187
2 - 1	0.000
3 - 1	0.000
4 - 1	0.000
5 - 1	0.000
6 - 1	0.000
7 - 1	0.000

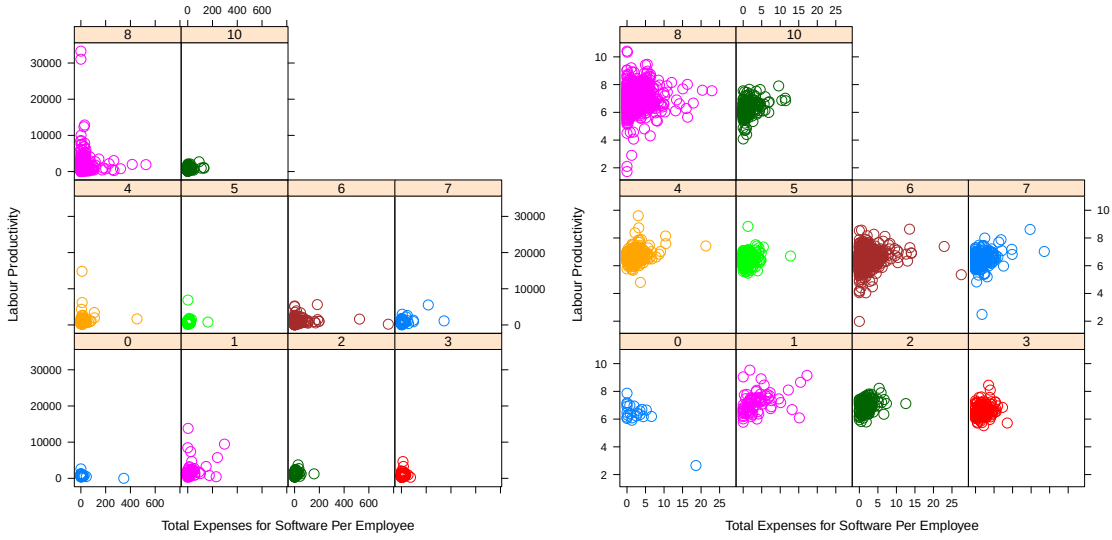
Branch of Industry	
8 - 1	0.083
10 - 1	0.000
3 - 2	1.000
4 - 2	1.000
5 - 2	0.000
6 - 2	1.000
7 - 2	0.040
8 - 2	0.001
10 - 2	0.040
4 -3	0.443
5 - 3	0.000
6 - 3	1.000
7 - 3	0.106
8 - 3	0.000
10 - 3	0.107

Branch of Industry	
5 - 4	0.000
6 - 4	0.000
7 - 4	0.000
8 - 4	0.390
10 - 4	0.000
6 - 5	0.000
7 - 5	1.000
8 - 5	0.000
10 - 5	1.000
7 - 6	0.063
8 - 6	0.000
10 - 6	0.101
8 - 7	0.000
10 - 7	1.000
10 - 8	0.000

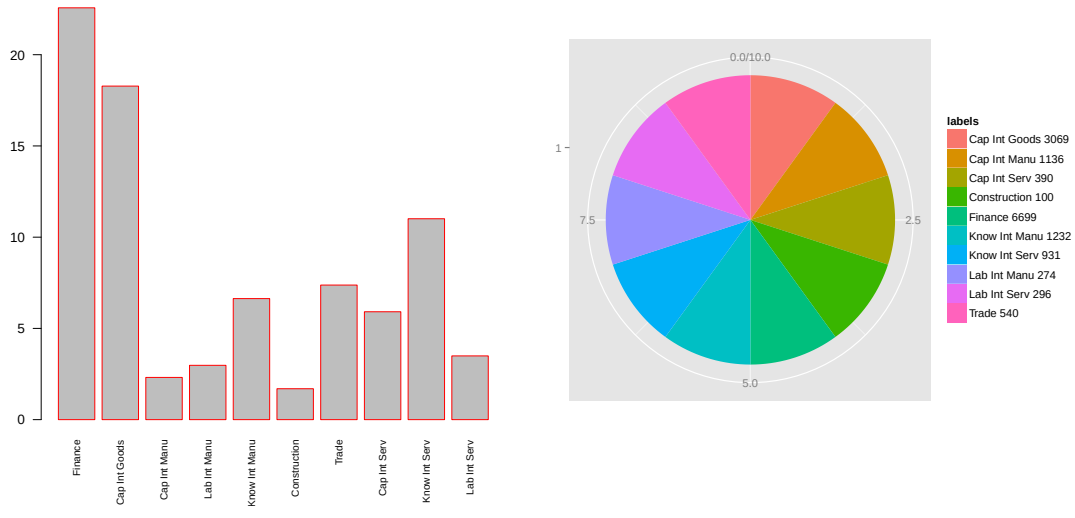
4.3.3 Interaction Assessment - Total Expenses for Software per Employee

Figure 4.7 depicts a plot of the labour productivity against KBC investment, conditioned on branch of industry. Due to the information described in 3.1.6 in section Outliers on page 22 and 3.2 in section Econometric method on page 24, the transformations of the KBC investment and labour productivity are seen in the right plot. The conditional variable illustrates the discrepancies amongst the branch industries. Focusing on the right plot, where the transformations have made the detection of linear dependencies clearer, there exist a weak indication of linearity in several industry branches, except for *trade*.
Moreover examining the differences between the groups, it is suggested that *interaction* between the factors is existent since the impact on labour productivity due to the contribution of KBC investment varies, depending on the branch of industry.
Additional to the scatterplots, figure 4.7 presents the computed mean for KBC investment per employee per branch of industry. *Finance* display the highest value followed by *capital intensive goods*. One must take into account that the observation size of each group can exhibit great differences due to the sample selection and SNI categorisation. *Construction* and *capital intensive manufacturing* is not coined with high levels of KBC investment. The chart pie display that the branch industry *finance* exhibits greater KBC investment in total value.

Figure 4.8 presents the labour productivity against *capital per employee*, conditioned on branch of industry and labour productivity against *labour*, conditioned on branch of industry. As previously implemented for the KBC investment and labour productivity, analogous transformation for the explanatory variables *capital per employee* and *labour* are applied in order to make the detection of linear dependencies easier, shown in the plots.
According to the plots, association is existent in all groups, indicating a relationship between the explanatory variables and labour productivity. Logically capital per employee and labour should influence the labour productivity of firms.
In similar case of KBC investment, according to the plots there is a weak suggestion of *interaction* between the factor of *capital per employee* on the dependent variable, while for *labour* the contribution is constant across the branch of industries.

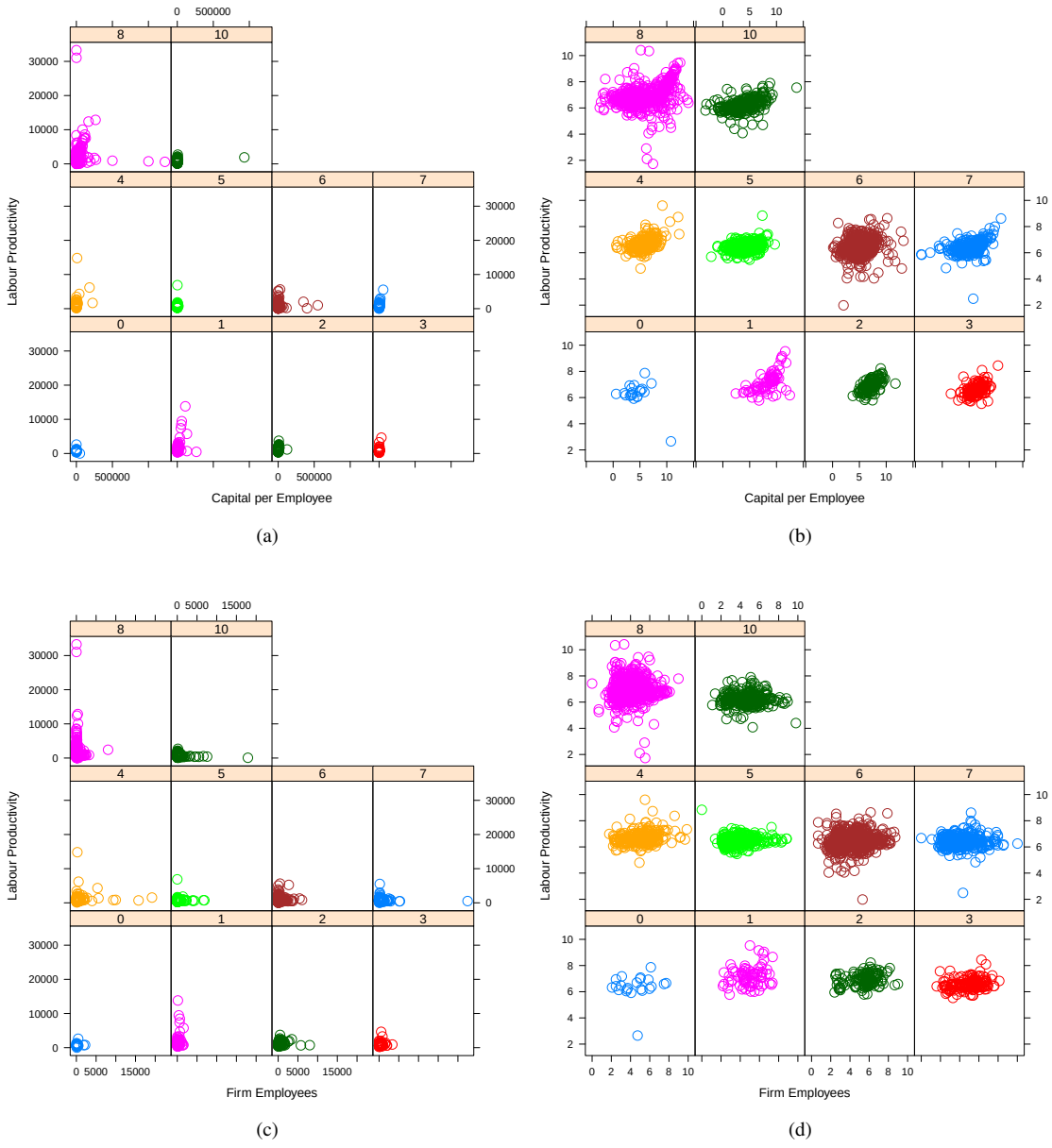


(a) (b)



(c) (d)

Figure 4.7: Top left: KBC investment per Employee VS Labour Productivity | Branch of Industry.
Top right: Square root of KBC investment per Employee VS Log Labour Productivity | Branch of Industry.
Bottom left: Distribution of the mean for Total Expenses for Software per Employee | Branch of Industry.
Bottom right: Distribution of the mean for Total Expenses for Software per Employee | Branch of Industry.



(a) (b)

(c) (d)

Figure 4.8: Top left: Capital per Employee VS Labour Productivity | Branch of Industry.
Top right: Log of Capital per Employee VS Log Labour Productivity | Branch of Industry.
Bottom left: Labour VS Labour Productivity | Branch of Industry.
Bottom right: Log of Labour VS Log Labour Productivity | Branch of Industry.

4.3.4 KBC Component - Total Expenses for Marketing per Employee

Figure A.7 on page 105 presents three plots; the total expenses for software per employee, the square root of the the total expenses for software per employee and the distribution of the KBC component from the survey. According to the figure it is visible that the distribution of the KBC investment is still heavy-tailed after the transformation has occurred in an attempt to suppress the heavy-tailed distribution, in accordance to 3.1.6 in section Outliers on page 22 and 3.2.2 in section Model Description on page 25.
The figures A.7 contain a sample of 500 observations from the survey for an improved plot, while for the presented histogram, the full data set is presented. According to the histogram the KBC investment still takes the form of a reduced but not entirely removed heavy-tailed distribution after the transformation.

4.3.5 Branch of Industry Assessment - Total Expenses for Marketing per Employee

Figure 4.9 present a boxplot of total expenses for marketing per employee as a function of the branch of industries. Due to its heavy-tailed distribution an additional boxplot is presented where the square root transformation is applied to the KBC component.
According to the plot the transformation produces an improved and readable plot for the KBC investment per branch of industry, although skewed for branch of industry *capital intensive goods*, *finance*, *construction* and *capital intensive service*. Nonetheless it is more symmetric. Values perceived as extreme are still found in the majority of the industry branches, most notably in *knowledge intensive service* and *trade*, representing firms that exhibit heavier investment in the KBC asset. Therefore the heavy-tailed distribution, although reduced after the transformation.
Assessing the branch of industry comparisons, there are idnication of differences in the KBC investment between the groups, such as *trade* and *knowledge intensive service*. It appears that some groups exhibit higher variability than other groups.

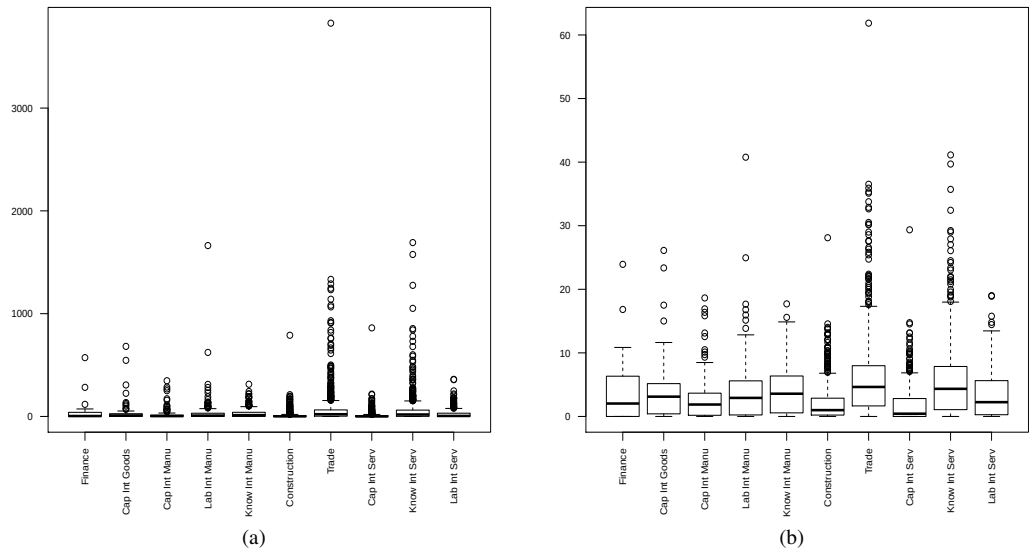


Figure 4.9: Left: Boxplot of Total Expenses for Marketing per Employee | Branch of Industry. Right: Boxplot of the Square Root of Total Expenses for Marketing per Employee | Branch of Industry.

Table 4.10 presents the analysis of variance (ANOVA) test. It compares the mean of the KBC investment per employee between the groups. The test rejects the hypothesis that the mean KBC investment per employee is equal in all industry branches. Moreover since the KBC investment sample follows a heavy-tailed distribution and contain unequal group variances, the table additionally presents a non-parametric Kruskal-Wallis test, which concludes the same as the ANOVA test.
Table 4.11 presents the Bonferroni post-hoc pairwise comparisons between the mean value of the groups. According to the table the KBC investment in group *finance* is significantly not different from all groups, while the other groups exhibit variability in their differences to specific groups.

Table 4.10: Top: Anova summary. Bottom: Kruskal-Wallis

ANOVA Summary					
	Df	Sum Sq	Mean Sq	F value	Pr(>F)
as.factor(Bransch07_Crude)	9	7971.04	885.67	37.41	0.0000
Residuals	3508	83051.32	23.67		
Kruskal-Wallis Rank Sum Test					
	Chi-Squared	Df	P-value		
Kruskal-Wallis	406.7966	9	0.0000		

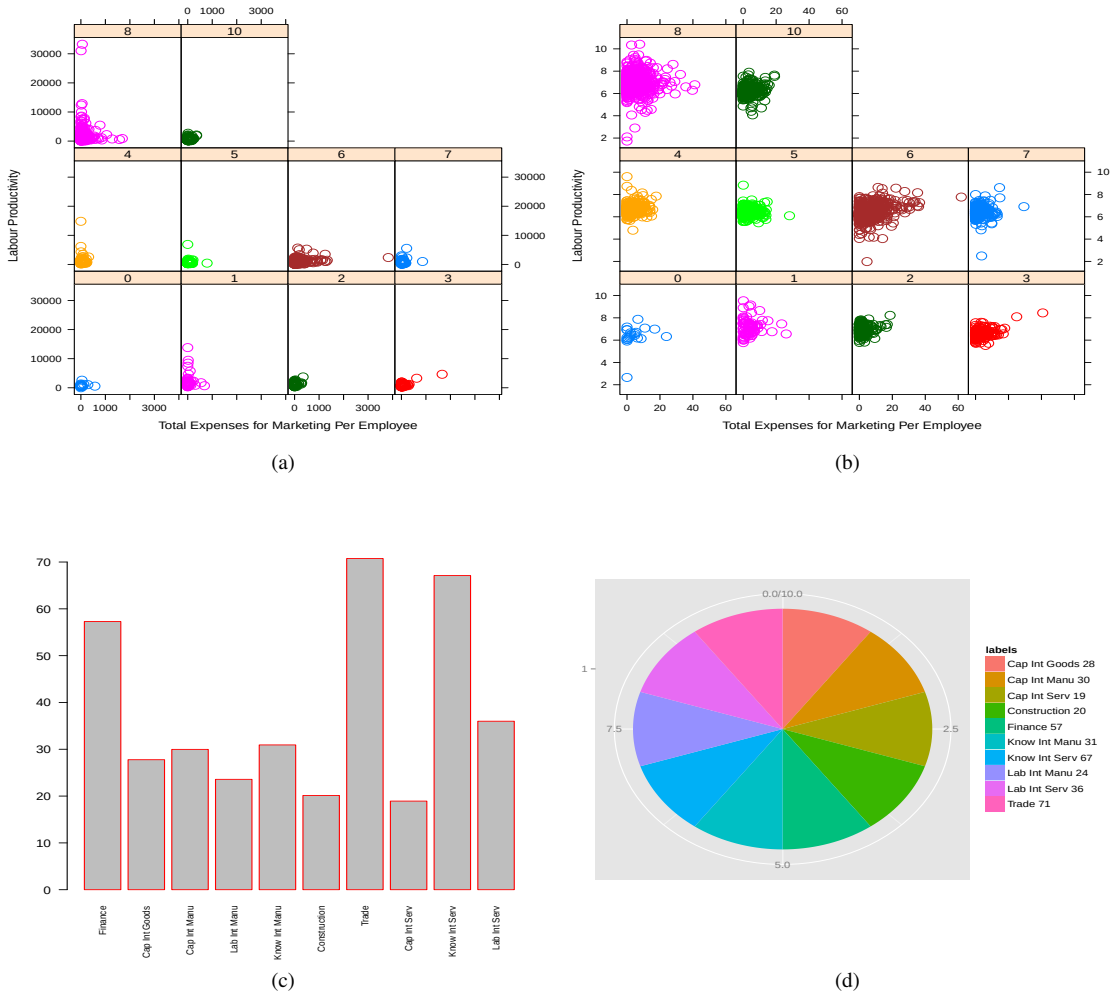
Table 4.11: Bonferroni method (post-hoc)

Branch of Industry		**Branch of Industry**		**Branch of Industry**	
1 - 0	1.000	8 - 1	0.894	5 - 4	0.000
2 - 0	1.000	10 - 1	1.000	6 - 4	0.000
3 - 0	1.000	3 - 2	1.000	7 - 4	0.000
4 - 0	1.000	4 - 2	0.973	8 - 4	0.015
5 - 0	1.000	5 - 2	1.000	10 - 4	1.000
6 - 0	1.000	6 - 2	0.000	6 - 5	0.000
7 - 0	0.815	7 - 2	1.000	7 - 5	1.000
8 - 0	1.000	8 - 2	0.000	8 - 5	0.000
10 - 0	1.000	10 - 2	1.000	10 - 5	0.014
2 - 1	1.000	4 -3	1.000	7 - 6	0.000
3 - 1	1.000	5 - 3	0.002	8 - 6	1.000
4 - 1	1.000	6 - 3	0.001	10 - 6	0.000
5 - 1	0.817	7 - 3	0.000	8 - 7	0.000
6 - 1	0.672	8 - 3	0.032	10 - 7	0.000
7 - 1	0.009	10 - 3	1.000	10 - 8	0.000

4.3.6 Interaction Assessment - Total Expenses for Marketing per Employee

Figure 4.10 depicts a plot of labour productivity against the KBC investment, conditioned on branch of industry. Due to the information described in 3.1.6 in section Outliers on page 22 and 3.2 in section Econometric method on page 24, the transformations of the KBC investment and labour productivity are seen in the right plot. The conditional variable illustrates the discrepancies amongst the branch industries. Focusing on the right plot, where the transformations have made the detection of linear dependencies clearer, there exist a weak indication of linearity in the majority of the industry branches, except for *construction* and *knowledge intensive manufacturing*. Moreover, examining the differences between the groups, it is not suggested that *interaction* between the factors exist, since the impact on labour productivity due to the contribution of KBC investment is constant across all groups.
Additional to the scatterplots, figure 4.10 presents the computed mean for KBC investment per employee per branch of industry. *Trade* display the highest value followed by *knowledge intensive service*. One must

take into account that the observation size of each group can exhibit great differences due to the sample selection and SNI categorisation. *Construction* and *capital intensive service* is not coined with high levels of KBC investment. The chart pie display that the branch industry *trade* exhibits greater KBC investment in total value.



(a) (b)

(c) (d)

Figure 4.10: Top left: KBC investment per Employee VS Labour Productivity | Branch of Industry. Top right: Square root of KBC investment per Employee VS Log Labour Productivity | Branch of Industry. Bottom left: Distribution of the mean for Total Expenses for Marketing per Employee | Branch of Industry. Bottom right: Distribution of the mean for Total Expenses for Marketing per Employee | Branch of Industry.

4.3.7 Regression results

Table 4.12 presents the results from the estimated models. The estimated models consists of a interaction model and one without the interrogated interaction. According to the table the suggestions of interaction are further strengthened for factors *KBC investment software* and *branch of industry*, although weak. The slope parameter is only not significant for branch of industry group *capital intensive manufacturing* (2). The interaction effect is rejected for the remaining factors. Thus according to the model, only the simultaneous influence of KBC investment software and branch of industry contain interaction. The intercept acts as the baseline of group *finance* (0).
Slope parameter *KBC investment software* has weak significant negative impact on labour productivity for the interaction model but stronger significant positive impact for the non interaction model. *KBC investment marketing* is significant for the model that excludes the interaction.
Peculiarly, analogous with previous results, *labour* and *capital per employee* is only significant for the model that excludes the interaction even though the plots presented a relationship between the explanatory variables and labour productivity.
Furthermore the model that excludes the interaction finds the indicator for KBC investment software to be significant.
The model that excludes the interaction finds that branch of industry *capital intensive goods* (1) is significant. Moreover according to the table, although very low, the adjusted R^2 value of the interaction model indicates a slightly better prediction of new observations.
Table 4.13 presents the model comparison of the interaction model and the simple model through a ANOVA test. Hence the simple model is *nested* within the interaction model (full model). The test examines if the bigger model adds more descriptive information than the simple model. Thus the null hypothesis tests if the additional terms are equal to zero, while the alternative hypothesis states that at least one of the additional terms is not equal to zero. The test rejects the hypothesis that the additional terms are equal to zero, stating that the interaction model fits better than the simple model, thus preferred since the interaction helps the model

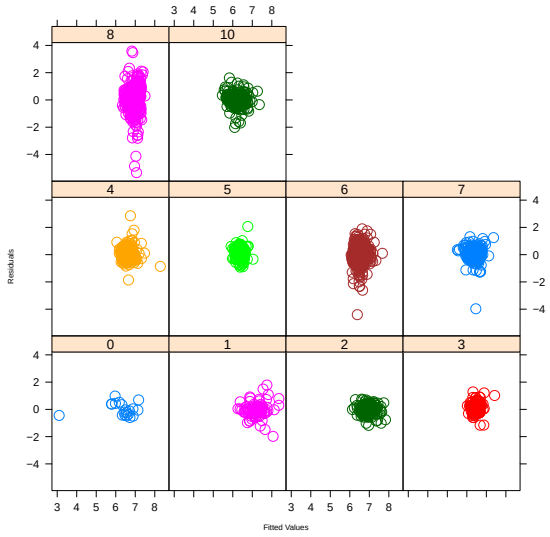
Figure 4.11 presents the diagnostics of the *interaction* model. In analogous manner to previous results the residuals (a) cluster towards the centre of the plot. They have a similar symmetry around the horizontal line with both positive and negative residuals. Hence there is no curvature in the residuals. The residual points are obviously not scattered, thus strengthening the weak linear relationship.
Unfortunatly the residuals are not normally distributed which is mostly related to the long-tailed distribution of labour productivity. The values are associated with the presence of large residuals from branch of industry groups containing greater labour productivity. Consequently the departure from the normality assumptions causes uncertainties concerning the p-values, since they can be incorrect due to the heavy-tailed error distribution.
A few outliers are visible according to the plot, most notable in group *finance* (0) and *knowledge intensive service*.

Table 4.12: Regression results between interaction and no interaction models

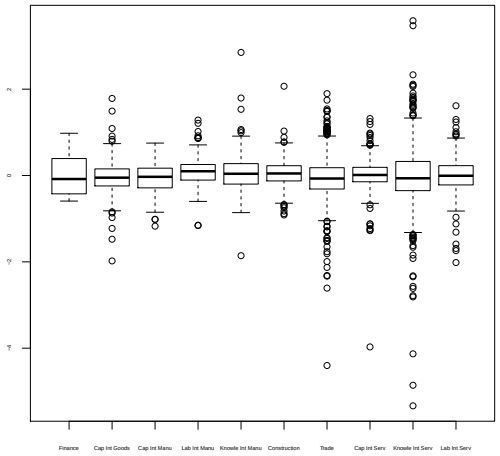
	Dependent variable:	
	Labour Productivity	
	(Inclusion of Interaction)	(Exclusion of Interaction)
KBC Investment Software	-0.192^{***}	0.016^{***}
	(0.034)	(0.005)
KBC Investment Marketing	0.040^{*}	0.016^{***}
	(0.021)	(0.002)
Labour	0.168^{**}	0.021^{***}
	(0.074)	(0.007)
Capital per Employee	-0.010	0.084^{***}
	(0.068)	(0.004)
Indicator for KBC investment Software	-0.794	0.510^{***}
	(0.524)	(0.129)
Indicator for KBC investment Marketing	-0.752	0.391^{***}
	(0.514)	(0.124)
Branch 1	-0.282	0.124
	(0.481)	(0.121)
Branch 2	-0.162	0.249^{**}
	(0.448)	(0.119)
Branch 3	0.142	0.217^{*}
	(0.437)	(0.118)
Branch 4	-0.083	0.034
	(0.433)	(0.116)
Branch 5	-0.059	0.088
	(0.441)	(0.118)
Branch 6	0.318	0.452^{***}
	(0.433)	(0.116)
Branch 7	-0.178	-0.026
	(0.446)	(0.119)
Branch 8	0.031	0.045^{*}
	(0.025)	(0.025)
Branch 10	-0.014	-0.033
	(0.027)	(0.027)
KBC Investment Software:Branch 1	0.230^{***}	
	(0.037)	
KBC Investment Software:Branch 2	0.199^{***}	
	(0.044)	
KBC Investment Software:Branch 3	0.168^{***}	
	(0.043)	
KBC Investment Software:Branch 4	0.215^{***}	
	(0.037)	
KBC Investment Software:Branch 5	0.227^{***}	
	(0.040)	
KBC Investment Software:Branch 6	0.215^{***}	
	(0.035)	
KBC Investment Software:Branch 7	0.246^{***}	
	(0.037)	
KBC Investment Software:Branch 8	0.197^{***}	
	(0.034)	
KBC Investment Software:Branch 10	0.255^{***}	
	(0.039)	
KBC Investment Marketing:Branch 1	-0.054^{**}	
	(0.024)	
KBC Investment Marketing:Branch 2	-0.021	
	(0.024)	
KBC Investment Marketing:Branch 3	-0.011	
	(0.023)	
KBC Investment Marketing:Branch 4	-0.023	
	(0.023)	
KBC Investment Marketing:Branch 5	-0.043^{*}	
	(0.022)	
KBC Investment Marketing:Branch 6	-0.015	
	(0.021)	
KBC Investment Marketing:Branch 7	-0.043^{*}	
	(0.023)	
KBC Investment Marketing:Branch 8	-0.033	
	(0.021)	
KBC Investment Marketing:Branch 10	-0.032	
	(0.023)	
Labour:Branch 1	-0.114	
	(0.087)	
Labour:Branch 2	-0.141^{*}	
	(0.083)	
Labour:Branch 3	-0.149^{*}	
	(0.081)	
Labour:Branch 4	-0.160^{**}	
	(0.078)	
Labour:Branch 5	-0.147^{*}	
	(0.077)	
Labour:Branch 6	-0.139^{*}	
	(0.075)	
Labour:Branch 7	-0.166^{**}	
	(0.076)	
Labour:Branch 8	-0.166^{**}	
	(0.076)	
Labour:Branch 10	-0.159^{**}	
	(0.078)	
Capital per Empl:Branch 1	0.209^{***}	
	(0.074)	
Capital per Empl:Branch 2	0.219^{***}	
	(0.078)	
Capital per Empl:Branch 3	0.127^{*}	
	(0.077)	
Capital per Empl:Branch 4	0.133^{*}	
	(0.072)	
Capital per Empl:Branch 5	0.064	
	(0.070)	
Capital per Empl:Branch 6	0.053	
	(0.069)	
Capital per Empl:Branch 7	0.091	
	(0.070)	
Capital per Empl:Branch 8	0.105	
	(0.069)	
Capital per Empl:Branch 10	0.080	
	(0.070)	
Constant	5.948^{***}	5.723^{***}
	(0.428)	(0.120)
Observations	3,431	3,431
R^2	0.335	0.296
Adjusted R^2	0.325	0.293
F Statistic	33.311^{***} (df = 51; 3379)	95.922^{***} (df = 15; 3415)
Note:		*p<0.1; **p<0.05; ***p<0.01

Table 4.13: Model Comparison

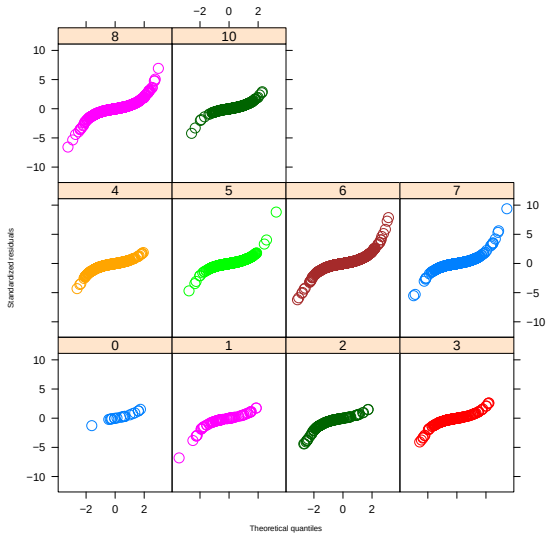
	Res.Df	RSS	Df	Sum of Sq	F	Pr(>F)
1	3379	846.28				
2	3415	894.78	-36	-48.50	5.38	0.0000



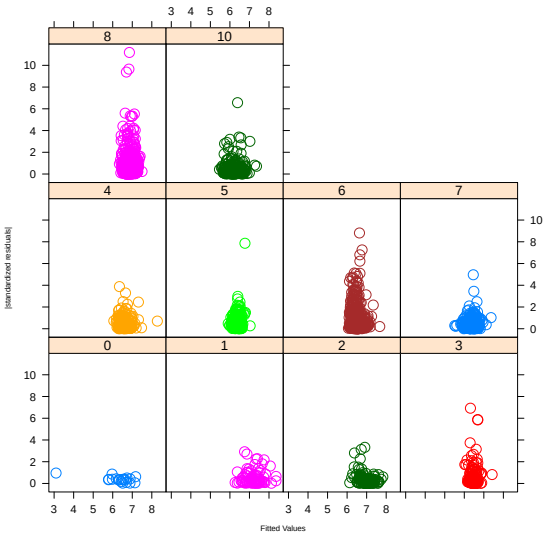
(a) Residuals vs Fitted



(b) Residual Boxplot



(c) Normal Q-Q



(d) Scale-Location

Figure 4.11: Diagnostic Plots of the Interaction Model

Table 4.14 presents the updated estimated model where the model only includes the interaction between the KBC investment *software* and branch of industry; the interactions which were proven to be significant in the previous model. Moreover, the model still exhibits equal observation count. Excluding outliers barely impacted the model improvements. Compared to the previous interaction model 4.12, variables *capital per employee*, *labour* and KBC investment *marketing* are now significant and have a positive impact on the labour productivity, which is aligned with the scatterplots of the explanatory variables and the labour productivity. Moreover the ***KBC investment*** in ***branch of industry*** construction (5) is now significant.
According to the table, although still low, the adjusted R^2 value of the new model indicates a weak prediction of new observations.
Table 4.15 presents the model comparisons of the previous interaction model with the new updated interaction model. The updated model is *nested* within the full model. The test rejects the hypothesis that the additional terms are equal to zero, stating that the full interaction model fits better than the updated interaction model.

Table 4.14: Regression results for the updated interaction model

	Dependent variable:
	Labour Productivity
KBC Investment Software	-0.217^{***}
	(0.028)
Branch 1	-0.280^{*}
	(0.159)
Branch 2	-0.322^{**}
	(0.153)
Branch 3	-0.501^{***}
	(0.150)
Branch 4	-0.448^{***}
	(0.146)
Branch 5	-0.451^{***}
	(0.142)
Branch 6	-0.635^{***}
	(0.139)
Branch 7	-0.607^{***}
	(0.141)
Branch 8	-0.174
	(0.140)
Branch 10	-0.728^{***}
	(0.143)
KBC Investment Marketing	0.015^{***}
	(0.002)
Labour	0.020^{***}
	(0.006)
Capital per Employee	0.084^{***}
	(0.004)
Indicator for KBC investment Software	0.038
	(0.025)
Indicator for KBC investment Marketing	-0.036
	(0.027)
KBC Investment Software:Branch 1	0.269^{***}
	(0.031)
KBC Investment Software:Branch 2	0.260^{***}
	(0.037)
KBC Investment Software:Branch 3	0.215^{***}
	(0.037)
KBC Investment Software:Branch 4	0.248^{***}
	(0.031)
KBC Investment Software:Branch 5	0.239^{***}
	(0.035)
KBC Investment Software:Branch 6	0.239^{***}
	(0.029)
KBC Investment Software:Branch 7	0.257^{***}
	(0.031)
KBC Investment Software:Branch 8	0.221^{***}
	(0.028)
KBC Investment Software:Branch 10	0.265^{***}
	(0.033)
Constant	6.396^{***}
	(0.142)
Observations	3,431
R^2	0.315
Adjusted R^2	0.310
F Statistic	65.113^{***} (df = 24; 3406)
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 4.15: Model Comparison

	Res.Df	RSS	Df	Sum of Sq	F	Pr(>F)
1	3379	846.28				
2	3406	871.79	-27	-25.50	3.77	0.0000

4.3.8 Backward Elimination Method - Mallow's Cp

Table 4.16 presents the results from the backward elimination method with the model selection criteria of *Mallow Cp*, using bootstrap to assess the number of times the selection criteria prefers the parameters.
In comparison to the updated model 4.14 on page 58, the Mallow Cp disregards the parameters *KBC investments*, *capital per employee* and *labour*. In opposite manner from 4.14, it perceives the branch of industries to contribute to labour productivity. Moreover, on positive note, it finds the interaction between the factors relatively strong, most notably *capital per employee* and *branch industry*; strongly indicated by the scatterplots. Thus is prefers the interaction model where the interaction between the factors contribute to labour productivity, while disregarding the individual slope parameters of *capital per employee*, *labour*.

Table 4.16: Bootstrap with Backward Elimination Method - Mallow's Cp

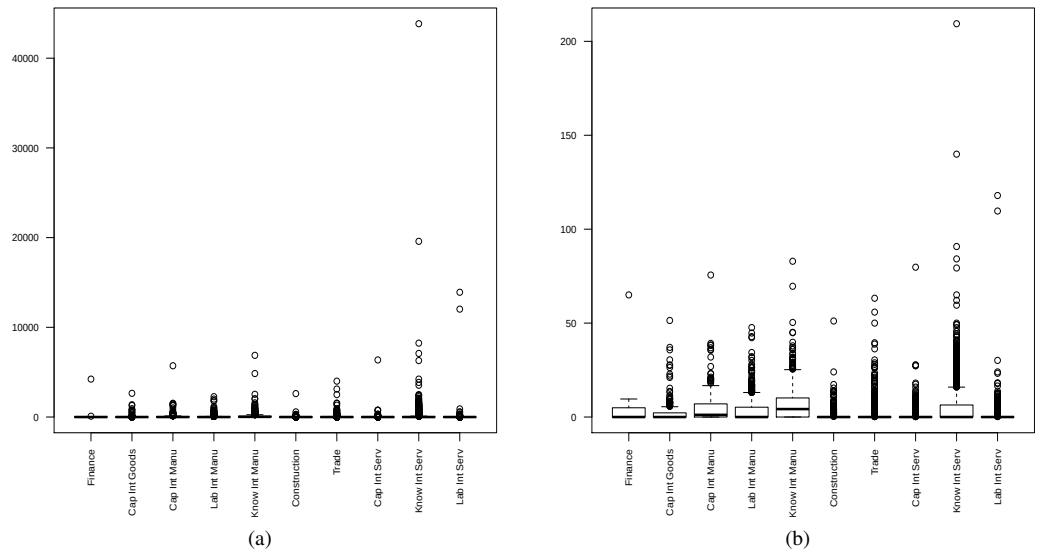
	Dependent variable:		*Dependent variable:*
	Labour Productivity		Labour Productivity
KBC Investment Indicator Software	363	KBC Investment Marketing:Branch 5	8
KBC Investment Indicator Marketing	70	KBC Investment Marketing:Branch 6	1000
Branch 0	250	KBC Investment Marketing:Branch 7	39
Branch 1	521	KBC Investment Marketing:Branch 8	483
Branch 2	556	KBC Investment Marketing:Branch 10	147
Branch 3	54	Labour:Branch 0	535
Branch 4	73	Labour:Branch 1	214
Branch 5	824	Labour:Branch 2	63
Branch 6	150	Labour:Branch 3	21
Branch 7	158	Labour:Branch 4	53
Branch 8	986	Labour:Branch 5	306
Branch 10	0	Labour:Branch 6	668
KBC Investment Software:Branch 0	548	Labour:Branch 7	21
KBC Investment Software:Branch 1	603	Labour:Branch 8	156
KBC Investment Software:Branch 2	83	Labour:Branch 10	111
KBC Investment Software:Branch 3	76	Capital per Employee:Branch 0	284
KBC Investment Software:Branch 4	351	Capital per Employee:Branch 1	1000
KBC Investment Software:Branch 5	365	Capital per Employee:Branch 2	1000
KBC Investment Software:Branch 6	705	Capital per Employee:Branch 3	982
KBC Investment Software:Branch 7	929	Capital per Employee:Branch 4	997
KBC Investment Software:Branch 8	267	Capital per Employee:Branch 5	998
KBC Investment Software:Branch 10	924	Capital per Employee:Branch 6	942
KBC Investment Marketing:Branch 0	386	Capital per Employee:Branch 7	1000
KBC Investment Marketing:Branch 1	339	Capital per Employee:Branch 8	1000
KBC Investment Marketing:Branch 2	278	Capital per Employee:Branch 10	997
KBC Investment Marketing:Branch 3	812	KBC Investment Software	0
KBC Investment Marketing:Branch 4	513	KBC Investment Marketing	0
KBC Investment Marketing:Branch 5	8	Capital per Employee	0
KBC Investment Marketing:Branch 6	1000	Labour	0
KBC Investment Marketing:Branch 7	39	Observations	3,431
KBC Investment Marketing:Branch 8	483		
KBC Investment Marketing:Branch 10	147		

4.4 Community Innovation Survey 2012 - 2014

Figure A.10 on page 107 presents three plots; the total expenses for innovation per employee, the square root of the the total expenses for innovation per employee and the distribution of the KBC component from the survey. According to the figure it is visible that the distribution of the KBC investment is still heavy-tailed after the transformation has occurred in an attempt to suppress the heavy-tailed distribution, in accordance to 3.1.6 in section Outliers on page 22 and 3.2.2 in section Model Description on page 25. The figures A.10 contain a sample of 500 observations from the survey for an improved plot, while for the presented histogram, the full data set is presented. According to the histogram the KBC investment takes the form of a reduced but not entirely removed heavy-tailed distribution after the transformation.

4.4.1 Branch of Industry Assessment

Figure 4.12 present a boxplot of total expenses for innovation per employee as a function of the branch of industries. Due to its heavy-tailed distribution an additional boxplot is resented where the square root transformation is applied to the KBC component.
According to the boxplot the transformation produces an improved and more readable plot for the KBC investment per branch of industry, although still very heavy-tailed for every group. Values perceived as extreme are still found in the majority of the industry branches, most notably in *knowledge intensive service* and *trade*, representing firms that have greater weight in their investment in the KBC asset. Thus the heavy-tailed distribution, although reduced.
Assessing the branch of industry comparisons, there seem to exist a slight indication of differences in the KBC investment between the groups.



(a) (b)

Figure 4.12: Left: Boxplot of Total Expenses for Innovation per Employee | Branch of Industry. Right: Boxplot of the Square Root of Total Expenses for Innovation per Employee | Branch of Industry.

Table 4.17 presents the analysis of variance (ANOVA) test. It compares the mean of the KBC investment per employee between the groups. The test rejects the hypothesis that the mean KBC investment per employee is equal in all industry branches. Moreover since the KBC investment sample follows a heavy-tailed distribution and contain unequal group variances, the table additionally presents a non-parametric Kruskal-Wallis test, which concludes the same as the ANOVA test.
Table 4.18 presents the Bonferroni post-hoc pairwise comparisons between the mean value of the groups. According to the table the KBC investment in group *capital intensive manufacturing* is significantly different from all groups except for *labour intensive manufacturing* and *knowledge intensive service*. Moreover group *labour intensive manufacturing* is significantly different from the majority of the groups.

Table 4.17: Top: Anova summary. Bottom: Kruskal-Wallis

ANOVA Summary					
	Df	Sum Sq	Mean Sq	F value	Pr(>F)
as.factor(Bransch07_Crude)	9	31991.08	3554.56	59.70	0.0000
Residuals	7712	459157.43	59.54		
Kruskal-Wallis Rank Sum Test					
	Chi-Squared	Df	P-value		
Kruskal-Wallis	847.7313	9	0.0000		

Table 4.18: Bonferroni method (post-hoc)

Branch of Industry		**Branch of Industry**		**Branch of Industry**	
1 - 0	1.000	8 - 1	0.000	5 - 4	0.000
2 - 0	1.000	10 - 1	1.000	6 - 4	0.000
3 - 0	1.000	3 - 2	1.000	7 - 4	0.000
4 - 0	1.000	4 - 2	0.000	8 - 4	0.010
5 - 0	0.347	5 - 2	0.000	10 - 4	0.000
6 - 0	0.664	6 - 2	0.000	6 - 5	1.000
7 - 0	0.411	7 - 2	0.000	7 - 5	1.000
8 - 0	1.000	8 - 2	0.061	8 - 5	0.000
10 - 0	0.507	10 - 2	0.000	10 - 5	1.000
2 - 1	0.008	4 -3	0.000	7 - 6	1.000
3 - 1	0.999	5 - 3	0.000	8 - 6	0.000
4 - 1	0.000	6 - 3	0.000	10 - 6	1.000
5 - 1	1.000	7 - 3	0.000	8 - 7	0.000
6 - 1	1.000	8 - 3	0.000	10 - 7	1.000
7 - 1	1.000	10 - 3	0.000	10 - 8	0.000

4.4.2 Interaction Assessment

Figure 4.13 depicts a plot of the labour productivity against KBC investment, conditioned on branch of industry. Due to the information described in 3.1.6 in section Outliers on page 22 and 3.2 in section Econometric method on page 24, the KBC investment and labour productivity are exposed to transformations seen in the right plot. The conditional variable illustrates the discrepancies amongst the branch industries. Focusing on the right plot, where the transformations have made the detection of linear dependencies clearer, there seem to exist a weak indication of linearity in the majority of the industry branches, except for *finance*.
Moreover examining the differences between the groups, it is suggested that weak *interaction* between the factors is existent since the impact on labour productivity due to the contribution of KBC investment varies, depending on the branch of industry.
Additional to the scatterplots, figure 4.13 presents the computed mean for KBC investment per employee per branch of industry. *Finance* display the highest value followed by *knowledge intensive service*. *Construction* is not coined with high levels of KBC investment. The chart pie display that the branch industry *knowledge intensive service* exhibits greater KBC investment in total value.

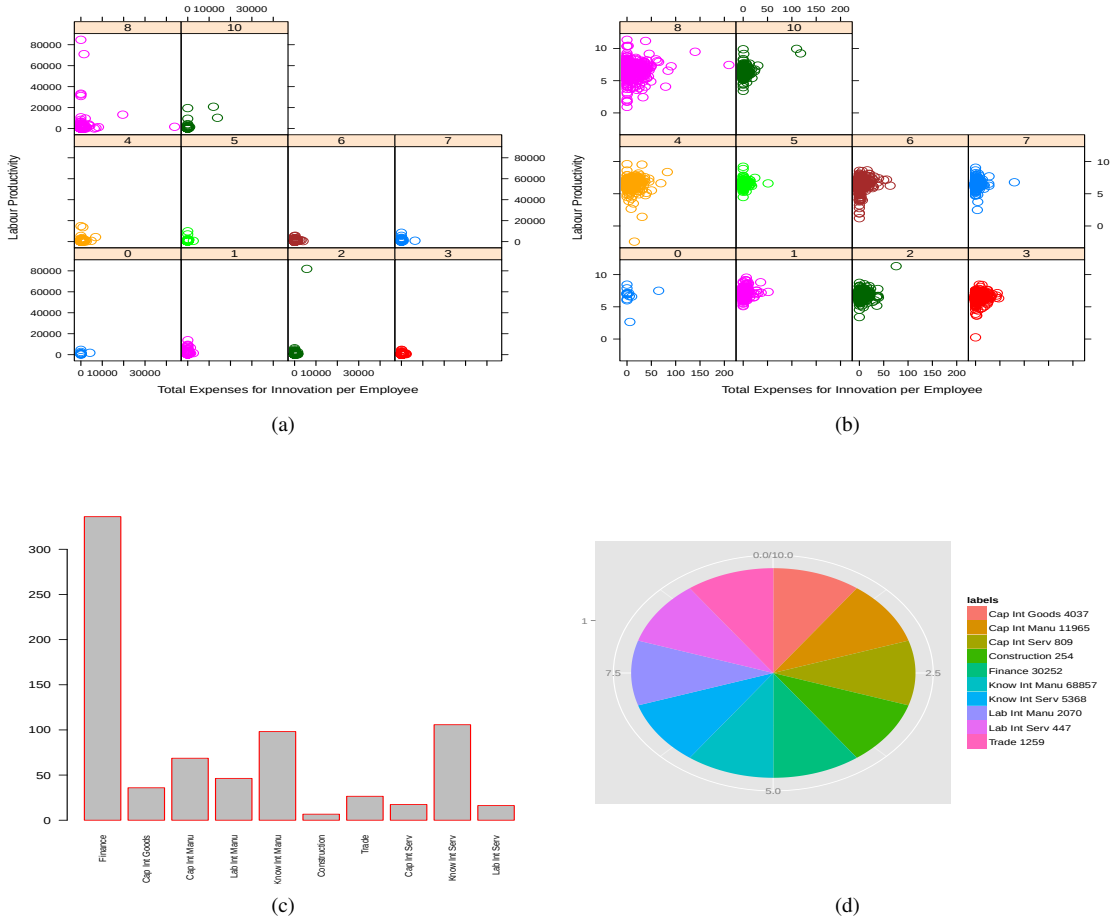


Figure 4.13: Top left: KBC investment per Employee VS Labour Productivity | Branch of Industry.
Top right: Square root of KBC investment per Employee VS Log Labour Productivity | Branch of Industry.
Bottom left: Distribution of the mean for Total Expenses for Software per Employee | Branch of Industry.
Bottom right: Distribution of the mean for Total Expenses for Software per Employee | Branch of Industry.

Figure 4.14 presents labour productivity against *capital per employee*, conditioned on branch of industry and labour productivity against *labour*, conditioned on branch of industry. As previously implemented for the KBC investment and labour productivity, analogous transformation for the explanatory variables *capital per employee* and *labour* are applied in order to make the detection of linear dependencies easier, shown in the plots.
According to the plots, association is existent in the majority of the groups, indicating a relationship between the explanatory variables and labour productivity. Logically capital per employee and labour should influence the labour productivity of firms.
In similar case of KBC investment, according to the plots there is a suggestion of *interaction* between the *capital per employee* and the dependent variable, while rejected for *labour*, due to being similar across the branch of industries.

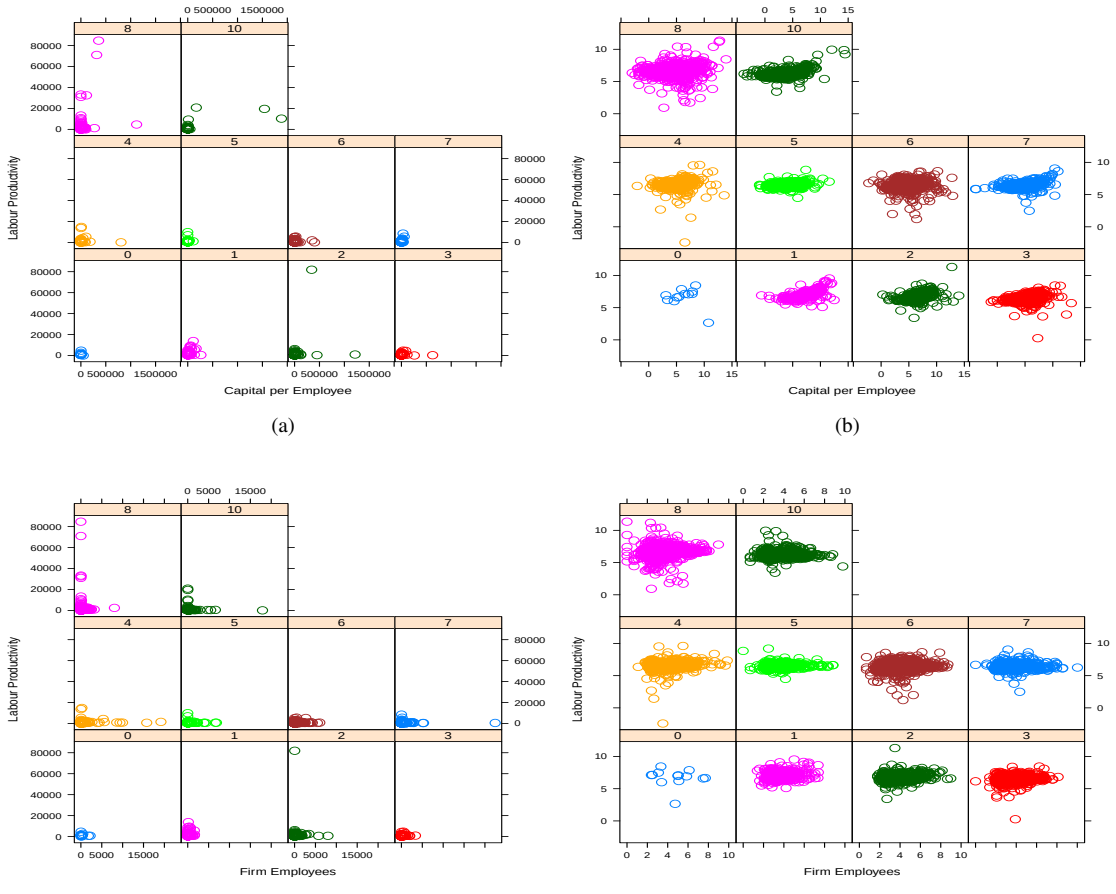


Figure 4.14: Top left: Capital per Employee VS Labour Productivity | Branch of Industry.
Top right: Log of Capital per Employee VS Log Labour Productivity | Branch of Industry.
Bottom left: Labour VS Labour Productivity | Branch of Industry.
Bottom right: Log of Labour VS Log Labour Productivity | Branch of Industry.

4.4.3 Regression results

Table 4.19 presents the results from the estimated models. The estimated models consists of a interaction model and one without the interrogated interaction. According to the table the suggestions of interaction are weakly strengthened for factors *capital per employee* and *branch of industry*, for specific branch of industries. The interaction term is rejected for the remaining interrogated factors.
The interaction model rejects the majority of the slope parameters while the model excluding the interaction finds that the *KBC investment*, *labour* and *capital per employee* to be significant. The intercept acts as the baseline of group *finance* (0).
The model that includes the interaction finds that branch of industry *capital intensive goods* (1) to be significant. Moreover according to the table, although very low, the adjusted R^2 value of the interaction model indicates a slightly better prediction of new observations.
Table 4.20 presents the interaction model and the simple model through a ANOVA test. Hence the simple model is *nested* within the interaction model (full model). The test examines if the bigger model adds more descriptive information than the simple model. Thus the null hypothesis tests if the additional terms are equal to zero, while the alternative hypothesis states that at least one of the additional terms is not equal to zero. The test rejects the hypothesis that the additional terms are equal to zero, stating that the interaction model fits better than the simple model, thus preferred.

Table 4.19: Regression results between interaction and no interaction models

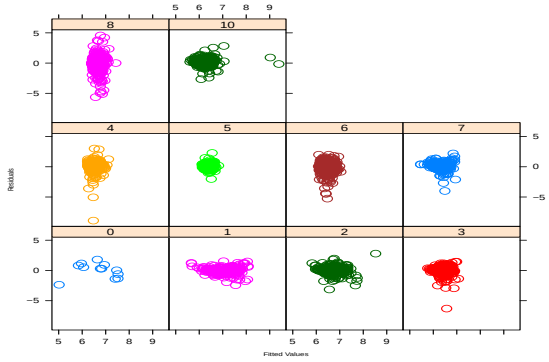
	Dependent variable:	
	Labour Productivity	
	(Inclusion of Interaction)	(Exclusion of Interaction)
KBC Investment Innovation	0.013	0.005^{***}
	(0.009)	(0.001)
Labour	-0.207^{**}	0.041^{***}
	(0.099)	(0.005)
Capital per Employee	-0.284^{***}	0.067^{***}
	(0.083)	(0.004)
Indicator for KBC investment	-3.893^{***}	0.399^{**}
	(0.849)	(0.164)
Branch 1	-3.735^{***}	0.076
	(0.846)	(0.162)
Branch 2	-3.630^{***}	-0.141
	(0.841)	(0.161)
Branch 3	-3.325^{***}	-0.068
	(0.842)	(0.162)
Branch 4	-3.276^{***}	-0.013
	(0.843)	(0.163)
Branch 5	-3.363^{***}	-0.142
	(0.840)	(0.161)
Branch 6	-3.428^{***}	-0.129
	(0.843)	(0.162)
Branch 7	-3.065^{***}	0.151
	(0.839)	(0.161)
Branch 8	-3.567^{***}	-0.187
	(0.842)	(0.162)
Branch 10	-0.026	-0.006
	(0.017)	(0.017)
KBC Investment Innovation:Branch 1	-0.004	
	(0.011)	
KBC Investment Innovation:Branch 2	-0.004	
	(0.010)	
KBC Investment Innovation:Branch 3	-0.004	
	(0.010)	
KBC Investment Innovation:Branch 4	-0.008	
	(0.010)	
KBC Investment Innovation:Branch 5	-0.004	
	(0.012)	
KBC Investment Innovation:Branch 6	0.007	
	(0.010)	
KBC Investment Innovation:Branch 7	-0.005	
	(0.011)	
KBC Investment Innovation:Branch 8	-0.010	
	(0.009)	
KBC Investment Innovation:Branch 10	0.007	
	(0.010)	
Labour:Branch 1	0.234^{**}	
	(0.103)	
Labour:Branch 2	0.252^{**}	
	(0.101)	
Labour:Branch 3	0.269^{***}	
	(0.100)	
Labour:Branch 4	0.272^{***}	
	(0.101)	
Labour:Branch 5	0.245^{**}	
	(0.101)	
Labour:Branch 6	0.254^{**}	
	(0.100)	
Labour:Branch 7	0.212^{**}	
	(0.101)	
Labour:Branch 8	0.256^{**}	
	(0.100)	
Labour:Branch 10	0.220^{**}	
	(0.101)	
Capital per Empl:Branch 1	0.479^{***}	
	(0.084)	
Capital per Empl:Branch 2	0.418^{***}	
	(0.084)	
Capital per Empl:Branch 3	0.362^{***}	
	(0.083)	
Capital per Empl:Branch 4	0.318^{***}	
	(0.084)	
Capital per Empl:Branch 5	0.334^{***}	
	(0.084)	
Capital per Empl:Branch 6	0.318^{***}	
	(0.083)	
Capital per Empl:Branch 7	0.367^{***}	
	(0.083)	
Capital per Empl:Branch 8	0.320^{***}	
	(0.083)	
Capital per Empl:Branch 10	0.382^{***}	
	(0.083)	
Constant	9.374^{***}	6.025^{***}
	(0.838)	(0.163)
Observations	7,456	7,456
R^2	0.185	0.156
Adjusted R^2	0.180	0.155
F Statistic	41.971^{***} (df = 40; 7415)	106.046^{***} (df = 13; 7442)
Note:		*p<0.1; **p<0.05; ***p<0.01

Figure 4.15 presents the diagnostics of the *interaction* model. In analogous manner to previous results the residuals (a) cluster towards the centre of the plot. They have a similar symmetry around the horizontal line with both positive and negative residuals. Hence there is no curvature in the residuals. The residual points are obviously not scattered, thus strengthening the weak linear relationship.
Unfortunatly the residuals are not normally distributed which is mostly related to the long-tailed distribution

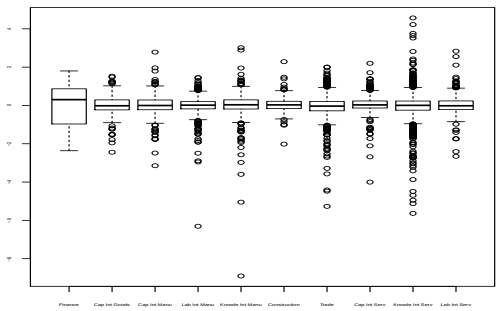
Table 4.20: Model Comparison

	Res.Df	RSS	Df	Sum of Sq	F	Pr(>F)
1	7415	2219.54				
2	7442	2296.63	-27	-77.09	9.54	0.0000

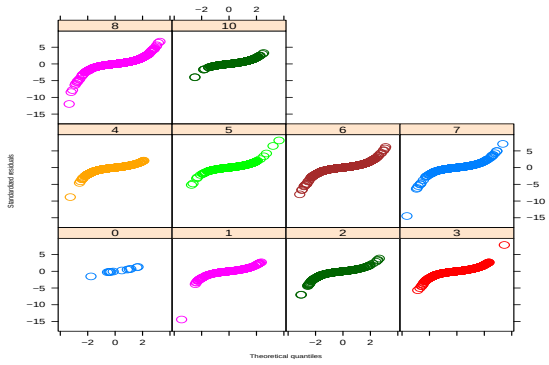
of labour productivity. The values are associated with the presence of large residuals from branch of industry groups containing greater labour productivity. Consequently the departure from the normality assumptions causes uncertainties concerning the p-values, since they can be incorrect due to the heavy-tailed error distribution.
A few outliers are visible according to the plot.



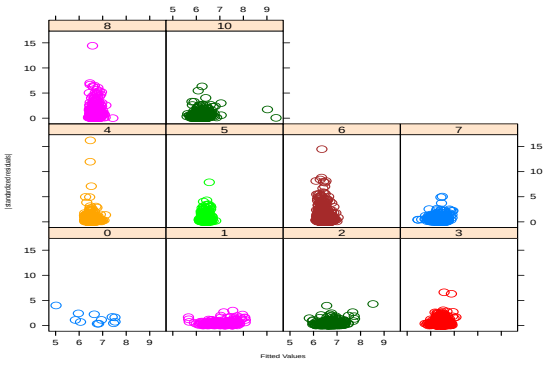
(a) Residuals vs Fitted



(b) Residual Boxplot



(c) Normal Q-Q



(d) Scale-Location

Figure 4.15: Diagnostic Plots of the Interaction Model

Table 4.21 presents the updated estimated model where the model only includes the interaction between the KBC investment *innovation* and branch of industry. Compared to the previous interaction model 4.19, variables *capital per employee*, *labour* are now significant and have a positive impact on the labour productivity, which is aligned with the plots of the explanatory variables and the labour productivity. Moreover the *KBC investment* is still perceived as not significant.
According to the table, although still low, the adjusted R^2 value of the new model indicates a weak prediction of new observations.
Table 4.22 presents the model comparisons of the previous interaction model with the new updated interaction model. The updated model is nested within the full model. The test rejects the hypothesis that the additional terms are equal to zero, stating that the full interaction model fits better than the updated interaction model.

Table 4.21: Regression results for the updated interaction model

	Dependent variable:
	Labour Productivity
KBC Investment Innovation	0.007
	(0.009)
Branch 1	0.392**
	(0.177)
Branch 2	0.056
	(0.176)
Branch 3	−0.141
	(0.174)
Branch 4	−0.040
	(0.175)
Branch 5	−0.007
	(0.175)
Branch 6	−0.153
	(0.174)
Branch 7	−0.122
	(0.175)
Branch 8	0.192
	(0.174)
Branch 10	−0.205
	(0.175)
Labour	0.042***
	(0.005)
Capital per Employee	0.066***
	(0.003)
Indicator for KBC investment Innovation	−0.026
	(0.017)
KBC Investment Innovation:Branch 1	0.006
	(0.010)
KBC Investment Innovation:Branch 2	0.006
	(0.010)
KBC Investment Innovation:Branch 3	0.002
	(0.010)
KBC Investment Innovation:Branch 4	−0.003
	(0.009)
KBC Investment Innovation:Branch 5	0.001
	(0.012)
KBC Investment Innovation:Branch 6	0.011
	(0.010)
KBC Investment Innovation:Branch 7	0.0002
	(0.010)
KBC Investment Innovation:Branch 8	−0.006
	(0.009)
KBC Investment Innovation:Branch 10	0.016
	(0.010)
Constant	6.021***
	(0.176)
Observations	7,456
R^2	0.126
Adjusted R^2	0.124
F Statistic	48.867*** (df = 22; 7433)
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 4.22: Model Comparison

	Res.Df	RSS	Df	Sum of Sq	F	Pr(>F)
1	7415	2219.54				
2	7433	2273.98	-18	-54.44	10.10	0.0000

4.4.4 Backward Elimination Method - Mallow's Cp

Table 4.23 presents the results from the backward elimination method with the model selection criteria of *Mallow Cp*, using bootstrap to assess the number of times the selection criteria prefers the parameters in question.
In comparison to the updated model 4.21 on page 58, the Mallow Cp once again disregards the parameters *KBC investment*, *capital per employee* and *labour*. In analogous manner from previous results, it perceives the branch of industry to contribute to labour productivity. Moreover, it finds the interaction between the factor *capital per employee* and *branch of industry*, *labour* and *branch of industry* relatively strong, indicated by the scatterplots. Thus is prefers the interaction where the interaction between the factors contribute to labour productivity, while disregarding the individual slopes of parameter capital per employee, labour and the KBC investment.

Table 4.23: Bootstrap with Backward Elimination Method - Mallow's Cp

	Dependent variable:		*Dependent variable:*
	Labour Productivity		Labour Productivity
KBC Investment Indicator Innovation	129	Labour:Branch 0	427
Branch 0	600	Labour:Branch 1	124
Branch 1	602	Labour:Branch 2	581
Branch 2	353	Labour:Branch 3	976
Branch 3	254	Labour:Branch 4	976
Branch 4	626	Labour:Branch 5	561
Branch 5	804	Labour:Branch 6	995
Branch 6	635	Labour:Branch 7	33
Branch 7	442	Labour:Branch 8	950
Branch 8	1000	Labour:Branch 10	251
Branch 10	0	Capital per Employee:Branch 0	821
KBC Investment Innovation:Branch 0	419	Capital per Employee:Branch 1	1000
KBC Investment Innovation:Branch 1	323	Capital per Employee:Branch 2	1000
KBC Investment Innovation:Branch 2	596	Capital per Employee:Branch 3	1000
KBC Investment Innovation:Branch 3	711	Capital per Employee:Branch 4	700
KBC Investment Innovation:Branch 4	453	Capital per Employee:Branch 5	994
KBC Investment Innovation:Branch 5	69	Capital per Employee:Branch 6	900
KBC Investment Innovation:Branch 6	1000	Capital per Employee:Branch 7	1000
KBC Investment Innovation:Branch 7	172	Capital per Employee:Branch 8	982
KBC Investment Innovation:Branch 8	488	Capital per Employee:Branch 10	1000
KBC Investment Innovation:Branch 10	800	KBC Investment Innovation	0
		Capital per Employee	0
		Labour	0
		Observations	3,431

4.5 Current status examination of organisational work and work environment in Swedish working life (2015 by *work Environment Authority*)

The obtained result for KBC components total expenses for education and competence development per employee and total expenses for re-organisation per employee will be presented in two separate subsections in order to avoid confusion. The model selection assessment will be presented in a grouped manner.

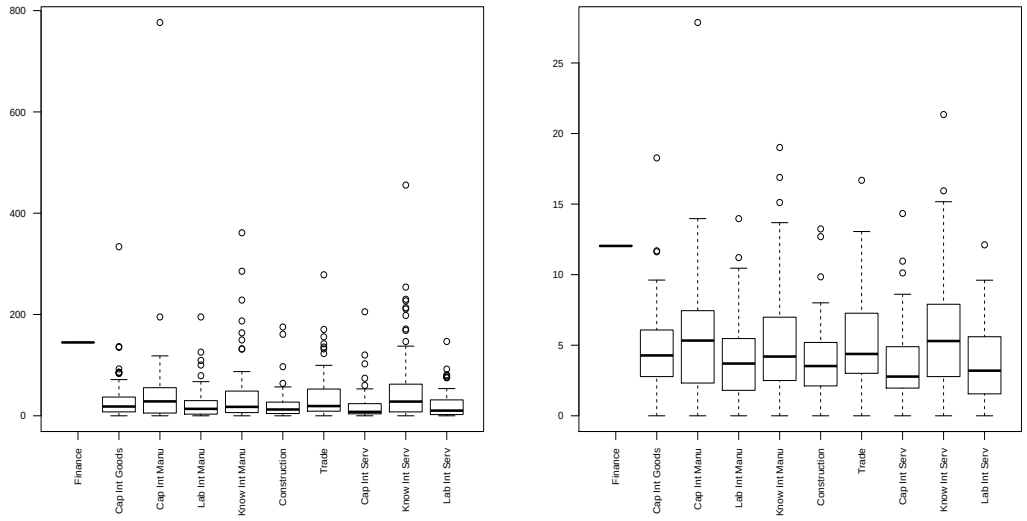
4.5.1 KBC Component - Total Expenses for Education and Competence Development Per Employee

Figure A.13 on page 109 presents three plots; the total expenses for education and competence development per employee, the square root of the the total expenses for education and competence development per employee and the distribution of the KBC component from the survey. According to the figure it is visible that the distribution of the KBC investment is still heavy-tailed after the transformation has occurred in an attempt to suppress the heavy-tailed distribution, in accordance to 3.1.6 in section Outliers on page 22 and 3.2.2 in section Model Description on page 25.
The figures A.13 contain a sample of 500 observations from the survey for an improved plot, while for the presented histogram, the full data set is presented. According to the histogram the KBC investment still takes the form of a heavy-tailed distribution after the transformation, although reduced.

4.5.2 Branch of Industry Assessment - Total Expenses for Education and Competence Development Per Employee

Figure 4.16 present a boxplot of total expenses for education and competence development per employee as a function of the branch of industries. Due to its heavy-tailed distribution an additional boxplot is presented where the square root transformation is applied to the KBC component.
According to the boxplot the outcome produces an improved and readable plot for the KBC investment per branch of industry, although slightly skewed for branch of industry *capital intensive manufacturing* and *knowledge intensive service*. Nonetheless it is more symmetric. Values perceived as extreme are still found in some industry branches.
Assessing the branch of industry comparisons, there seem to exist a slight indication of discrepancy in the KBC investment between the groups.

Table 4.24 presents the analysis of variance (ANOVA) test. It compares the mean of the KBC investment per employee between the. The test rejects the hypothesis that the mean KBC investment per employee is equal in all industry branches. Moreover since the standard deviation of each group is not equal due to its distribution, the table presents a non-parametric Kruskal-Wallis test which concludes the same as the ANOVA test.
Table 4.25 presents the Bonferroni post-hoc pairwise comparisons between the mean value of the groups. According to the table the KBC investment in group *capital intensive goods* is significantly different from all groups except for *finance* and *knowledge intensive service*. Moreover group *knowledge intensive service* is significantly different from the majority of the groups, except for *knowledge intensive manufacturing* and *finance*.



(a) (b)

Figure 4.16: Left: Boxplot of Total Expenses for Education and Competence Development Per Employee | Branch of Industry. Right: Boxplot of the Square Root of Total Expenses for Education and Competence Development Per Employee | Branch of Industry.

Table 4.24: Top: Anova summary. Bottom: Kruskal-Wallis

ANOVA Summary					
	Df	Sum Sq	Mean Sq	F value	Pr(>F)
as.factor(Bransch07_Crude)	9	546.87	60.76	5.47	0.0000
Residuals	715	7943.75	11.11		
Kruskal-Wallis Rank Sum Test					
	Chi-Squared	Df	P-value		
Kruskal-Wallis	45.2702	9	0.0000		

Table 4.25: Bonferroni method (post-hoc)

Branch of Industry	
1 - 0	1.000
2 - 0	1.000
3 - 0	1.000
4 - 0	1.000
5 - 0	0.042
6 - 0	1.000
7 - 0	0.216
8 - 0	1.000
10 - 0	0.187
2 - 1	0.000
3 - 1	0.000
4 - 1	0.000
5 - 1	0.000
6 - 1	0.000
7 - 1	0.000

Branch of Industry	
8 - 1	0.083
10 - 1	0.000
3 - 2	1.000
4 - 2	1.000
5 - 2	0.000
6 - 2	1.000
7 - 2	0.040
8 - 2	0.001
10 - 2	0.040
4 -3	0.443
5 - 3	0.000
6 - 3	1.000
7 - 3	0.106
8 - 3	0.000
10 - 3	0.107

Branch of Industry	
5 - 4	0.000
6 - 4	0.000
7 - 4	0.000
8 - 4	0.390
10 - 4	0.000
6 - 5	0.000
7 - 5	1.000
8 - 5	0.000
10 - 5	1.000
7 - 6	0.063
8 - 6	0.000
10 - 6	0.101
8 - 7	0.000
10 - 7	1.000
10 - 8	0.000

4.5.3 Interaction Assessment - Total Expenses for Education and Competence Development Per Employee

Figure 4.17 depicts a plot of labour productivity against KBC investment, conditioned on branch of industry. Due to the information described in 3.1.6 in section Outliers on page 22 and 3.2 in section Econometric method on page 24, the KBC investment and labour productivity are transformed, seen in the right plot. The conditional variable illustrates the differences amongst the branch industries. Focusing on the right plot, where the transformations have made the detection of linear dependencies easier, there seem to exist an indication of linearity in the majority of the industry branches. One should disregard group *trade* (0) due to its small group size.
Moreover examining the differences between the groups, it is suggested that *interaction* between the factors exist.
Additional to the plots, figure 4.17 presents the computed mean for KBC investment per employee per branch of industry. *Finance* display the highest value followed by *capital intensive manufacturing*. *Capital intensive service* is not coined with high levels of KBC investment. The chart pie display that the branch industry *capital intensive manufacturing* exhibits greater KBC investment in total value.

Figure 4.18 presents labour productivity against *capital per employee*, conditioned on branch of industry and labour productivity against *labour*, conditioned on branch of industry. As previously implemented for the KBC investment and labour productivity, analogous transformations for the explanatory variables *capital per employee* and *labour* are applied in order to detect the linearity, shown in the plots.
According to the plots, association is existent in all groups, indicating a relationship between the explanatory variables and labour productivity. Logically capital per employee and labour should influence the labour productivity of firms.
In similar case of KBC investment, according to the plots there is a weak suggestion of *interaction* between the factors *capital per employee*, *labour* and *branch of industry*, on the dependent variable.
Note that group *trade* (0) is to disregarded.

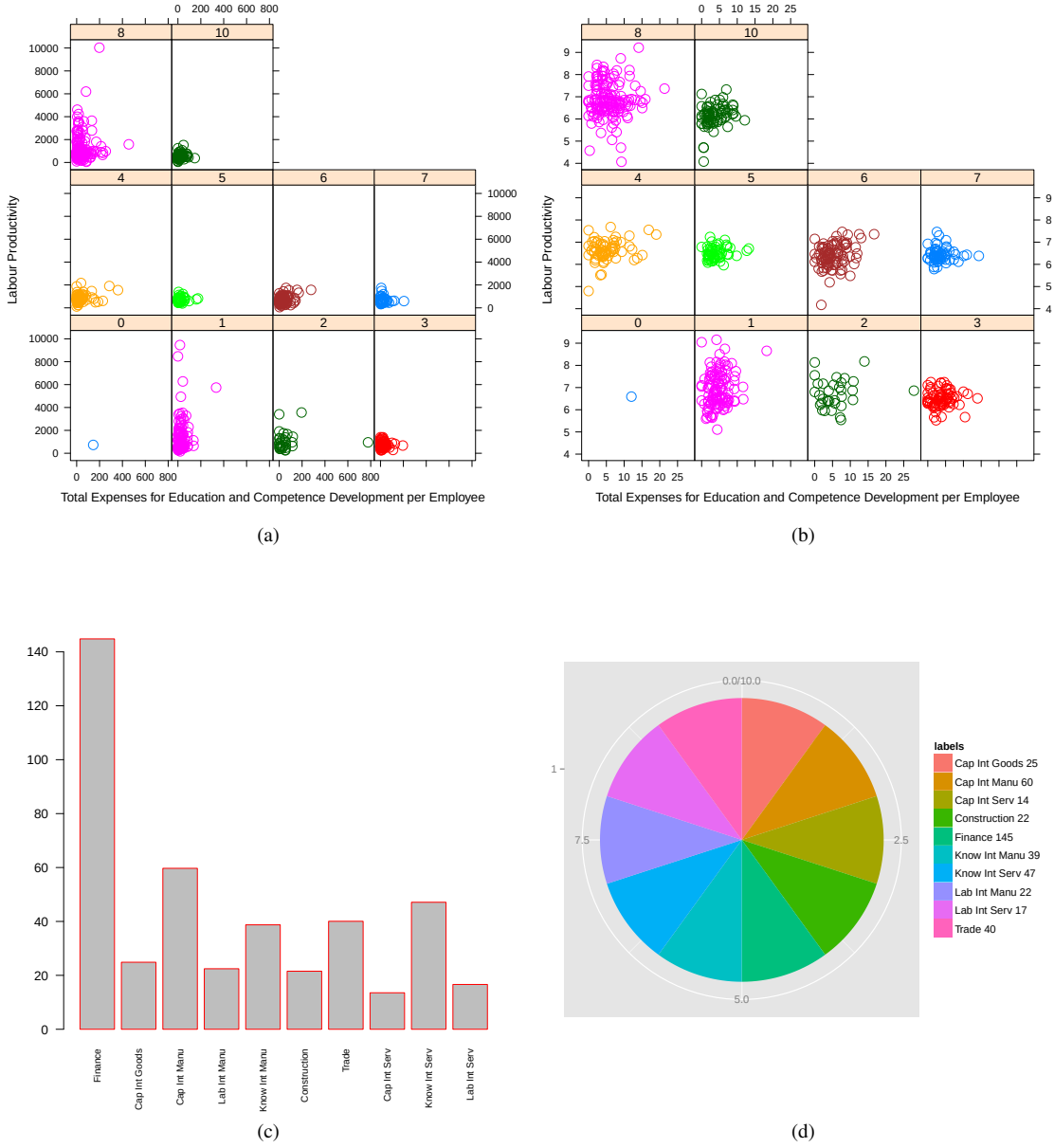
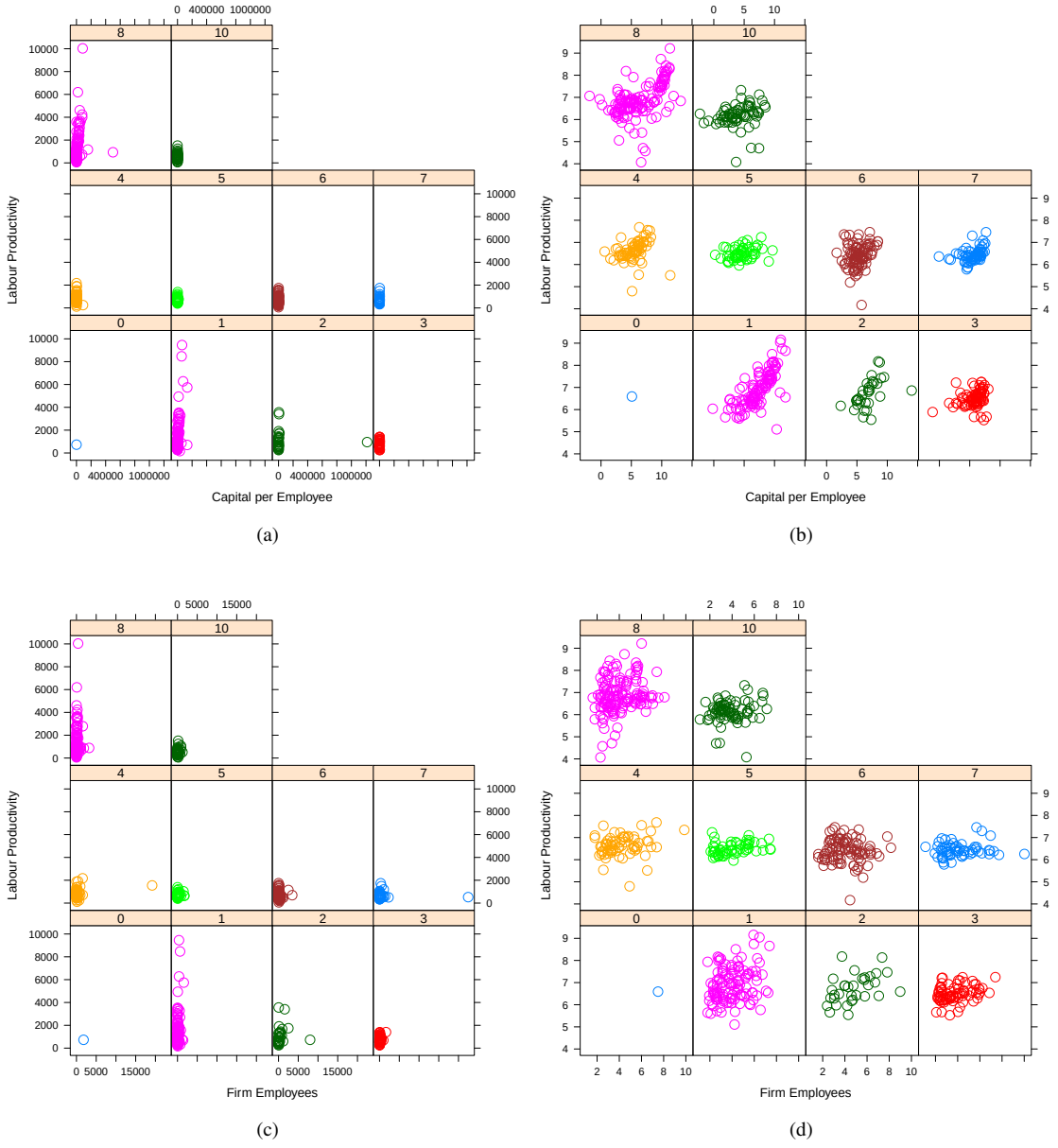


Figure 4.17: Top left: KBC investment per Employee VS Labour Productivity | Branch of Industry.
Top right: Square root of KBC investment per Employee VS Log Labour Productivity | Branch of Industry.
Bottom left: Distribution of the mean for Total Expenses for Education and Competence Development per Employee | Branch of Industry.
Bottom right: Distribution of the mean for Total Expenses for Education and Competence Development per Employee | Branch of Industry.



(a) (b)

(c) (d)

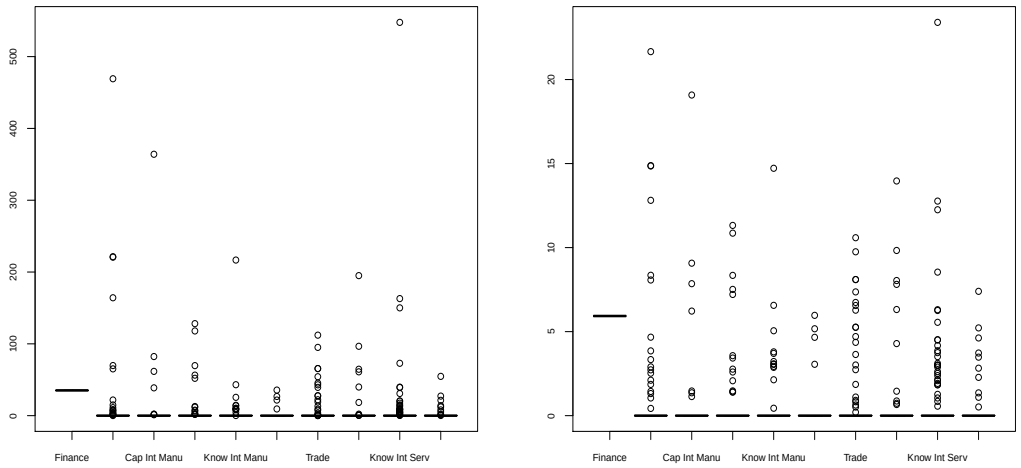
Figure 4.18: Top left: Capital per Employee VS Labour Productivity | Branch of Industry.
Top right: Log of Capital per Employee VS Log Labour Productivity | Branch of Industry.
Bottom left: Labour VS Labour Productivity | Branch of Industry.
Bottom right: Log of Labour VS Log Labour Productivity | Branch of Industry.

4.5.4 KBC Component - Total Expenses for Re-Organisation per Employee

Figure A.14 on page 109 presents three plots; the total expenses for re-organisation per employee, the square root of the the total expenses for re-organisation per employee and the distribution of the KBC component from the survey. According to the figure it is visible that the distribution of the KBC investment is still heavy-tailed after the transformation has occurred in an attempt to suppress the heavy-tailed distribution, in accordance to 3.1.6 in section Outliers on page 22 and 3.2.2 in section Model Description on page 25.
The figures A.14 contain a sample of 500 observations from the survey for an improved plot, while for the presented histogram, the full data set is presented. According to the histogram the KBC investment still takes the form of a heavy-tailed distribution after the transformation, barely reduced.

4.5.5 Branch of Industry Assessment - Total Expenses for Re-Organisation per Employee

Figure 4.19 present a boxplot of total expenses for re-organisation per employee as a function of the branch of industries. Due to its heavy-tailed distribution an additional boxplot is presented where the square-root transformation has been applied to the KBC component.
According to the boxplot the results from the transformation is neglible for the KBC investment per branch of industry. Moreover it is still heavy tailed for all the groups. Values perceived as extreme are still found in the majority of the industry branches.
Assessing the branch of industry comparisons, there does not seem to exist a slight indication of discrepancy in the KBC investment.



(a) (b)

Figure 4.19: Left: Boxplot of Total Expenses for Re-organisation per Employee | Branch of Industry. Right: Boxplot of the Square Root of Total Expenses for Re-organisation per Employee | Branch of Industry.

Table 4.26 compares the mean KBC investment per employee between the groups through the analysis of variance (ANOVA) test. The test does not reject the hypothesis of equal mean KBC investment between the groups. Moreover since the standard deviation of each sample may not be equal due to its distribution, the table presents a non-parametric Kruskal-Wallis test which concludes the same as the ANOVA test.

Table 4.27 presents the Bonferroni post-hoc pairwise comparisons between the mean value of the groups. According to the table the KBC investment in group *finance* is significantly not different from all groups except, while the other groups exhibit variability in their differences to specific groups.

Table 4.26: Top: Anova summary. Bottom: Kruskal-Wallis

ANOVA Summary					
hline	Df	Sum Sq	Mean Sq	F value	Pr(>F)
as.factor(Bransch07_Crude)	9	70.58	7.84	1.19	0.3007
Residuals	715	4727.38	6.61		
Kruskal-Wallis Rank Sum Test					
	Chi-Squared	Df	P-value		
Kruskal-Wallis	14.6947	9	0.09967		

Table 4.27: Bonferroni method (post-hoc)

Branch of Industry		**Branch of Industry**		**Branch of Industry**	
1 - 0	1.000	8 - 1	0.894	5 - 4	0.000
2 - 0	1.000	10 - 1	1.000	6 - 4	0.000
3 - 0	1.000	3 - 2	1.000	7 - 4	0.000
4 - 0	1.000	4 - 2	0.973	8 - 4	0.015
5 - 0	1.000	5 - 2	1.000	10 - 4	1.000
6 - 0	1.000	6 - 2	0.000	6 - 5	0.000
7 - 0	0.815	7 - 2	1.000	7 - 5	1.000
8 - 0	1.000	8 - 2	0.000	8 - 5	0.000
10 - 0	1.000	10 - 2	1.000	10 - 5	0.014
2 - 1	1.000	4 -3	1.000	7 - 6	0.000
3 - 1	1.000	5 - 3	0.002	8 - 6	1.000
4 - 1	1.000	6 - 3	0.001	10 - 6	0.000
5 - 1	0.817	7 - 3	0.000	8 - 7	0.000
6 - 1	0.672	8 - 3	0.032	10 - 7	0.000
7 - 1	0.009	10 - 3	1.000	10 - 8	0.000

4.5.6 Interaction Assessment - Total Expenses for Re-Organisation per Employee

Figure 4.20 depicts a plot of labour productivity against KBC investment, conditioned on branch of industry. Due to the information described in 3.1.6 in section Outliers on page 22 and 3.2 in section Econometric method on page 24, the KBC investment and labour productivity are transformed, seen in the right plot. The conditional variable illustrates the discrepancies amongst the branch industries. Focusing on the right plot where the transformations are negligible, the indication of linearity is rejected.
Moreover examining the differences between the groups, it is suggested that *interaction* between the factors does not exist as since their contribution to labour productivity is the same across the groups.
Additional to the scatterplots, figure 4.20 presents the computed mean for KBC investment per employee per branch of industry. *Finance* display the highest value followed by *capital intensive goods*. One must take into account that the sample sizes of each group can exhibit great differences. *Construction* and *labour intensive service* is not coined with high levels of KBC investment. The chart pie display that the branch industry *capital intensive goods* exhibit greater KBC investment in total value.

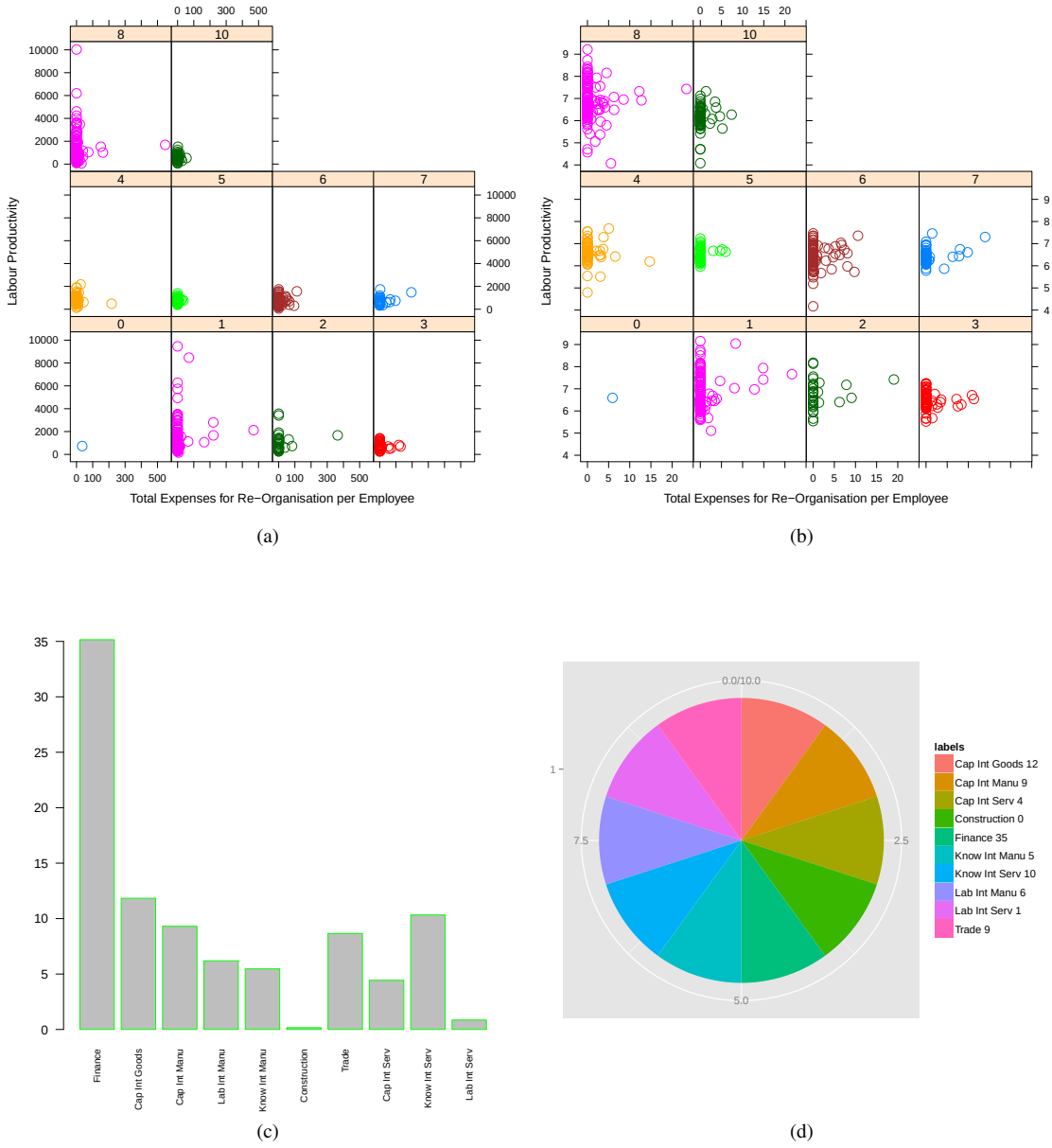


Figure 4.20: Top left: KBC investment per Employee VS Labour Productivity | Branch of Industry.
Top right: Square root of KBC investment per Employee VS Log Labour Productivity | Branch of Industry.
Bottom left: Distribution of the mean for Total Expenses for Re-Organisation per Employee | Branch of Industry.
Bottom right: Distribution of the mean for Total Expenses for Re-Organisation per Employee | Branch of Industry.

4.5.7 Regression results

Table 4.28 presents the results from the estimated models. The estimated models consists of a interaction model and one without the interrogated interaction. According to the table the suggestions of interaction are further weakened for all factors. The intercept acts as the baseline of group *finance* (0).
Slope parameter *KBC investment education and competence development* is significant on labour productivity for both models. *KBC investment re-organisation* is weak significant for the model that excludes the interaction.
Peculiarly analogous with previous results, *labour* and *capital per employee* is only significant for the model that excludes the interaction even though the plots presents a relationship between the explanatory variables and labour productivity.
Furthermore the model that excludes the interaction finds the indicators for KBC investments to be significant.
According to the table, although very low, the adjusted R^2 value of the interaction model indicates a slightly better prediction of new observations.
Table 4.29 presents the model comparison of the two models through a ANOVA test. The test rejects the hypothesis of equal models, thus the greater model adds more information than the simple model since few interaction groups contributes to the model. Due to not finding the variables significant in influencing the *labour productivity*, further tests are not made. The results will be aligned with the results from the previous survey 4.4, Community Innovation Survey 2012 - 2014 on page 74 since the sample size derives from survey Community Innovation Survey 2012 - 2014.

Table 4.28: Regression results between interaction and no interaction models

	Dependent variable:	
	Labour Productivity	
	(Inclusion of Interaction)	(Exclusion of Interaction)
KBC Investment Education and Competence Development	0.058***	0.024***
	(0.022)	(0.006)
KBC Investment Re-Organisation	0.049	0.046***
	(0.047)	(0.011)
Labour	0.035	0.044***
	(0.048)	(0.014)
Capital per Labour	0.055**	0.122***
	(0.026)	(0.009)
Indicator for KBC investment Education and Competence Development	−0.521	0.358
	(0.705)	(0.517)
Indicator for KBC investment Re-Organisation	−0.152	0.128
	(0.777)	(0.521)
Branch 1	0.642	0.142
	(0.723)	(0.518)
Branch 2	0.742	0.276
	(0.713)	(0.517)
Branch 3	0.801	0.274
	(0.721)	(0.519)
Branch 4	0.414	0.083
	(0.725)	(0.516)
Branch 5	0.525	0.105
	(0.740)	(0.519)
Branch 6	0.224	0.422
	(0.699)	(0.516)
Branch 7	0.252	0.031
	(0.573)	(0.518)
Branch 8	−0.192**	−0.196**
	(0.092)	(0.092)
Branch 10	−0.277***	−0.315***
	(0.075)	(0.073)
KBC Investment Education and Competence Development:Branch 1	−0.024	
	(0.028)	
KBC Investment Education and Competence Development:Branch 2	−0.079***	
	(0.030)	
KBC Investment Education and Competence Development:Branch 3	−0.043	
	(0.030)	
KBC Investment Education and Competence Development:Branch 4	−0.024	
	(0.027)	
KBC Investment Education and Competence Development:Branch 5	−0.044	
	(0.034)	
KBC Investment Education and Competence Development:Branch 6	−0.006	
	(0.027)	
KBC Investment Education and Competence Development:Branch 7	−0.063*	
	(0.033)	
KBC Investment Education and Competence Development:Branch 8	−0.038	
	(0.025)	
KBC Investment Education and Competence Development:Branch 10		
KBC Investment Re-Organisation:Branch 1	0.012	
	(0.048)	
KBC Investment Re-Organisation:Branch 2	−0.036	
	(0.052)	
KBC Investment Re-Organisation:Branch 3	−0.033	
	(0.051)	
KBC Investment Re-Organisation:Branch 4	−0.033	
	(0.053)	
KBC Investment Re-Organisation:Branch 5	0.037	
	(0.069)	
KBC Investment Re-Organisation:Branch 6	−0.002	
	(0.050)	
KBC Investment Re-Organisation:Branch 7	0.021	
	(0.051)	
KBC Investment Re-Organisation:Branch 8	−0.024	
	(0.048)	
KBC Investment Re-Organisation:Branch 10		
Labour:Branch 1	0.028	
	(0.059)	
Labour:Branch 2	0.095	
	(0.078)	
Labour:Branch 3	0.035	
	(0.067)	
Labour:Branch 4	−0.028	
	(0.066)	
Labour:Branch 5	0.006	
	(0.067)	
Labour:Branch 6	−0.062	
	(0.061)	
Labour:Branch 7	−0.007	
	(0.062)	
Labour:Branch 8	0.055	
	(0.056)	
Labour:Branch 10		
Capital per Empl:Branch 1	0.175***	
	(0.033)	
Capital per Empl:Branch 2	0.099	
	(0.063)	
Capital per Empl:Branch 3	−0.019	
	(0.046)	
Capital per Empl:Branch 4	0.012	
	(0.047)	
Capital per Empl:Branch 5	−0.028	
	(0.044)	
Capital per Empl:Branch 6	0.039	
	(0.048)	
Capital per Empl:Branch 7	0.026	
	(0.049)	
Capital per Empl:Branch 8	0.082***	
	(0.029)	
Capital per Empl:Branch 10		
Constant	5.534***	5.587***
	(0.681)	(0.530)
Observations	709	709
R^2	0.461	0.385
Adjusted R^2	0.422	0.371
F Statistic	12.020*** (df = 47; 661)	28.897*** (df = 15; 693)
Note:		*p<0.1; **p<0.05; ***p<0.01

Table 4.29: Model Comparison

	Res.Df	RSS	Df	Sum of Sq	F	Pr(>F)
1	661	157.53				
2	693	179.74	-32	-22.21	2.91	0.0000

Chapter 5

Discussion

5.1 Measurement of the KBC investment

A debatable aspect for this study is the measurement creation for the KBC investments in order to identify the estimated value of the KBC components distributed towards the branch of industries in Sweden. Currently there does not exist research for the accumulation of the KBC investment on micro level, referring to enterprise level. Current research regarding the KBC investments is approximated on macro level and thus display its development on an aggregated level, as a percentage of the GDP. Therefore the assessment concerning KBC investments will lack dimension and more importantly not represent an accurate presentation concerning the KBC investments and its relation to the firms. Consequently measurements had to be created with the help of expertise and the FDB-database supplied by SCB. If the trend in size growth of KBC investment continues to escalate and its causality to economies continues to increase, a change in the regulations set by policymakers will not be far away in order to adapt to the ”new economy”. With developments of the national accounts and new policies concerning accounting, the extraction of KBC investments will hopefully become more transparent. Nevertheless the creation of the measurements were vital due to the current insufficient databases concerning KBC investments in order to achieve a visual concerning the current distribution of KBC investment in Sweden towards the branch of industries. Hence the process implementation for the measurement creation of KBC investments can be used as a reference for future assessment.

5.2 Regression Model

An explanation to the weak results of the chosen model and its model fit, is related to the lack of additional explanatory variables and more importantly, the time perspective; historical data points needed to assess the contributions of investment on labour productivity over a longer time span. Unfortunately current relevant variables are not accessible because of the accumulation difficulties or because additional relevant explanatory variables are unknown at this point in time. Still, modelling suggested that an association between labour productivity and KBC investments existed. Thus there was an indication agreement in the obtained results and the results of Haskel (2012), although weak, due to the lack of historical data.
Supplementary known influential explanatory variables that contribute to the labour productivity were not supplied by Statistics Sweden for this study due to the goals and limitations of this study. An added dimension to the explanation of labour productivity could be the individual level of employees, such as the educational level of the employees.
Since the majority of the observations that participated in the surveys did not exhibit any KBC investments, the presented distribution was asymmetrical, implying that a minority of the observations actually invested

in KBC assets. Nonetheless, the results are meant to illustrate how KBC investments can be analysed and how to develop databases for the collection of KBC assets. More importantly, the results presented the current status of KBC investments and its distribution in the Swedish economy.

5.2.1 Missing values

Minor unanswered sub-query's can result with a great loss of observations. It was therefore imperative to allocate the reason behind the missing data. Given the substance of the surveys and its extensiveness, the missing values may not have been random (*MNAR*). Besides the already discussed grounds related to this thesis concerning missing values in 3.1.5 on page 21, further ground is needed to be covered. Missing values can furthermore arise due to secrecy of the companies or the reluctance to reveal sensitive information concerning their operations and risk exposure. The simple scenario of unknown information as a cause of complexity within the firm can also be the case (Soley-Bori, 2013). Moreover, there are questions in the surveys that are difficult to comprehend for the participants or difficult to distinguish from one another; the survey caretaker might not be inserted in the concerned field of questions. Consequences related to the discussed circumstances will result with data sets that suffer from a great portion of observations that contain missing values, spread out in various variables.
Deciding on the best path that will subsequently result with the optimum results is difficult. There are various methods to deal with the various types of missing data. With the inclusion of the chosen method used in 3.1.5 on page 21, there is deletion methods consisting of *partial deletion* and *listwise deletion*, single imputation methods such as *mean substitution* or model based methods consisting of *maximum likelihood* or *multiple imputation*; see (Rubin, 2002; Schafer, 1997). Using deletion methods such as listwise deletion or pairwise deletion has its positives with a combination of its negatives. *Listwise deletion* will return a data set with observations where full information is available. Thus it excludes observations that exhibit missing values in any of the variables, reducing the sample size. The advantages here is the simplicity of its execution and it enables comparability across various analysis but it reduces the statistical power of the inferences due to the loss of observations. Consequently due to the nature of the surveys used for this thesis, the loss of observations will be large given the high probability that the missingness is not random and the large portion of observations containing missing values in various variables. Moreover the data set might lose large quantities of imperative information due to the loss of many observations. *Pairwise deletion* only removes the variables from the observations that are missing, hence it retains as much information as possible which is positive but it becomes difficult to compare analyses due to sample discrepancies over time. Single imputation methods enables the analysis to run at complete case but it increases the biasness of the estimates. There are various methods considered to the family of imputation. *Mean-* or *median substitutions* replaces the missing value with the mean or median. The substituted value can be computed by allocating the stratum of the observation or other parameters of interest when computing the substituted value.

One can argue that the implementation of changing the non-respondents to no for indicator based variables and zero for numerical based variables in order to retain observations is an incorrect imputation of the data. The logic behind the chosen procedure given a non-response or the response alternative that result with a recorded missing value is believed to be robust given the structure of the surveys and rationality of the survey caretaker. Thus the sample size remained intact and the assessment concerning the distribution of KBC assets remained stronger. Deleting the missing values could have decreased the likelihood of the statistical analysis from being distorted when assessing the data, although subsequently exhibiting weaker statistical power due to the sample size reduction.

Once historical data concerning the observations deriving from the surveys are collected, the imputations will be more accurate by examining the pattern of an observation. Another possibility would be to consider the stratum distribution, the branch of industry distribution or the size magnitude of the corporation when computing the median or mean for the missing values. Considering both branch of industry and the magnitude of the corporations in the stratum's would exclude the potential threat of grouping enterprises with large spread in their KBC investments or grouping together enterprises operating in different markets.

Hence obtaining a more precise measurement for the mean or median.

5.3 Quadruple merge

A discussed approach during this study was to pivot to a merged data set for further assessment; containing data from each individual survey. An issue that arose with the merged data set was the loss of observations. Due to having surveys with different purposes and aim, they targeted different populations marked by specific attributes and therefore the population sampling is non-identical. Moreover, the size of the surveys differ. Therefore a cross-sectional data set was obtained when merging the data sets deriving from the surveys. Observations not in union in all the surveys were removed due to the matching difficulty amongst the surveys. Consequently the size of the merged data set was much smaller in comparison to the surveys in their original state. With great probability the observations that remained are the firms with an employee staff of 200 or more. These observations are obligated to participate in the majority of the surveys created at SCB in order to obtain more harmony amongst the surveys.

Moreover, since this thesis deals with multiple surveys resulting with data originating from various data sources, it increases the sensitivity regarding the deletion of extreme values when examining each data set individually. Observations perceived as extreme or highly influential in data set A, might not be extreme or highly influential in data set B given that there exist an intersection for that observation. Deleting observations exhibiting extreme values with regard to one KBC component might remove vital information regarding a different KBC component whom its value is not extreme. Thus in the merged case and for the individual cases of each survey, the deletion of an observation is very sensitive. The same case iterates itself when plotting the KBC components towards labour productivity and accounting for the branch of industry differentiation.

An additional issue that arose with the merged data set was the allocated weights. Each survey had allocated weights attached to each observation in order to get a correct representation of the Swedish industry. Merging the data set would misplace the weights and their purpose, thus returning inaccurate representation of the Swedish industry.

5.4 Future work

The progression in the assessment concerning the KBC investments is dependent on the continuous accumulation of data in the field of KBC assets. Thus future data is imperative to strengthen the conclusion concerning the KBC investments and the topics linked to KBC assets. Tapping into a data source where historical data is supplied enhances the drawn conclusion regarding the course of the KBC investments within the economy and its estimated value. With the supply of time series data, the assessment whether KBC investments contribute to the labour productivity of firms and the economys workforce will be enabled. According to economics, todays implemented investments will not display a positive output in the results until a few years (E. Parcharidis). Thus the conclusion concerning its contribution is in need of more data. However this study set out to identify KBC investments in Sweden and to develop a framework boundary regarding the construction for the measurement of the KBC investments in order to increase the quality for the field of KBC investment. Thus the illustration of KBC investments and its spread on Sweden's industry was achieved.

A milestone during this study was to examine the expenditures on KBC investments per branch of industry, with the crudest classification concerning the companies. The assessment with a selective classification considering the firms would have been very interesting and more informative. The examination could then have been more meticulous. Furthermore it would be very interesting to view the discrepancies in the magnitude classification of firms.

Chapter 6

Conclusions

This thesis set out to increase the quality of the current database for the KBC investments by identifying components defined as KBC investments according to the theoretical framework, and initiating a framework embryo for the construction concerning measurements of the KBC investments. With the guidelines given by Tillväxtanalys (Tillväxtanalys, 2014) the accumulation of the KBC investments was accomplished on a micro level. With the accumulated data, a descriptive illustration of the expenditures on the KBC investments per industry in Sweden was enabled. According to the study, branch of industry *knowledge intensive service* and *finance* featured high levels of KBC investment, while branch of industry *construction* marked low levels of KBC investments.

Moreover, the study aimed to assess the relationship between KBC investments and labour productivity of firms. Additionally, an objective was to assess if KBC investments increases the economic results of firms due to the increased labour productivity of firms; since the increase in labour productivity indicates a growth in added value of firms. Hence the indication statement of growth in the economic results with the contribution of KBC investments. The obtained results presented a small indication of contribution concerning the KBC investments on labour productivity. Unfortunately, further data collected at consistent time points in the future is needed to assess the significant possible contribution of KBC investments to the labour productivity, both for Sweden's economy and economic growth of both Sweden and its enterprises. Thus, the results of this study concerning the relationship between labour productivity and KBC investments should be taken with a grain of salt.
Strengthening the databases for KBC investments will become important for future understanding and assessment concerning the trajectory of the Swedish economy. Further enhancement concerning the research field of KBC investments and the identification of the KBC components will be vital.

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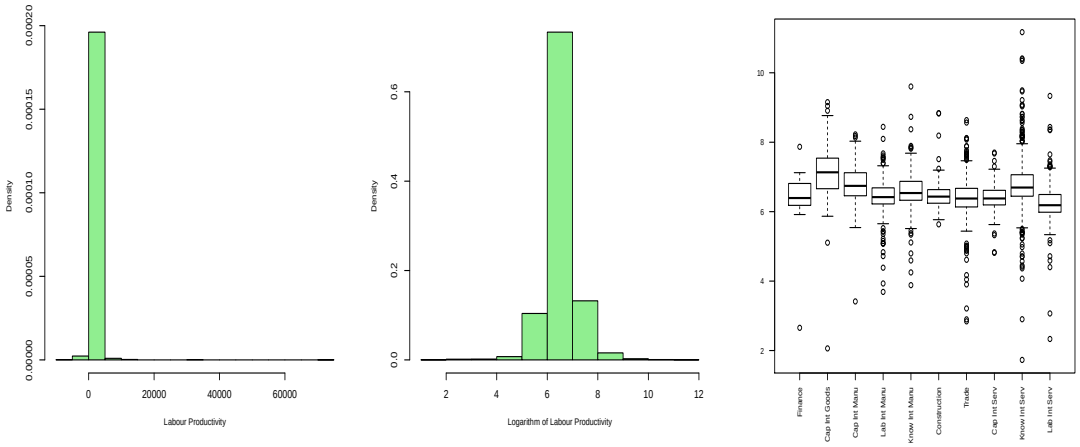
Appendix A

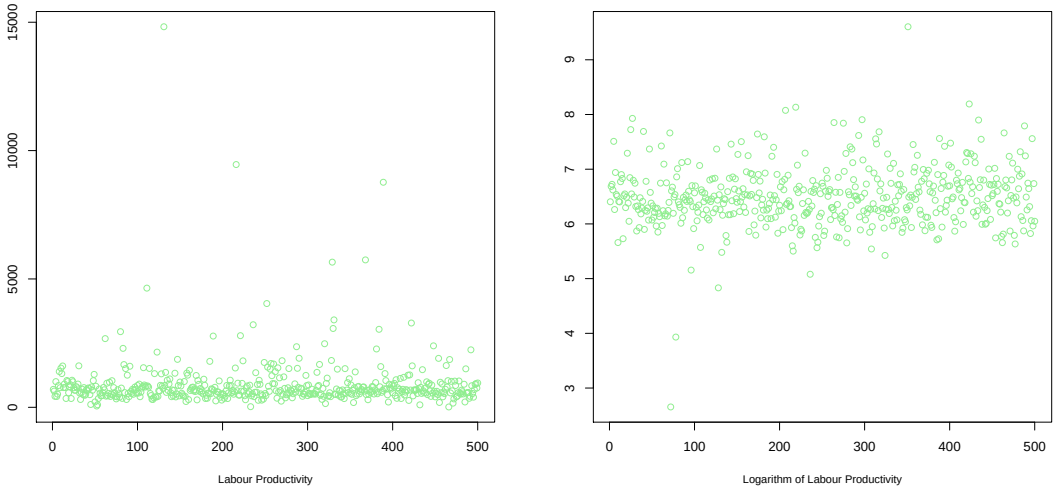
Appendix

A.1 ICT usage in firms 2014



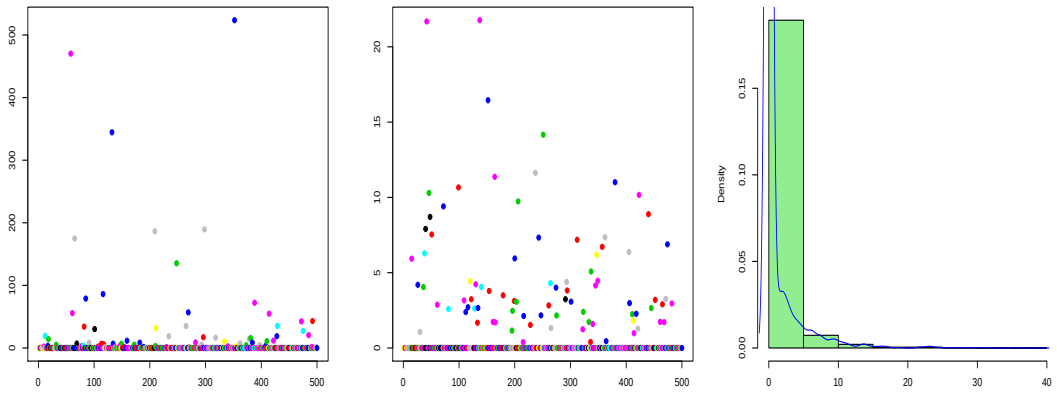
(a) (b) (c)

Figure A.1: Left: Distribution of Firms Labour Productivity in Survey ICT usage in firms. Right: Distribution of Firms Log Labour Productivity in Survey ICT usage in firms.



(a) (b)

Figure A.2: Left: Plot of Firms Labour Productivity in Survey ICT usage in firms. Right: Plot of Firms **Log** Labour Productivity in Survey ICT usage in firms. Note: Both present a sample of 500 observations for a clearer vision.



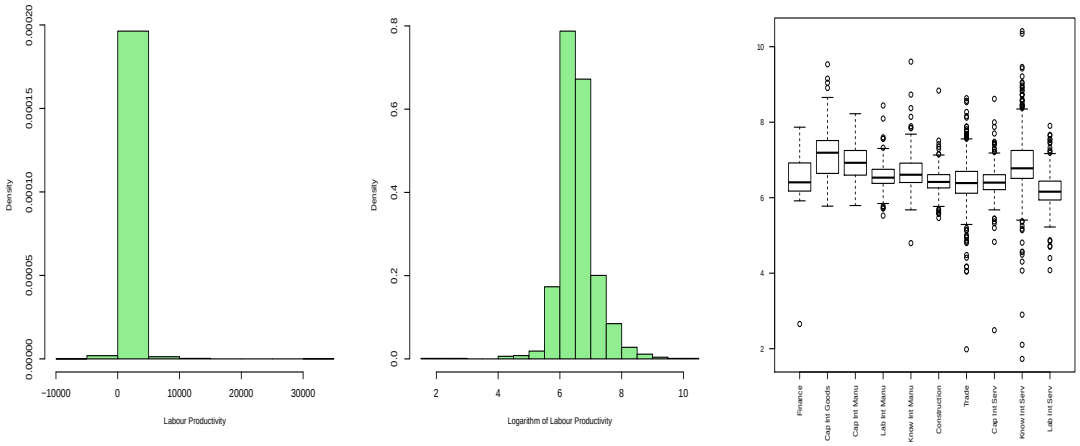
(a) (b) (c)

Figure A.3: Left: Total Expenditure for Software Development for Own Usage per Employee.
Middle: Square Root of Total Expenditure for Software Development for Own Usage per Employee
Right: Histogram of Square Root of Total Expenditure for Software Development for Own Usage per Employee.

Table A.1: Regression comparison results

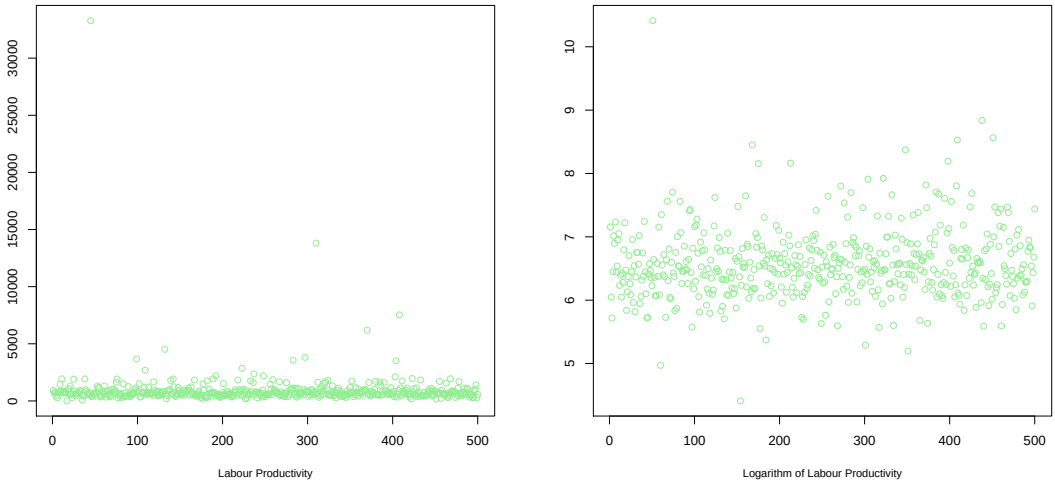
	Dependent variable:	
	Labour Productivity	
	(Scenario 1)	(Scenario 2)
KBC Investment	−0.237***	−0.237***
	(0.087)	(0.087)
Labour	0.019	0.019
	(0.198)	(0.197)
Capital per Labour	0.170	0.170
	(0.208)	(0.207)
Indicator for KBC investment	0.202	0.202
	(0.783)	(0.781)
Branch 1	−0.857	−1.015
	(1.348)	(1.350)
Branch 2	−0.393	−0.410
	(1.329)	(1.325)
Branch 3	−0.186	−0.168
	(1.309)	(1.305)
Branch 4	−0.048	−0.044
	(1.311)	(1.307)
Branch 5	0.361	0.353
	(1.305)	(1.301)
Branch 6	0.167	0.180
	(1.304)	(1.300)
Branch 7	0.240	0.128
	(1.311)	(1.309)
Branch 8	0.432	0.410
	(1.304)	(1.300)
Branch 10	−0.099	−0.095
	(1.307)	(1.305)
KBC Investment:Branch 1	0.289***	0.288***
	(0.103)	(0.102)
KBC Investment:Branch 2	0.256**	0.253**
	(0.119)	(0.119)
KBC Investment:Branch 3	0.237***	0.237***
	(0.090)	(0.090)
KBC Investment:Branch 4	0.278***	0.278***
	(0.096)	(0.096)
KBC Investment:Branch 5	0.138	0.138
	(0.100)	(0.099)
KBC Investment:Branch 6	0.236***	0.234***
	(0.089)	(0.089)
KBC Investment:Branch 7	0.247**	0.254**
	(0.101)	(0.101)
KBC Investment:Branch 8	0.225***	0.225***
	(0.087)	(0.087)
KBC Investment:Branch 10	0.305***	0.304***
	(0.094)	(0.094)
Labour:Branch 1	0.026	0.020
	(0.209)	(0.208)
Labour:Branch 2	0.079	0.073
	(0.206)	(0.206)
Labour:Branch 3	0.025	0.023
	(0.200)	(0.199)
Labour:Branch 4	0.051	0.051
	(0.201)	(0.200)
Labour:Branch 5	−0.053	−0.051
	(0.199)	(0.199)
Labour:Branch 6	0.027	0.027
	(0.198)	(0.198)
Labour:Branch 7	−0.053	−0.047
	(0.200)	(0.199)
Labour:Branch 8	0.035	0.037
	(0.199)	(0.198)
Labour:Branch 10	0.019	0.025
	(0.200)	(0.200)
Capital per Empl:Branch 1	0.060	0.082
	(0.211)	(0.211)
Capital per Empl:Branch 2	−0.059	−0.054
	(0.211)	(0.211)
Capital per Empl:Branch 3	−0.080	−0.082
	(0.208)	(0.208)
Capital per Empl:Branch 4	−0.102	−0.102
	(0.209)	(0.208)
Capital per Empl:Branch 5	−0.111	−0.111
	(0.208)	(0.207)
Capital per Empl:Branch 6	−0.143	−0.145
	(0.208)	(0.207)
Capital per Empl:Branch 7	−0.110	−0.094
	(0.208)	(0.208)
Capital per Empl:Branch 8	−0.122	−0.119
	(0.208)	(0.207)
Capital per Empl:Branch 10	−0.098	−0.102
	(0.208)	(0.208)
Indicator KBC:Branch 1	−0.309	−0.287
	(0.869)	(0.866)
Indicator KBC:Branch 2	−0.261	−0.246
	(0.857)	(0.855)
Indicator KBC:Branch 3	−0.064	−0.061
	(0.799)	(0.797)
Indicator KBC:Branch 4	−0.667	−0.666
	(0.803)	(0.801)
Indicator KBC:Branch 5	0.489	0.489
	(0.834)	(0.831)
Indicator KBC:Branch 6	−0.165	−0.163
	(0.794)	(0.794)
Indicator KBC:Branch 7	−0.146	−0.158
	(0.849)	(0.847)
Indicator KBC:Branch 8	−0.317	−0.331
	(0.786)	(0.784)
Indicator KBC:Branch 10	−0.714	−0.761
	(0.832)	(0.839)
Constant	5.932***	5.932***
	(1.302)	(1.298)
Observations	3,819	3,722
R^2	0.154	0.149
Adjusted R^2	0.143	0.138
F Statistic	13.976*** (df = 49; 3769)	13.152*** (df = 49; 3672)
Note:		*p≤0.1; **p≤0.05; ***p≤0.01

A.2 Expenditures in IT and Marketing in firms 2014



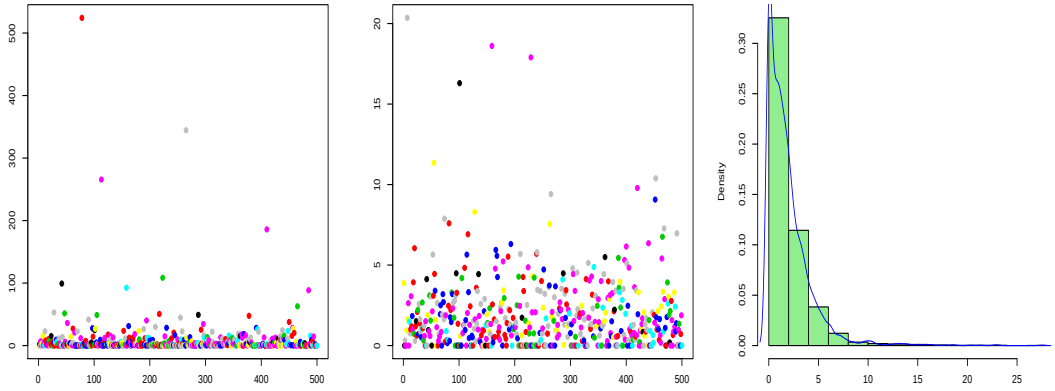
(a) (b) (c)

Figure A.4: Left: Distribution of Firms Labour Productivity in Survey Expenditures in IT and Marketing. Middle: Distribution of Firms Log Labour Productivity in Survey Expenditures in IT and Marketing. Right: Boxplot of Firms log labor productivity by branch of industry in Survey Expenditures in IT and Marketing.



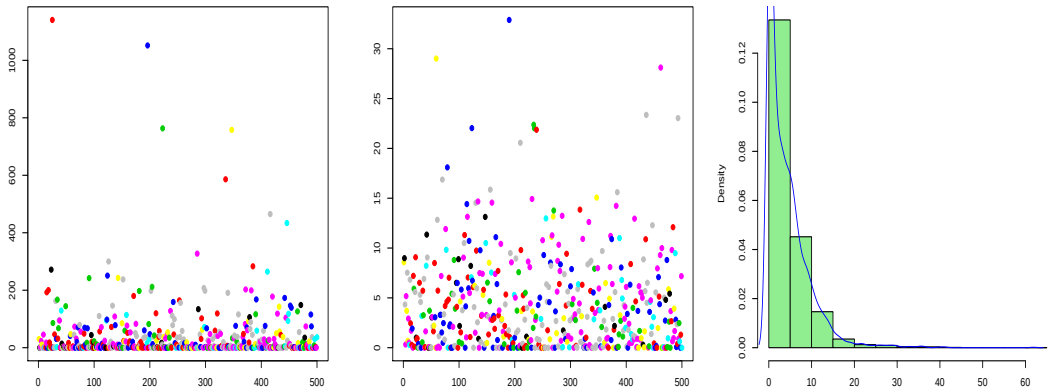
(a) (b)

Figure A.5: Left: Plot of Firms Labour Productivity in Survey Expenditures in IT and Marketing. Right: Plot of Firms **Log** Labour Productivity in Survey Expenditures in IT and Marketing. Note: Both present a sample of 500 observations for a clearer vision.



(a) (b) (c)

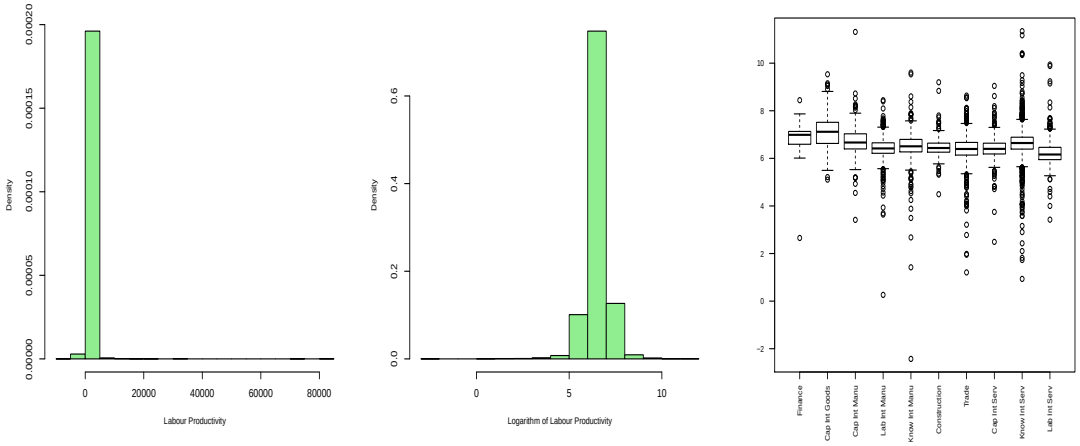
Figure A.6: Left: Total Expenses for Software per Employee.
Middle: Square Root of Total Expenses for Software per Employee
Right: Histogram of Square Root of Total Expenses for Software per Employee.



(a) (b) (c)

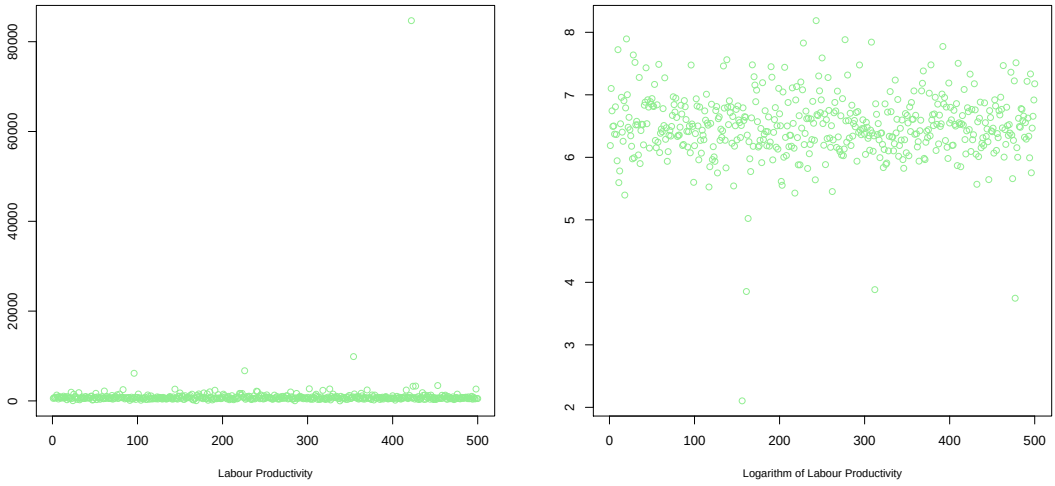
Figure A.7: Left: Total Expenses for Marketing per Employee.
Middle: Square Root of Total Expenses for Marketing per Employee
Right: Histogram of Square Root of Total Expenses for Marketing per Employee.

A.3 Community Innovation Survey 2012 - 2014



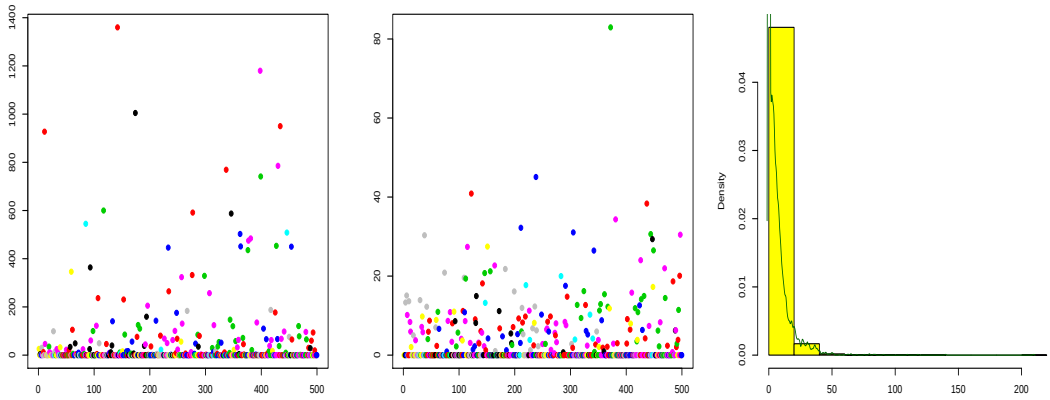
(a) (b) (c)

Figure A.8: Left: Distribution of Firms Labour Productivity in Survey Community Innovation 2012 - 2014. Middle: Distribution of Firms Log Labour Productivity in Survey Community Innovation 2012 - 2014. Right: Boxplot of Firms log labor productivity by branch of industry in Survey Community Innovation 2012 - 2014.



(a) (b)

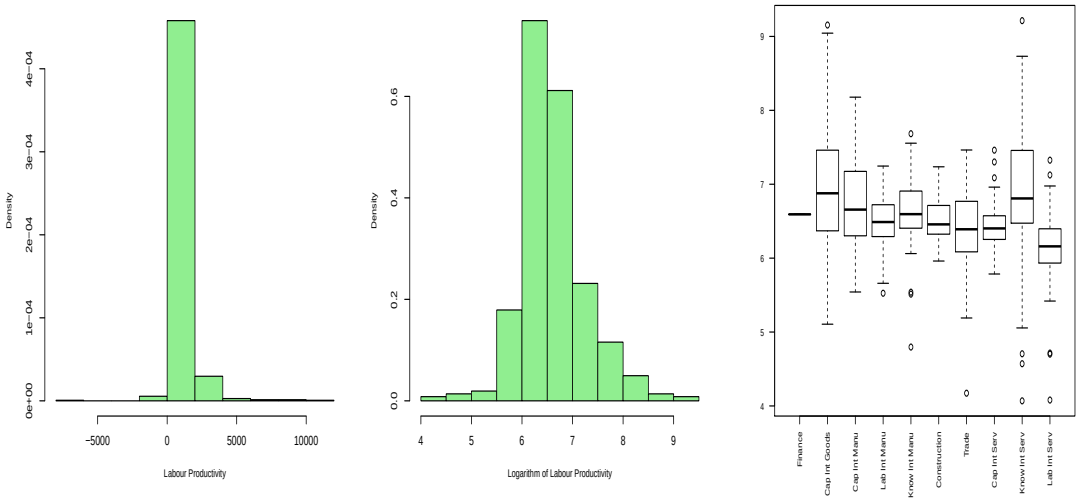
Figure A.9: Left: Plot of Firms Labour Productivity in Survey Community Innovation 2012 - 2014. Right: Plot of Firms Log Labour Productivity in Survey Community Innovation 2012 - 2014. Note: Both present a sample of 500 observations for a clearer vision.



(a) (b) (c)

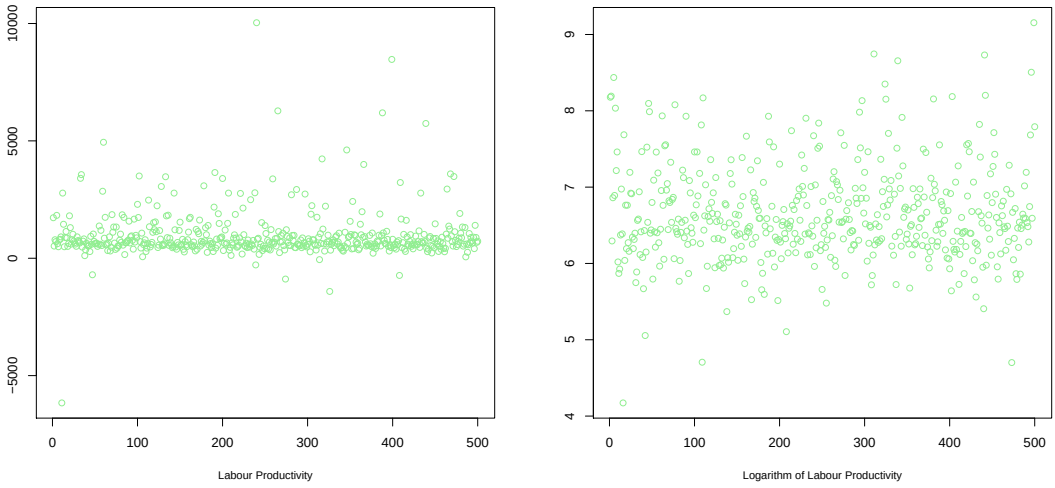
Figure A.10: Left: Total Expenses for Innovation per Employee.
Middle: Square Root of Total Expenses for Innovation per Employee
Right: Histogram of Square Root of Total Expenses for Innovation per Employee.

A.4 Current status examination of organisational work and work environment in Swedish working life in 2015 (NU2015) by *work Environment Authority*



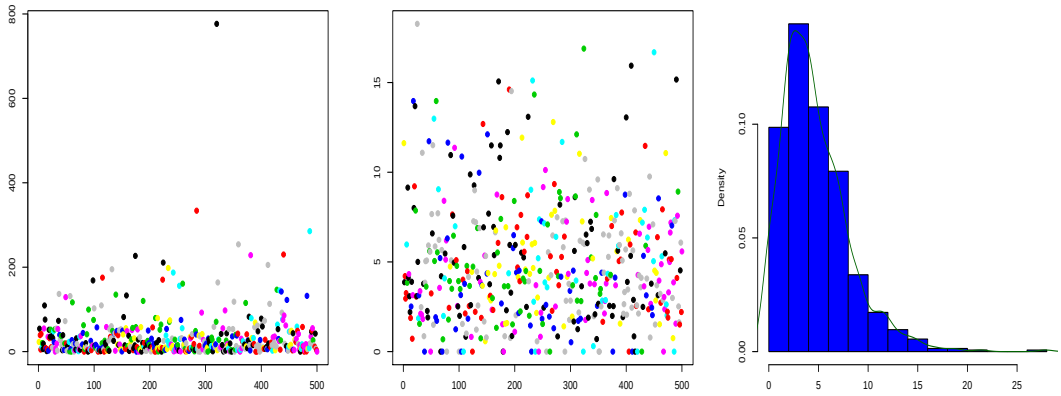
(a) (b) (c)

Figure A.11: Left: Distribution of Firms Labour Productivity in Survey Current status examination of organisational work and work environment in Swedish working life in 2015.
Middle: Distribution of Firms Log Labour Productivity in Survey Current status examination of organisational work and work environment in Swedish working life in 2015.
Right: Boxplot of Firms log labor productivity by branch of industry in Survey Current status examination of organisational work and work environment in Swedish working life in 2015.



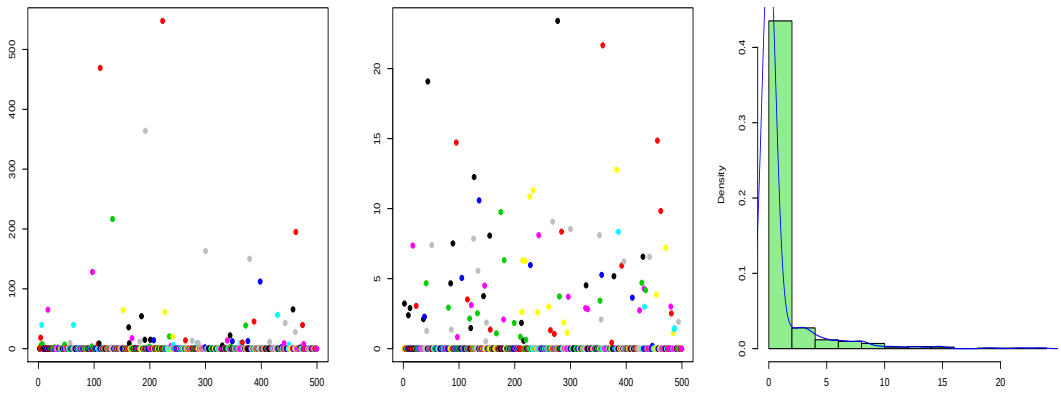
(a) (b)

Figure A.12: Left: Plot of Firms Labour Productivity in Survey Current status examination of organisational work and work environment in Swedish working life in 2015.
Right: Plot of Firms **Log** Labour Productivity in Survey Current status examination of organisational work and work environment in Swedish working life in 2015. Note: Both present a sample of 500 observations for a clearer vision.



(a) (b) (c)

Figure A.13: Left: Total Expenses for Education and Competence Development Per Employee.
Middle: Square Root of Total Expenses for Education and Competence Development Per Employee
Right: Histogram of Square Root of Total Expenses for Education and Competence Development Per Employee.



(a) (b) (c)

Figure A.14: Left: Total Expenses for Re-Organisation per Employee.
Middle: Square Root of Total Expenses for Re-Organisation per Employee
Right: Histogram of Square Root of Total Expenses for Re-Organisation per Employee.

A.5 SNI Materials

Broad Structure of NACE Rev. 2

Section	Title	Divisions
A	Agriculture, forestry and fishing	01 – 03
B	Mining and quarrying	05 – 09
C	Manufacturing	10 – 33
D	Electricity, gas, steam and air conditioning supply	35
E	Water supply; sewerage, waste management and remediation activities	36 – 39
F	Construction	41 – 43
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	45 – 47
H	Transportation and storage	49 – 53
I	Accommodation and food service activities	55 – 56
J	Information and communication	58 – 63
K	Financial and insurance activities	64 – 66
L	Real estate activities	68
M	Professional, scientific and technical activities	69 – 75
N	Administrative and support service activities	77 – 82
O	Public administration and defence; compulsory social security	84
P	Education	85
Q	Human health and social work activities	86 – 88
R	Arts, entertainment and recreation	90 – 93
S	Other service activities	94 – 96
T	Activities of households as employers; u0ndifferentiated goods- and services-producing activities of households for own use	97 – 98
U	Activities of extraterritorial organisations and bodies	99

A JORDBRUK, SKOGSBRUK OCH FISKE

01110 Odling av spannmål (utom ris), baljväxter och oljeväxter
01120 Odling av ris
01131 Potatisodling
01132 Sockerbetsodling
01133 Odling av grönsaker (köksväxter) på friland
01134 Odling av grönsaker (köksväxter) i växthus
01135 Svampodling m.m.
01140 Odling av sockerrör
01150 Odling av tobak
01160 Odling av fiberväxter
01191 Odling av prydnadsväxter i växthus
01199 Odling av övriga ett- och tvååriga växter
01210 Odling av druvor
01220 Odling av tropiska och subtropiska frukter
01230 Odling av citrusfrukter
01240 Odling av kärnfrukter och stenfrukter
01250 Odling av andra frukter och bär samt nötter
01260 Odling av oljehaltiga frukter
01270 Odling av växter för dryckesframställning
01280 Odling av kryddväxter, drog- och medicinalväxter
01290 Odling av andra fleråriga växter
01301 Odling av plantskoleväxter i växthus
01302 Odling av plantskoleväxter m.m. på friland
01410 Mjölkproduktion och uppfödning av nötkreatur av mjölkras
01420 Uppfödning av andra nötkreatur och bufflar
01430 Uppfödning av hästar och andra hästdjur
01440 Uppfödning av kameler och kameldjur
01450 Uppfödning av får och getter
01461 Uppfödning av smågrisar
01462 Uppfödning av slaktsvin
01471 Äggproduktion (för försäljning)
01472 Uppfödning av fjäderfä, ej äggproduktion
01491 Renskötsel
01492 Uppfödning av sällskapsdjur
01499 Övrig uppfödning av andra djur
01500 Blandat jordbruk
01610 Service till växtodling
01620 Service till husdjursskötsel
01630 Bearbetning av skördade växter
01640 Bearbetning av utsäde
01700 Jakt och service i anslutning härtill
02101 Skogsförvaltning
02102 Skogsskötsel
02109 Övrig skogsförvaltning och skogsskötsel
02200 Drivning (avverkning)
02300 Insamling av annat vilt växande skogsmaterial än trä
02401 Virkesmätning
02409 Övrig service till skogsbruk
03111 Trålfiske i saltvatten
03119 Övrigt saltvattensfiske
03120 Sötvattensfiske
03210 Fiskodling i saltvatten
03220 Fiskodling i sötvatten

B UTVINNING AV MINERAL

05100 Stenkolsutvinning
05200 Brunkolsutvinning
06100 Utvinning av råpetroleum
06200 Utvinning av naturgas
07100 Järnmalmsutvinning
07210 Utvinning av uran- och toriummalm
07290 Utvinning av annan malm
08110 Brytning av natursten, kalk- och gipssten, krita och skiffer
08120 Utvinning av sand, grus och berg; utvinning av lera och kaolin
08910 Brytning av kemiska mineral
08920 Torvutvinning
08930 Saltutvinning
08990 Diverse övrig utvinning av mineral
09100 Stödtjänster till råpetroleum- och naturgasutvinning
09900 Stödtjänster till annan utvinning

C TILLVERKNING

10111 Kreatursslakt
10112 Styckning av kött
10120 Beredning och hållbarhetsbehandling av fjäderfäkött
10130 Charkuteri- och annan köttvarutillverkning
10200 Beredning och hållbarhetsbehandling av fisk samt skal- och blötdjur
10310 Beredning och hållbarhetsbehandling av potatis
10320 Juice- och safttillverkning
10390 Annan beredning och hållbarhetsbehandling av frukt, bär och grönsaker
10410 Framställning av oljor och fetter
10420 Matfettstillverkning
10511 Osttillverkning
10519 Annan mejerivarutillverkning
10520 Glasstillverkning
10611 Mjöltillverkning
10612 Tillverkning av frukostflingor, mixer och andra livsmedelsberedningar av kvarnprodukter
10620 Stärkelsetillverkning
10710 Tillverkning av mjukt matbröd och färska bakverk
10721 Knäckebrödstillverkning
10722 Tillverkning av kex och konserverade bakverk
10730 Tillverkning av pastaprodukter
10810 Sockertillverkning
10821 Tillverkning av sockerkonfektyrer
10822 Tillverkning av choklad och chokladkonfektyrer
10830 Framställning av te och kaffe
10840 Tillverkning av senap, ketchup, kryddor och andra smaksättningsmedel
10850 Tillverkning av lagad mat och färdigrätter (ej på restaurang eller i butik)
10860 Tillverkning av homogeniserade livsmedelspreparat inklusive dietmat
10890 Framställning av andra livsmedel
10910 Framställning av beredda fodermedel
10920 Framställning av mat till sällskapsdjur
11010 Destillering, rening och tillblandning av spritdrycker
11020 Framställning av vin från druvor
11030 Framställning av cider och andra fruktviner
11040 Framställning av andra icke-destillerade jästa drycker
11050 Framställning av öl
11060 Framställning av malt
11070 Framställning av läskedrycker, mineralvatten och annat vatten på flaska
12000 Tobaksvarutillverkning
13100 Garntillverkning
13200 Vävnadstillverkning
13300 Blekning, färgning och annan textilberedning
13910 Tillverkning av trikåväv
13921 Sömnad av gardiner, sängkläder och linnevaror
13922 Tillverkning av presenningar, tält, segel o.d.
13930 Tillverkning av mattor
13940 Tågvirkes- och bindgarnstillverkning
13950 Tillverkning av bondad duk
13960 Tillverkning av andra tekniska textilier och industritextilier
13990 Övrig textilietillverkning
14110 Tillverkning av läder- och skinnkläder
14120 Tillverkning av arbets-, skydds- och överdragskläder
14130 Tillverkning av andra gång- och ytterkläder
14140 Tillverkning av underkläder, skjortor och blusar
14190 Tillverkning av andra beklädnadsvaror och tillbehör
14200 Tillverkning av pälsvaror
14310 Tillverkning av strumpor
14390 Tillverkning av andra trikåvaror
15110 Garvning och annan läderberedning; pälsberedning
15120 Tillverkning av reseffekter, handväskor, sadel- och seldon m.m.
15200 Tillverkning av skodon
16101 Sågning av trä
16102 Hyvling av trä
16103 Träimpregnering
16210 Tillverkning av faner och träbaserade skivor
16220 Tillverkning av sammansatta parkettgolv
16231 Tillverkning av monteringsfärdiga trähus
16232 Tillverkning av dörrar av trä
16233 Tillverkning av fönster av trä
16239 Tillverkning av övriga byggnads- och inredningssnickerier (takbjälkar, takstolar, trappor, räcken, vikväggar, träpersienner)
16240 Träförpackningstillverkning
16291 Tillverkning av förädlade trädbränslen
16292 Övrig trävarutillverkning
16293 Tillverkning av varor av kork, halm, rotting o.d.
17111 Tillverkning av mekanisk eller halvkemisk massa
17112 Sulfatmassatillverkning
17113 Sulfitmassatillverkning
17121 Tillverkning av tidnings- och journalpapper
17122 Tryckpapperstillverkning, ej tidnings- och journalpapper
17123 Tillverkning av kraftpapper och kraftpapp
17129 Övrig tillverkning av papper och papp

17211 Tillverkning av wellpapp och wellpappförpackningar
17219 Övrig tillverkning av pappers- och pappförpackningar
17220 Tillverkning av hushålls- och hygienartiklar av papper
17230 Tillverkning av skrivpapper, kuvert o.d.
17240 Tapettillverkning
17290 Tillverkning av andra pappers- och pappvaror
18110 Tryckning av dagstidningar
18121 Tryckning av tidskrifter
18122 Tryckning av böcker och övriga trycksaker
18130 Grafiska tjänster före tryckning (prepress/premedia)
18140 Bokbindning och andra tjänster i samband med tryckning
18200 Reproduktion av inspelningar
19100 Tillverkning av stenkolsprodukter
19200 Petroleumraffinering
20110 Industrigasframställning
20120 Tillverkning av färgämnen
20130 Tillverkning av andra oorganiska baskemikalier
20140 Tillverkning av andra organiska baskemikalier
20150 Tillverkning av gödselmedel och kväveprodukter
20160 Basplastframställning
20170 Tillverkning av syntetiskt basgummi
20200 Tillverkning av bekämpningsmedel och andra lantbrukskemiska produkter
20300 Tillverkning av färg, lack, tryckfärg m.m.
20410 Tillverkning av tvål, såpa, tvättmedel och polermedel
20420 Tillverkning av parfymer och toalettartiklar
20510 Sprängämnestillverkning
20520 Tillverkning av lim
20530 Tillverkning av eteriska oljor
20590 Tillverkning av övriga kemiska produkter
20600 Konstfibertillverkning
21100 Tillverkning av farmaceutiska basprodukter
21200 Tillverkning av läkemedel
22110 Tillverkning av däck och slangar; regummering
22190 Annan gummivarutilllverkning
22210 Tillverkning av plasthalvfabrikat
22220 Plastförpackningstillverkning
22230 Byggplastvarutillverkning
22290 Annan plastvarutillverkning
23110 Framställning av planglas
23120 Bearbetning av planglas
23130 Tillverkning av buteljer, glasförpackningar och husgeråd av glas
23140 Tillverkning av glasfiber
23190 Tillverkning av andra glasvaror inklusive tekniska glasvaror
23200 Tillverkning av eldfasta produkter
23310 Tillverkning av keramiska golv- och väggplattor
23320 Tillverkning av murtegel, takpannor och andra byggvaror av tegel
23410 Tillverkning av keramiska hushålls- och prydnadsartiklar
23420 Tillverkning av keramiska sanitetsartiklar
23430 Tillverkning av keramiska isolatorer o.d.
23440 Tillverkning av andra tekniska keramiska produkter
23490 Tillverkning av andra keramiska produkter
23510 Tillverkning av cement
23520 Tillverkning av kalk och gips
23610 Tillverkning av betongvaror för byggändamål
23620 Tillverkning av gipsvaror för byggändamål
23630 Tillverkning av fabriksblandad betong
23640 Tillverkning av murbruk
23650 Tillverkning av fibercementvaror
23690 Tillverkning av andra varor av betong, cement och gips
23701 Huggning, formning och slutlig bearbetning av sten för byggnadsändamål
23709 Huggning, formning och slutlig bearbetning av sten för prydnadsändamål
23910 Slipmedelstillverkning
23991 Tillverkning av varor av sten- och mineralull
23999 Diverse övrig tillverkning av icke-metalliska mineraliska produkter
24100 Framställning av järn och stål samt ferrolegeringar
24200 Tillverkning av rör, ledningar, ihåliga profiler och tillbehör av stål
24310 Tillverkning av kalldragen stålstång
24320 Tillverkning av kallvalsade stålband
24330 Tillverkning av andra kallformade produkter av stål
24340 Tillverkning av kalldragen ståltråd
24410 Framställning av ädla metaller
24420 Framställning av aluminium
24430 Framställning av bly, zink och tenn
24440 Framställning av koppar
24450 Framställning av andra metaller
24460 Tillverkning av kärnbränsle
24510 Gjutning av järn
24520 Gjutning av stål
24530 Gjutning av lättmetall
24540 Gjutning av andra metaller
25110 Tillverkning av metallstommar och delar därav
25120 Tillverkning av dörrar och fönster av metall
25210 Tillverkning av radiatorer och pannor för centraluppvärmning
25290 Tillverkning av andra cisterner, tankar, kar och andra behållare av metall
25300 Tillverkning av ånggeneratorer utom varmvattenpannor för centraluppvärmning
25400 Tillverkning av vapen och ammunition
25500 Smidning, pressning, prägling och valsning av metall; pulvermetallurgi
25610 Beläggning och överdragning metall
25620 Metallegoarbeten
25710 Tillverkning av bestick
25720 Tillverkning av lås och gångjärn
25730 Tillverkning av verktyg och redskap
25910 Tillverkning av stålfat o.d. behållare
25920 Tillverkning av lättmetallförpackningar
25930 Tillverkning av metalltrådvaror, kedjor och fjädrar
25940 Tillverkning av nitar och skruvar
25991 Tillverkning av diskbänkar, sanitetsgods m.m. av metall för byggändamål
25999 Diverse övrig metallvarutillverkning
26110 Tillverkning av elektroniska komponenter
26120 Tillverkning av kretskort
26200 Tillverkning av datorer och kringutrustning
26300 Tillverkning av kommunikationsutrustning
26400 Tillverkning av hemelektronik
26510 Tillverkning av instrument och apparater för mätning, provning och navigering
26520 Urtillverkning
26600 Tillverkning av strålningsutrustning samt elektromedicinsk och elektroterapeutisk utrustning
26700 Tillverkning av optiska instrument och fotoutrustning
26800 Tillverkning av magnetiska och optiska medier
27110 Tillverkning av elmotorer, generatorer och transformatorer
27120 Tillverkning av eldistributions- och elkontrollapparater
27200 Batteri- och ackumulatortillverkning
27310 Tillverkning av optiska fiberkablar
27320 Tillverkning av andra elektroniska och elektriska ledningar och kablar
27330 Tillverkning av kabeltillbehör
27400 Tillverkning av belysningsarmatur
27510 Tillverkning av elektriska hushållsmaskiner och hushållsapparater
27520 Tillverkning av icke-elektriska hushållsmaskiner och hushållsapparater
27900 Tillverkning av annan elapparatur
28110 Tillverkning av motorer och turbiner utom för luftfartyg och fordon
28120 Tillverkning av fluidteknisk utrustning
28130 Tillverkning av andra pumpar och kompressorer
28140 Tillverkning av andra kranar och ventiler
28150 Tillverkning av lager, kugghjul och andra delar för kraftöverföring
28210 Tillverkning av ugnar och brännare
28220 Tillverkning av lyft- och godshanteringsanordningar
28230 Tillverkning av kontorsmaskiner och kontorsutrustning (utom datorer och kringutrustning)
28240 Tillverkning av motordrivna handverktyg
28250 Tillverkning av maskiner och apparater för kyla och ventilation utom för hushåll
28290 Övrig tillverkning av maskiner för allmänt ändamål
28300 Tillverkning av jord- och skogsbruksmaskiner
28410 Tillverkning av verktygsmaskiner för metallbearbetning
28490 Tillverkning av övriga verktygsmaskiner
28910 Tillverkning av maskiner för metallurgi
28920 Tillverkning av gruv-, bergbrytnings- och byggmaskiner
28930 Tillverkning av maskiner för framställning av livsmedel, drycker och tobaksvaror
28940 Tillverkning av maskiner för produktion av textil-, beklädnads- och lädervaror
28950 Tillverkning av maskiner för produktion av massa, papper och papp
28960 Tillverkning av maskiner för gummi och plast
28990 Tillverkning av övriga specialmaskiner
29101 Tillverkning av personbilar och andra lätta motorfordon
29102 Tillverkning av lastbilar och andra tunga motorfordon
29200 Tillverkning av karosserier för motorfordon; tillverkning av släpfordon och påhängsvagnar
29310 Tillverkning av elektrisk och elektronisk utrustning för motorfordon
29320 Tillverkning av andra delar och tillbehör till motorfordon
30110 Byggande av fartyg och flytande materiel

30120 Byggande av fritidsbåtar
30200 Tillverkning av rälsfordon (även signalutrustning för trafik eller säkerhet, ej för fordon)
30300 Tillverkning av luftfartyg, rymdfarkoster o.d.
30400 Tillverkning av militära stridsfordon (även reparation)
30910 Tillverkning av motorcyklar
30920 Tillverkning av cyklar och invalidfordon
30990 Diverse övrig transportmedelstillverkning
31011 Tillverkning av kontors- och butiksmöbler (även möbler till annan offentlig miljö, som hotell, restaurang, verkstäder m.fl.)
31012 Tillverkning av kontors- och butiksinredningar (även för annan offentlig miljö, som hotell, restaurang, verkstäder m.fl.)
31021 Tillverkning av köksmöbler
31022 Tillverkning av köksinredningar
31030 Tillverkning av madrasser
31090 Tillverkning av andra möbler
32110 Prägling av mynt
32120 Tillverkning av smycken, guld- och silversmedsvaror
32130 Tillverkning av bijouterier o.d.
32200 Tillverkning av musikinstrument
32300 Tillverkning av sportartiklar
32400 Tillverkning av spel och leksaker
32501 Tillverkning av medicinska och dentala instrument och tillbehör
32502 Tillverkning av tandproteser
32910 Tillverkning av borstbinderiarbeten
32990 Diverse övrig tillverkning
33110 Reparation av metallvaror (ej egentillverkade)
33120 Reparation av maskiner (ej egentillverkade)
33130 Reparation av elektronisk och optisk utrustning (ej egentillverkad)
33140 Reparation av elapparatur (ej egentillverkad)
33150 Reparation och underhåll av fartyg och båtar (ej egentillverkade)
33160 Reparation och underhåll av luftfartyg och rymdfarkoster (ej egentillverkade)
33170 Reparation och underhåll av andra transportmedel (ej egentillverkade eller motorfordon)
33190 Reparation av annan utrustning (ej egentillverkad)
33200 Installation av industrimaskiner och -utrustning

D FÖRSÖRJNING AV EL, GAS, VÄRME OCH KYLA

35110 Generering av elektricitet
35120 Överföring av elektricitet
35130 Distribution av elektricitet
35140 Handel med elektricitet
35210 Framställning av gas
35220 Distribution av gasformiga bränslen via rörnät
35230 Handel med gas via rörnät
35300 Försörjning av värme och kyla

E VATTENFÖRSÖRJNING; AVLOPPSRENING, AVFALLSHANTERING OCH SANERING

36001 Grundvattenförsörjning
36002 Ytvattenförsörjning
37000 Avloppsrening
38110 Insamling av icke-farligt avfall
38120 Insamling av farligt avfall
38210 Behandling och bortskaffande av icke-farligt avfall
38220 Behandling och bortskaffande av farligt avfall
38311 Demontering av uttjänta fordon
38312 Demontering av elektrisk och elektronisk utrustning
38319 Demontering av övrig kasserad utrustning
38320 Återvinning av källsorterat material
39000 Sanering; efterbehandling av jord och vatten samt annan verksamhet för föroreningsbekämpning

F BYGGVERKSAMHET

41100 Utformning av byggprojekt
41200 Byggande av bostadshus och andra byggnader
42110 Anläggning av vägar och motorvägar
42120 Anläggning av järnvägar och tunnelbanor
42130 Anläggning av broar och tunnlar
42210 Allmännyttiga anläggningsarbeten för värme, vatten och avlopp
42220 Anläggningsarbeten för el och telekommunikation
42910 Vattenbyggnad
42990 Övriga anläggningsarbeten
43110 Rivning av hus och byggnader
43120 Mark- och grundarbeten
43130 Markundersökning
43210 Elinstallationer
43221 Värme- och sanitetsarbeten
43222 Ventilationsarbeten
43223 Kyl- och frysinstallationsarbeten
43229 Övriga VVS-arbeten
43290 Andra bygginstallationer
43310 Puts-, fasad- och stuckatörsarbeten
43320 Byggnadssnickeriarbeten
43330 Golv- och väggbeläggningsarbeten
43341 Måleriarbeten
43342 Glasmästeriarbeten
43390 Annan slutbehandling av byggnader
43911 Takarbeten av plåt
43912 Takarbeten av andra material än plåt
43991 Uthyrning av bygg- och anläggningsmaskiner med förare
43999 Diverse övrig specialiserad bygg- och anläggningsverksamhet

G HANDEL; REPARATION AV MOTORFORDON OCH MOTORCYKLAR

45110 Handel med personbilar och lätta motorfordon
45191 Handel med lastbilar, bussar och specialfordon
45192 Handel med husvagnar, husbilar, släpfordon och påhängsvagnar
45201 Allmän service och reparation av motorfordon utom motorcyklar
45202 Plåt-, lack- och glasreparationer på motorfordon utom motorcyklar (även rostskyddsbehandling)
45203 Installationer och reparationer av elsystem till motorfordon utom motorcyklar
45204 Däckservice
45310 Parti- och provisionshandel med reservdelar och tillbehör till motorfordon utom motorcyklar
45320 Detaljhandel med reservdelar och tillbehör till motorfordon utom motorcyklar
45400 Handel med och service av motorcyklar inklusive reservdelar och tillbehör
46110 Provisionshandel med jordbruksråvaror, levande djur, textilråvaror och textilhalvfabrikat
46120 Provisionshandel med bränsle, malm, metaller och industrikemikalier
46130 Provisionshandel med virke och byggmaterial
46141 Provisionshandel med maskiner, industriell utrustning, fartyg och luftfartyg utom kontorsutrustning och datorer
46142 Provisionshandel med kontorsutrustning och datorer
46150 Provisionshandel med möbler, hushålls- och järnhandelsvaror
46160 Provisionshandel med textilier, kläder, skodon och lädervaror
46170 Provisionshandel med livsmedel, drycker och tobak
46180 Provisionshandel med annat specialsortiment
46190 Provisionshandel med blandat sortiment
46210 Partihandel med spannmål, råtobak, utsäde och djurfoder
46220 Partihandel med blommor och växter
46230 Partihandel med levande djur
46240 Partihandel med hudar, skinn och läder
46310 Partihandel med frukt och grönsaker
46320 Partihandel med kött och köttvaror
46330 Partihandel med mejeriprodukter, ägg, matolja och matfett
46340 Partihandel med drycker
46350 Partihandel med tobak
46360 Partihandel med socker, choklad och sockerkonfektyrer
46370 Partihandel med kaffe, te, kakao och kryddor
46380 Partihandel med andra livsmedel, bl.a. fisk, skal- och blötdjur
46390 Icke specialiserad partihandel med livsmedel, drycker och tobak
46410 Partihandel med textilier
46420 Partihandel med kläder och skodon
46431 Partihandel med elektriska hushållsmaskiner och -apparater
46432 Partihandel med ljud- och bildanläggningar samt videoutrustning
46433 Partihandel med inspelade band och skivor för musik och bild
46434 Partihandel med elartiklar
46435 Partihandel med fotografiska och optiska produkter
46440 Partihandel med glas och porslin, rengöringsmedel
46450 Partihandel med parfym och kosmetika
46460 Partihandel med medicinsk utrustning och apoteksvaror
46470 Partihandel med möbler, mattor och belysningsartiklar
46480 Partihandel med ur och guldsmedsvaror
46491 Partihandel med sport- och fritidsartiklar
46492 Partihandel med kontorsförbrukningsvaror
46499 Partihandel med övriga hushållsvaror
46510 Partihandel med datorer och kringutrustning samt programvara
46521 Partihandel med elektronikkomponenter
46522 Partihandel med teleprodukter
46610 Partihandel med jordbruksmaskiner och -utrustning (inkl. traktorer)
46620 Partihandel med verktygsmaskiner

46630 Partihandel med gruv-, bygg- och anläggningsmaskiner
46640 Partihandel med textil-, sy- och stickmaskiner
46650 Partihandel med kontorsmöbler
46660 Partihandel med andra kontorsmaskiner och kontorsutrustning
46691 Partihandel med mät- och precisionsinstrument
46692 Partihandel med datoriserad materialhanteringsutrustning
46699 Partihandel med diverse andra maskiner och diverse annan utrustning
46710 Partihandel med bränslen
46720 Partihandel med metaller och metallmalmer
46731 Partihandel med virke och andra byggmaterial
46732 Partihandel med sanitetsgods
46741 Partihandel med järnhandelsvaror
46742 Partihandel med VVS-varor
46750 Partihandel med kemiska produkter
46761 Partihandel med industriförnödenheter
46762 Partihandel med emballage
46769 Partihandel med övriga insatsvaror
46771 Partihandel med uttjänta fordon
46772 Partihandel med metallavfall och metallskrot
46773 Partihandel med avfall och skrot av icke-metall
46900 Övrig partihandel
47111 Varuhus- och stormarknadshandel, mest livsmedel, drycker och tobak
47112 Livsmedelshandel med brett sortiment, ej varuhus eller stormarknad
47191 Annan varuhus- eller stormarknadshandel
47199 Övrig detaljhandel med brett sortiment
47210 Specialiserad butikshandel med frukt och grönsaker
47220 Specialiserad butikshandel med kött och charkuterier
47230 Specialiserad butikshandel med fisk, skal- och blötdjur
47241 Specialiserad butikshandel med bröd och konditorivaror
47242 Specialiserad butikshandel med konfektyrer
47250 Specialiserad butikshandel med alkoholhaltiga och andra drycker
47260 Specialiserad butikshandel med tobaksvaror
47291 Specialiserad butikshandel med hälsokost
47299 Övrig specialiserad butikshandel med livsmedel
47300 Specialiserad detaljhandel med drivmedel
47410 Specialiserad butikshandel med datorer, programvara, data- och tv-spel
47420 Specialiserad butikshandel med telekommunikationsutrustning
47430 Specialiserad butikshandel med ljud- och bildanläggningar samt videoutrustning
47510 Specialiserad butikshandel med textilier
47521 Specialiserad butikshandel med virke och byggvaror
47522 Specialiserad butikshandel med järn- och VVS-varor
47523 Specialiserad butikshandel med färger, fernissor och lacker
47531 Specialiserad butikshandel med mattor och annan vägg- och golvbeklädnad
47532 Specialiserad butikshandel med inredningstextilier
47540 Specialiserad butikshandel med elektriska hushållsmaskiner och hushållsapparater
47591 Specialiserad butikshandel med möbler för hemmet
47592 Specialiserad butikshandel med kontorsmöbler
47593 Specialiserad butikshandel med glas, porslin och andra bosättningsvaror
47594 Specialiserad butikshandel med belysningsartiklar
47595 Specialiserad butikshandel med musikinstrument och noter
47610 Specialiserad butikshandel med böcker
47621 Specialiserad butikshandel med tidningar
47622 Specialiserad butikshandel med kontorsförbrukningsvaror
47630 Specialiserad butikshandel med inspelade och oinspelade band och skivor för musik och bild
47641 Specialiserad butikshandel med sport- och fritidsartiklar utom cyklar och båtar
47642 Specialiserad butikshandel med cyklar
47643 Specialiserad butikshandel med båtar
47650 Specialiserad butikshandel med spel och leksaker
47711 Specialiserad butikshandel med herr-, dam- och barnkläder, blandat
47712 Specialiserad butikshandel med herrkläder
47713 Specialiserad butikshandel med damkläder
47714 Specialiserad butikshandel med barnkläder
47715 Specialiserad butikshandel med pälsar
47721 Specialiserad butikshandel med skodon och lädervaror
47722 Specialiserad butikshandel med väskor, reseffekter och lädervaror
47730 Apotekshandel
47740 Specialiserad butikshandel med sjukvårdsartiklar
47750 Specialiserad butikshandel med kosmetika och hygienartiklar
47761 Specialiserad butikshandel med blommor och andra växter, frön och gödselmedel
47762 Specialiserad butikshandel med små sällskapsdjur
47771 Specialiserad butikshandel med ur
47772 Specialiserad butikshandel med guldsmedsvaror och smycken
47781 Specialiserad butikshandel med glasögon och andra optiska artiklar utom fotoutrustning
47782 Specialiserad butikshandel med fotoutrustning
47783 Specialiserad butikshandel med konst samt galleriverksamhet
47784 Specialiserad butikshandel med mynt och frimärken
47789 Övrig specialiserad butikshandel
47791 Butikshandel med antikviteter och begagnade böcker
47792 Butikshandel med övriga begagnade varor
47793 Auktioner i butik
47810 Torg- och marknadshandel med livsmedel, drycker och tobak
47820 Torg- och marknadshandel med textilier, kläder och skodon
47890 Torg- och marknadshandel med övriga varor
47911 Postorderhandel och detaljhandel på Internet med brett sortiment
47912 Postorderhandel och detaljhandel på Internet med beklädnadsvaror
47913 Postorderhandel och detaljhandel på Internet med böcker och andra mediavaror
47914 Postorderhandel och detaljhandel på Internet med datorer och annan elektronisk utrustning
47915 Postorderhandel och detaljhandel på Internet med sport- och fritidsutrustning
47916 Postorderhandel och detaljhandel på Internet med bosättningsvaror
47917 Auktioner på Internet
47919 Postorderhandel och detaljhandel på Internet med övriga varor
47991 Provisionsdetaljhandel (ej auktioner)
47992 Ambulerande och tillfällig handel med livsmedel
47993 Ambulerande och tillfällig handel med övriga varor
47994 Auktioner ej i butik eller på Internet
47999 Övrig detaljhandel ej i butik

H TRANSPORT OCH MAGASINERING

49100 Järnvägstransport, passagerartrafik
49200 Järnvägstransport, godstrafik
49311 Linjebussverksamhet
49319 Övrig kollektivtrafik
49320 Taxitrafik
49390 Annan landtransport av passagerare
49410 Vägtransport, godstrafik
49420 Flyttjänster
49500 Transporter i rörsystem
50101 Reguljär sjötrafik över hav och kust av passagerare
50102 Icke reguljär sjötrafik över hav och kust av passagerare
50201 Reguljär sjötrafik över hav och kust av gods
50202 Icke reguljär sjötrafik över hav och kust av gods
50301 Reguljär sjötrafik på inre vattenvägar av passagerare
50302 Icke reguljär sjötrafik på inre vattenvägar av passagerare
50401 Reguljär sjötrafik på inre vattenvägar av gods
50402 Icke reguljär sjötrafik på inre vattenvägar av gods
51101 Reguljär lufttransport av passagerare
51102 Icke reguljär lufttransport av passagerare
51211 Reguljär lufttransport av gods
51212 Icke reguljär lufttransport av gods
51220 Rymdfart
52100 Magasinering och varulagring
52211 Bärgning för landtransport
52219 Övriga stödtjänster till landtransport
52220 Stödtjänster till sjötransport
52230 Stödtjänster till lufttransport
52241 Hamngodshantering
52249 Övrig godshantering
52290 Övriga stödtjänster till transport
53100 Postbefordran via nationella posten
53201 Annan postbefordran
53202 Bud- och kurirverksamhet
53203 Tidningsdistribution

I HOTELL- OCH RESTAURANGVERKSAMHET

55101 Hotellverksamhet med restaurangrörelse
55102 Drift av konferensanläggningar
55103 Hotellverksamhet utan restaurangrörelse
55201 Vandrarhemsverksamhet

55202 Stugbyverksamhet m.m. (även rumsuthyrning)
55300 Campingplatsverksamhet
55900 Annan logiverksamhet
56100 Restaurangverksamhet
56210 Cateringverksamhet vid enskilda evenemang
56291 Drift av personalmatsalar
56292 Centralköksverksamhet för sjukhus
56293 Centralköksverksamhet för skolor, omsorgs- och andra institutioner
56294 Cateringverksamhet för transportsektorn
56299 Övrig cateringverksamhet
56300 Barverksamhet

J INFORMATIONS- OCH KOMMUNIKATIONSVERKSAMHET

58110 Bokutgivning
58120 Publicering av kataloger och sändlistor
58131 Dagstidningsutgivning
58132 Annonstidningsutgivning
58140 Utgivning av tidskrifter
58190 Annan förlagsverksamhet
58210 Utgivning av dataspel (programvara)
58290 Utgivning av annan programvara (ej för dataspel)
59110 Produktion av film, video och TV-program
59120 Efterproduktion av film, video och TV-program
59130 Film-, video- och TV-programdistribution
59140 Filmvisning (kino-, video- och dvd-film, även filmklubbverksamhet)
59200 Ljudinspelning och fonogramutgivning
60100 Sändning av radioprogram
60200 Planering av TV-program och sändningsverksamhet
61100 Trådbunden telekommunikation
61200 Trådlös telekommunikation
61300 Telekommunikation via satellit
61900 Annan telekommunikation
62010 Dataprogrammering (utveckling av programvaror, hemsidor och programmering)
62020 Datakonsultverksamhet (utveckling av datasystem)
62030 Datordrifttjänster
62090 Andra IT- och datatjänster
63110 Databehandling, hosting o.d.
63120 Webbportaler
63910 Nyhetsservice
63990 Övriga informationstjänster

K FINANS- OCH FÖRSÄKRINGSVERKSAMHET

64110 Centralbanksverksamhet
64190 Annan monetär finansförmedling
64201 Holdingverksamhet i finansiella koncerner
64202 Holdingverksamhet i icke-finansiella koncerner
64301 Investeringsfonder
64309 Andra fonder och liknande finansiella enheter
64910 Finansiell leasing
64920 Annan kreditgivning
64991 Investment- och riskkapitalbolagsverksamhet
64992 Handel med och förvaltning av värdepapper, för egen räkning
64993 Förvaltning av och handel med värdepapper, för en begränsad och sluten krets av ägare
64999 Diverse övrig finansförmedling
65111 Fondanknuten livförsäkring
65119 Övrig livförsäkring
65120 Skadeförsäkring
65200 Återförsäkring
65300 Pensionsfondsverksamhet
66110 Administrativa tjänster till finansiella marknader
66120 Verksamhet utförd av värdepappers- och varumäklare (handel för annans räkning)
66190 Andra stödtjänster till finansiella tjänster utom försäkring och pensionsfondsverksamhet
66210 Risk- och skadebedömning
66220 Verksamhet utförd av försäkringsombud och försäkringsmäklare
66290 Andra stödtjänster till försäkring och pensionsfondsverksamhet
66301 Förvaltning av investeringsfonder (värdepappersfonder eller s.k. specialfonder)
66309 Annan fondförvaltning

L FASTIGHETSVERKSAMHET

68100 Handel med egna fastigheter
68201 Uthyrning och förvaltning av egna eller arrenderade bostäder
68202 Uthyrning och förvaltning av egna eller arrenderade industrilokaler
68203 Uthyrning och förvaltning av egna eller arrenderade, andra lokaler
68204 Förvaltning i bostadsrättsföreningar (ej på uppdrag)
68209 Övrig förvaltning av egna eller arrenderade fastigheter
68310 Fastighetsförmedling (på uppdrag)
68320 Fastighetsförvaltning på uppdrag

M VERKSAMHET INOM JURIDIK, EKONOMI, VETENSKAP OCH TEKNIK

69101 Advokatbyråverksamhet
69102 Juridiska byråers verksamhet m.m.
69103 Patentbyråverksamhet m.m.
69201 Redovisning och bokföring
69202 Revision
69203 Skatterådgivning
70100 Verksamheter som utövas av huvudkontor (även central administration)
70210 PR och kommunikation
70220 Konsultverksamhet avseende företags organisation
71110 Arkitektverksamhet (även landskapsarkitekter, ej inredningsarkitekter)
71121 Teknisk konsultverksamhet inom bygg- och anläggningsteknik
71122 Teknisk konsultverksamhet inom industriteknik
71123 Teknisk konsultverksamhet inom elteknik
71124 Teknisk konsultverksamhet inom energi-, miljö- och VVS-teknik
71129 Övrig teknisk konsultverksamhet
71200 Teknisk provning och analys (även typgodkännande av fartyg, flygplan, motorfordon m.m.; periodisk bilbesiktning)
72110 Bioteknisk forskning och utveckling
72190 Annan naturvetenskaplig och teknisk forskning och utveckling
72200 Samhällsvetenskaplig och humanistisk forskning och utveckling
73111 Reklambyråverksamhet
73112 Direktreklamverksamhet
73119 Övrig reklamverksamhet
73120 Mediebyråverksamhet och annonsförsäljning
73200 Marknads- och opinionsundersökning
74101 Industri- och produktdesignverksamhet
74102 Grafisk designverksamhet
74103 Inredningsarkitektverksamhet
74201 Porträttfotoverksamhet
74202 Reklamfotoverksamhet
74203 Press- och övrig fotografverksamhet (även flygfotografering; ej porträtt eller reklam)
74204 Fotolaboratorieverksamhet (ej i samband med film- och videoproduktion)
74300 Översättning och tolkning
74900 Övrig verksamhet inom juridik, ekonomi, vetenskap och teknik
75000 Veterinärverksamhet

N UTHYRNING, FASTIGHETSSERVICE, RESETJÄNSTER OCH ANDRA STÖDTJÄNSTER

77110 Uthyrning och leasing av personbilar och lätta motorfordon
77120 Uthyrning och leasing av lastbilar och andra tunga motorfordon
77210 Uthyrning och leasing av fritids- och sportutrustning
77220 Uthyrning av videokassetter och dvd-skivor
77290 Uthyrning och leasing av andra hushållsartiklar och varor för personligt bruk (till hushåll och företag)
77310 Uthyrning och leasing av jordbruksmaskiner och jordbruksredskap (utan förare, även skogsbruksmaskiner)
77320 Uthyrning och leasing av bygg- och anläggningsmaskiner
77330 Uthyrning och leasing av kontorsmaskiner och kontorsutrustning (inklusive datorer)
77340 Uthyrning och leasing av fartyg och båtar
77350 Uthyrning och leasing av flygplan (utan besättning, ej segel- och glidflygplan)
77390 Uthyrning och leasing av övrig utrustning och övriga maskiner och materiella tillgångar
77400 Leasing av immateriell egendom och liknande produkter, med undantag för upphovsrättsskyddade verk
78100 Arbetsförmedling och rekrytering
78200 Personaluthyrning
78300 Övrigt tillhandahållande av personalfunktioner
79110 Resebyråverksamhet
79120 Researrangemang
79900 Turist- och bokningsservice
80100 Säkerhetsverksamhet
80200 Säkerhetssystemtjänster
80300 Spanings- och detektivverksamhet
81100 Fastighetsrelaterade stödtjänster
81210 Lokalvård
81221 Rengöring av byggnader (även tankar och industrimaskiner m.m.)
81222 Skorstensfejarverksamhet
81290 Annan rengöring
81300 Skötsel och underhåll av grönytor
82110 Kombinerade kontorstjänster
82190 Kopiering, dokumentsammanställning och andra specialiserade kontorstjänster

82200 Callcenterverksamhet
82300 Arrangemang av kongresser och mässor
82910 Inkassoföretags och kreditupplysningsföretags verksamhet
82920 Förpackningsverksamhet (för annans räkning, ej i anslutning till transportverksamhet)
82990 Övriga företagstjänster

O OFFENTLIG FÖRVALTNING OCH FÖRSVAR; OBLIGATORISK SOCIALFÖRSÄKRING

84111 Stats- och kommunledning, lagstiftning och övergripande planering
84112 Inspektion, kontroll och tillståndsgivning
84113 Skatteförvaltning, indrivning
84114 Samhällelig informationsförsörjning
84115 Personalförvaltning och andra allmänna stödtjänster
84121 Administration av grundskole- och gymnasieskoleutbildning
84122 Administration av universitets- och högskoleutbildning samt forskning
84123 Administration av hälso- och sjukvård
84124 Administration av omsorg och socialtjänst
84125 Administration av program för kultur, miljö och boende m.m.
84131 Administration av infrastrukturprogram
84132 Administration av program för jordbruk, skogsbruk, jakt och fiske
84133 Administration av arbetsmarknadsprogram
84139 Administration av andra näringslivsprogram
84210 Utrikesförvaltning
84221 Militärt försvar
84222 Gemensam verksamhet för totalförsvaret
84223 Civilt försvar och frivilligförsvar
84231 Åklagarverksamhet
84232 Domstolsverksamhet
84233 Kriminalvård
84240 Polisverksamhet
84250 Brand- och räddningsverksamhet
84300 Obligatorisk socialförsäkring

P UTBILDNING

85100 Förskoleutbildning
85201 Grundskoleutbildning och förskoleklass
85202 Utbildning inom grundsärskola
85311 Studieförberedande gymnasial utbildning
85312 Kommunal vuxenutbildning o.d.
85321 Gymnasial yrkesutbildning
85322 Utbildning inom gymnasiesärskola
85323 Annan gymnasial utbildning
85324 Yrkesförarutbildning m.m.
85410 Eftergymnasial utbildning vid annat än universitet och högskola
85420 Universitets- eller högskoleutbildning
85510 Sport- och fritidsutbildning
85521 Kommunala kulturskolans utbildning
85522 Övrig musik-, dans- och kulturell utbildning
85530 Trafikskoleverksamhet (även för fritidsbåtar och icke yrkesmässigt flyg)
85591 Arbetsmarknadsutbildning
85592 Folkhögskoleutbildning
85593 Studieförbundens och frivilligorganisationernas utbildning
85594 Personalutbildning
85599 Annan övrig utbildning
85600 Stödverksamhet för utbildningsväsendet

Q VÅRD OCH OMSORG; SOCIALA TJÄNSTER

86101 Sluten primärvård
86102 Specialiserad sluten somatisk hälso- och sjukvård på sjukhus
86103 Specialiserad sluten psykiatrisk hälso- och sjukvård på sjukhus
86211 Primärvårdsmottagningar med läkare m.m.
86212 Annan allmän öppen hälso- och sjukvård, ej primärvård
86221 Specialistläkarverksamhet inom öppenvård, på sjukhus
86222 Specialistläkarverksamhet inom öppenvård, ej på sjukhus
86230 Tandläkarverksamhet
86901 Medicinsk laboratorieverksamhet m.m.
86902 Ambulanstransporter och ambulanssjukvård
86903 Primärvård, ej läkare
86904 Tandhygienistverksamhet
86905 Fysioterapeutisk verksamhet o.d.
86909 Annan öppen hälso- och sjukvård, utan läkare
87100 Boende med sjuksköterskevård
87201 Boende med särskild service för personer med utvecklingsstörning eller psykiska funktionshinder
87202 Boende med särskild service för barn och ungdomar med missbruksproblem
87203 Boende med särskild service för vuxna med missbruksproblem
87301 Vård och omsorg i särskilda boendeformer för äldre personer
87302 Vård och omsorg i särskilda boendeformer för personer med funktionshinder
87901 Heldygnsvård med boende för barn och ungdomar med sociala problem
87902 Omsorg och sociala insatser i övriga boendeformer för vuxna
88101 Öppna sociala insatser för äldre personer
88102 Öppna sociala insatser för personer med funktionshinder
88910 Dagbarnvård
88991 Öppna sociala insatser för barn och ungdomar med sociala problem
88992 Öppna sociala insatser för vuxna med missbruksproblem
88993 Övriga öppna sociala insatser för vuxna
88994 Humanitära insatser
88995 Drift av flyktingförläggning

R KULTUR, NÖJE OCH FRITID

90010 Artistisk verksamhet
90020 Stödtjänster till artistisk verksamhet
90030 Litterärt och konstnärligt skapande
90040 Drift av teatrar, konserthus o.d.
91011 Biblioteksverksamhet
91012 Arkivverksamhet
91020 Museiverksamhet
91030 Vård av historiska minnesmärken och byggnader och liknande sevärdheter
91040 Drift av botaniska trädgårdar, djurparker och naturreservat
92000 Spel- och vadhållningsverksamhet
93111 Drift av skidsportanläggningar
93112 Drift av golfbanor
93113 Drift av motorbanor
93114 Drift av trav- och galoppbanor
93119 Drift av sporthallar, idrottsplatser och andra sportanläggningar (ej uthyrning av sportutrustning)
93120 Sportklubbars och idrottsföreningars verksamhet
93130 Drift av gymanläggningar
93191 Tävling med hästar
93199 Övrig sportverksamhet
93210 Nöjes- och temaparksverksamhet
93290 Övrig fritids- och nöjesverksamhet

S ANNAN SERVICEVERKSAMHET

94111 Intressebevakning inom branschorganisationer
94112 Intressebevakning inom arbetsgivarorganisationer
94120 Intressebevakning inom yrkesorganisationer (även vetenskapliga samfund)
94200 Intressebevakning inom arbetstagarorganisationer
94910 Verksamhet i religiösa samfund (ej undervisning eller humanitär verksamhet m.m.)
94920 Verksamhet i politiska organisationer
94990 Verksamhet i andra intresseorganisationer (ej yrkesorganisationer, artist- eller författarverksamhet)
95110 Reparation av datorer och kringutrustning
95120 Reparation av kommunikationsutrustning
95210 Reparation av hemelektronik
95220 Reparation av hushållsapparater samt av utrustning för hem och trädgård
95230 Lagning av skodon och lädervaror
95240 Reparation av möbler och heminredning
95250 Reparation av ur och guldsmedsvaror
95290 Reparation av övriga hushållsartiklar och personliga artiklar
96011 Industri- och institutionstvätt
96012 Konsumenttvätt
96021 Hårvård (ej tillverkning av peruker)
96022 Skönhetsvård
96030 Begravningsverksamhet
96040 Kroppsvård
96090 Övriga konsumenttjänster

T FÖRVÄRVSARBETE I HUSHÅLL; HUSHÅLLENS PRODUKTION AV DIVERSE VAROR OCH TJÄNSTER FÖR EGET BRUK

97000 Förvärvsarbete i hushåll
98100 Hushållens produktion av diverse varor för eget bruk
98200 Hushållens produktion av diverse tjänster för eget bruk

U VERKSAMHET VID INTERNATIONELLA ORGANISATIONER, UTLÄNDSKA AMBASSADER O.D.

99000 Verksamhet vid internationella organisationer, utländska ambassader o.d.

A.6 Survey - ICT usage in firms 2014

Här lämnade uppgifter är sekretesskyddade enligt 24 kap. 8 § offentlighets- och sekretesslagen (2009:400).
Uppgiftsskyldighet föreligger enligt lagen (2001:99) om den officiella statistiken. Frågorna 35-37 samt 39 är frivilliga.
Samråd har skett med Näringslivets Regelnämnd (NNR).

It-användning i företag 2015

DFO/IF

It-användning i företag **522-1**

Organisationsnr

Skicka in efterfrågade uppgifter

Logga in på **www.scb.se/it-foretag** eller skicka in blanketten i bifogat svarskuvert.

Användarnamn:	
Lösenord:	

Uppgifterna som lämnas ska endast avse den företagsenhet vars namn och organisationsnummer angivits ovan. För företag som har verksamhet i flera länder ska **svaren endast avse den svenska delen av verksamheten.**

Svaren ska avse företagets egen verksamhet. **It-verksamhet som utförs på uppdrag ska inte redovisas.**

Frågorna ska besvaras utifrån hur situationen var i **januari 2015**, såvida inget annat anges.

Besvara blanketten även om företaget inte använt it. Alla svar är viktiga för undersökningens kvalitet.

A It-specialister och it-kunskaper

1 Har företaget anställda it-specialister? ITSP2
It-specialister är anställda med it som huvudsaklig arbetsuppgift, t.ex. att utveckla, styra eller underhålla it-system och applikationer.
☐ Ja
☐ Nej

2 Erbjöd företaget de anställda någon it-relaterad utbildning under 2014?

	Ja	Nej	
a) Utbildning för it-specialister ..... *Svara Nej om företaget inte hade någon it-specialist anställd 2014.*	☐	☐	ITSPT2
b) Utbildning för annan personal	☐	☐	ITUST2

3 Rekryterade eller försökte företaget rekrytera it-specialister under 2014? ITSPRCR2
☐ Ja
☐ Nej → ***Gå till fråga 5***

4 Hade företaget vakanta it-tjänster under 2014 som var svåra att tillsätta? ITSPVAC2
☐ Ja
☐ Nej

SCB ES/IFI 522-1 2015

Blankettutgivare
Statistiska centralbyrån
Statistics Sweden
Enheten för investeringar, FoU och IT

Postadress
Box 24300
104 51 STOCKHOLM

Telefon
Gruppnummer
08-506 945 20

E-post
itanvandning@scb.se

5 **Var det i huvudsak egen personal eller extern leverantör som utförde följande it-funktioner i företaget 2014?**	Egen personal, inkl. anställda i moder- eller dotterbolag	Extern leverantör	Ej aktuellt	
a) Drift av servrar, datorer, skrivare eller nätverk	☐	☐	☐	IT_INFR
b) Support och underhåll av programvara för allmänt kontorsarbete *T.ex. Word, Excel eller liknande.*	☐	☐	☐	IT_OSS
c) Support och underhåll av affärssystem, programvara för hantering av kundinformation, eller databaser *T.ex. ERP (Enterprise Resource Planning), CRM (Customer Relationship Management) eller liknande.*	☐	☐	☐	IT_BMSS
d) Utveckling av affärssystem, programvara för hantering av kundinformation, eller databaser *T.ex. ERP (Enterprise Resource Planning), CRM (Customer Relationship Management) eller liknande.*	☐	☐	☐	IT_BMSD
e) Support och underhåll av webblösningar *T.ex. webbsidor eller e-handelslösningar.*	☐	☐	☐	IT_WEBS
f) Utveckling av webblösningar *T.ex. webbsidor eller e-handelslösningar.*	☐	☐	☐	IT_WEBD
g) It-säkerhet och skydd av data *T.ex. tester med avseende på it-säkerhet eller installation av virusskydd och brandväggar.*	☐	☐	☐	IT_SEC

B Internetanvändning

6 Har företaget tillgång till internet? IACC

☐ Ja

☐ Nej → ***Gå till avsnitt C***

7 Ungefär hur stor andel av de anställda använder internetanslutna datorer i arbetet? EMPIUSEPCT

Med datorer menas persondatorer, bärbara datorer, surfplattor och andra bärbara enheter som till exempel smartphones.

☐☐☐ % av de anställda

Fasta bredbandsanslutningar

8 Använder företaget någon typ av fast bredbandsanslutning? FIXBB

T.ex. DSL, ADSL, fiberoptik (FTTH), kabel.

☐ Ja

☐ Nej → ***Gå till fråga 10***

9 Vilken hastighet kan företagets snabbaste fasta internetanslutning uppnå för att ta emot data enligt avtalet med leverantören? ISPDF

*Markera endast **ett** svarsalternativ.*

☐ Under 2 Mbit/s

☐ Minst 2 men mindre än 10 Mbit/s

☐ Minst 10 men mindre än 30 Mbit/s

☐ Minst 30 men mindre än 100 Mbit/s

☐ Minst 100 Mbit/s

Mobila bredbandsanslutningar

Med mobila anslutningar till internet menas att företaget använder bärbara enheter för att ansluta till internet via mobiltelefonnät för företagsändamål. Företaget tillhandahåller enheterna och betalar helt eller delvis för abonnemang och användning.

10 Använder företaget bärbara enheter som ansluter till internet via mobiltelefonnätet (3G eller 4G)?
*Med bärbara enheter menas t.ex. bärbara datorer, surfplattor eller smartphones. Räkna **inte** med enheter som bara kan ansluta till internet via trådlöst nätverk.*

☐ Ja
☐ Nej

MOBBB

11 Ungefär hur stor andel av de anställda använder bärbara enheter i arbetet som kan anslutas till internet via mobiltelefonnätet?
*Med bärbara enheter menas t.ex. bärbara datorer, surfplattor eller smartphones. Räkna **inte** med enheter som bara kan ansluta till internet via trådlöst nätverk.*

☐☐ % av de anställda

EMPMD1PCT

Användning av webbplats

12 Har företaget en webbplats?
*Svara **Ja** även om information om företaget finns på en gemensam webbplats inom en koncern eller företagsgrupp.*

☐ Ja
☐ Nej → ***Gå till fråga 14***

WEB

13 Finns något av följande på företagets webbplats?

	Ja	Nej	
a) Produktkatalog eller prislista	☐	☐	WEBACC
b) Möjlighet att lägga beställningar, göra bokningar eller reservationer	☐	☐	WEBORD
c) Möjlighet för besökare att anpassa eller designa produkterna	☐	☐	WEBCTM
d) Möjlighet för kunder att spåra sin beställning	☐	☐	WEBOT
e) Personanpassat innehåll för återkommande besökare	☐	☐	WEBPER
f) Länk eller hänvisning till företagets profil på sociala medier	☐	☐	WEBSM

Användning av sociala medier

Företag som använder sociala medier är de som har en profil, ett konto eller en licens beroende på vad som krävs utifrån typ av sociala medier.

14 Använder företaget något av följande sociala medier?
Att använda sociala medier enligt nedan enbart för betalda annonser räknas som "Nej".

	Ja	Nej	
a) Sociala nätverk t.ex. Facebook, LinkedIn eller Yammer	☐	☐	SM1_SNET
b) Bloggar eller mikrobloggar t.ex. Twitter	☐	☐	SM1_BLOG
c) Webbplatser för att dela multimedia t.ex. YouTube, Pinterest eller Picasa	☐	☐	SM1_CNTSHR
d) Wiki-baserade verktyg för kunskapsutbyte	☐	☐	SM1_WIKI

→ Om **Nej** på **alla** alternativ, **gå till avsnitt C**

15 Använder företaget sociala medier för något av följande ändamål?

	Ja	Nej	
a) Utveckla företagets image eller marknadsföra företagets produkter, t.ex. annonsering eller lansering av nya produkter	☐	☐	SM_PADVERT
b) Ta del av eller svara på kunders åsikter, recensioner eller frågor	☐	☐	SM_PCUQR
c) Involvera kunder i utveckling eller innovation av varor eller tjänster	☐	☐	SM_PCUDEV
d) Samarbete med affärspartners (t.ex. leverantörer) eller andra organisationer, t.ex. myndigheter eller ideella organisationer	☐	☐	SM_PBPCOLL
e) Rekrytering av personal	☐	☐	SM_PRCR
f) Utbyte av synpunkter, åsikter eller kunskap **inom** företaget	☐	☐	SM_PEXCHVOK

C Automatiserat informationsutbyte inom företaget

16 Använder företaget ett affärssystem, s.k. ERP *(Enterprise Resource Planning)* **för att dela information mellan olika funktioner inom företaget, t.ex. bokföring, planering, produktion eller marknadsföring?**

☐ Ja ITERP1
☐ Nej

17 Använder företaget mjukvara för att hantera kundinformation, s.k. CRM *(Customer Relationship Management)* **för...**

	Ja	Nej	
a) ... insamling och lagring av kunduppgifter eller för att göra kundinformation tillgänglig för olika funktioner inom företaget?	☐	☐	CRMSTR
b) ... att analysera information om kunder för marknadsförings-syfte t.ex. prissättning, kampanjer, val av distributionskanal?	☐	☐	CRMAN

D Elektronisk delning av lagertillgång

Med elektronisk delning av lagertillgång menas elektroniskt utbyte av all slags information med leverntörer och/eller kunder som rör tillgång, produktion, utveckling och distribution av varor och tjänster. Denna information kan utbytas via webbplatser, nätverk och andra betydelser av elektronisk dataöverföring, utom manuellt skickad e-post.

18 Delar företaget information om lagertillgång elektroniskt med kunder eller leverantörer?

☐ Ja SISC
☐ Nej → ***Gå till avsnitt E***

19 Hur delar företaget information om lagertillgång elektroniskt?

	Ja	Nej	
a) Via webbplatser eller webbportaler (egna eller affärspartners)	☐	☐	SISCWEB
b) Via automatiserat informationsutbyte, t.ex. EDI, XML, EDIFACT	☐	☐	SISCADE

E It-säkerhet

Här avses åtgärder, kontroller och rutiner som används för att säkerställa integritet, autenticitet, tillgänglighet samt skydd av data och system.

20 Har företaget en policy eller liknande för it-säkerhet med plan för regelbunden översyn?

☐ Ja SECPOL1

☐ Nej → ***Gå till avsnitt F***

21 Tar företagets policy för it-säkerhet upp följande risker?

	Ja	Nej	
a) Förstöring eller förvanskning av data p.g.a. attack eller oförutsedda händelser	☐	☐	SECPDD
b) Röjande av hemliga uppgifter p.g.a. intrång, bedrägeri eller olyckshändelse	☐	☐	SECPCNF
c) Problem med åtkomst till företagets it-system p.g.a. angrepp utifrån t.ex. överbelastningsattack	☐	☐	SECPDS

22 När fastställdes eller uppdaterades senast företagets policy för it-säkerhet?

☐ Under de senaste 12 månaderna

☐ Mellan 12 och 24 månader sedan

☐ Mer än 24 månader sedan SECPREV

F Elektronisk handel

Här avses beställningar av varor eller tjänster som görs via datornätverk. E-handel kan ske via webbplats (inklusive extranät), app eller genom automatiserat informationsutbyte såsom EDI. Betalning och leverans behöver inte ske elektroniskt.

Om företagets försäljning helt eller delvis sker via en återförsäljare och ert företag tar emot beställningarna från återförsäljaren elektroniskt enligt ovan, ska även denna försäljning inkluderas.

Försäljning via webbplats eller app

Med försäljning via webbplats avses försäljning som sker via webbutik, webbformulär på företagets webbplats, företagets extranät eller app. Beställningarna görs exempelvis med hjälp av dator eller smartphone.

23 Tog företaget emot beställningar via webbplats eller app under 2014?
*Räkna **inte** med beställningar via manuellt skickad e-post.*

☐ Ja AWSELL

☐ Nej → ***Gå till fråga 27***

24 Ungefär hur stor andel av företagets omsättning kom från beställningar som inkommit via webbplats eller app under 2014?

[ ] % av företagets omsättning AWSVALPCT

25 Ungefär hur fördelades omsättningen som kom från beställningar som inkommit via webbplats eller app under 2014?

a) Försäljning till konsumenter	[ ] %	AWSVALCPCT
b) Försäljning till företag och offentlig sektor	[ ] %	AWSVALBGPCT
Totalt	100 %	

26 Tog företaget emot beställningar under 2014 som inkommit via webbplats eller app från kunder i följande områden?

	Ja	Nej	
a) Sverige	☐	☐	AWSHM
b) Övriga EU [1]	☐	☐	AWSEU
c) Resten av världen	☐	☐	AWSWW

[1] *EU består utöver Sverige av Belgien, Bulgarien, Cypern, Danmark, Estland, Finland, Frankrike, Grekland, Irland, Italien, Kroatien, Lettland, Litauen, Luxemburg, Malta, Nederländerna, Polen, Portugal, Rumänien, Slovakien, Slovenien, Spanien, Storbritannien, Tjeckien, Tyskland, Ungern och Österrike.*

Försäljning via automatiserat informationsutbyte (EDI)

Med försäljning via automatiserat informationsutbyte avses försäljning som sker genom att kunden skickar beställningar i ett överenskommet format (t.ex. XML eller EDIFACT), som gör det möjligt att processa beställningen automatiskt i företagets it-system. Beställningar via automatiserat informationsutbyte kallas här för **EDI-beställningar**. EDI står för Electronic Data Interchange.

27 Tog företaget emot EDI-beställningar under 2014?
☐ Ja AXSELL
☐ Nej → ***Gå till fråga 30***

28 Ungefär hur stor andel av företagets omsättning kom från EDI-beställningar under 2014?
AXSVALPCT
☐☐ % av företagets omsättning

29 Tog företaget emot EDI-beställningar från kunder i följande områden under 2014?

	Ja	Nej	
a) Sverige	☐	☐	AXSHM
b) Övriga EU-länder [1]	☐	☐	AXSEU
c) Resten av världen	☐	☐	AXSWW

[1] *EU består utöver Sverige av Belgien, Bulgarien, Cypern, Danmark, Estland, Finland, Frankrike, Grekland, Irland, Italien, Kroatien, Lettland, Litauen, Luxemburg, Malta, Nederländerna, Polen, Portugal, Rumänien, Slovakien, Slovenien, Spanien, Storbritannien, Tjeckien, Tyskland, Ungern och Österrike.*

Elektroniska inköp

30 Beställde företaget varor eller tjänster via webbplats, app eller EDI under 2014?
*Räkna **inte** med beställningar via manuellt skickad e-post.*
☐ Ja AEBUY
☐ Nej → ***Gå till avsnitt G***

31 Var ordervärdet (i kronor) av företagets elektroniska inköp minst en procent av företagets totala inköp under 2014?
*Räkna **inte** med moms i ordervärdet.*
☐ Ja EBUY2
☐ Nej

G Programvaruutveckling

32 Hade företaget egen personal som arbetade med programvaruutveckling, t.ex. systemerare eller programmerare under 2014?
*Räkna **inte** med externa konsulter.*
☐ Ja UTVP
☐ Nej → ***Gå till avsnitt H***

33 Ungefär hur många årsverken utfördes av egen personal som arbetar med programvaruutveckling under 2014?
*Ett **årsverke** är det arbete en heltidsanställd person utför under ett år.*
UTVANTP
☐☐☐☐ årsverken

34 Ungefär hur fördelas de årsverken som utfördes av egen personal som arbetade med programvaruutveckling på följande under 2014?

a) Programvaruutveckling för företagets egen användning, t.ex. program för ekonomistyrning och administration	☐☐ %	UTVEGANV
b) Programvaruutveckling för extern försäljning. Räkna även med sådan programvara som ingår i de produkter företaget säljer	☐☐ %	UTVEXP
c) Övrigt, t.ex. underhåll, support eller reparation	☐☐ %	UTVSUP
Totalt	1 0 0 %	

H It och miljö

35 Har företaget någon miljöpolicy eller motsvarande som innebär att företaget ska minska sin miljöpåverkan genom något av följande? *(Frivillig uppgift)*

	Ja	Nej	
a) Välja telefon-/webb-/videomöten i stället för möten som innebär resor	☐	☐	GMEET
b) Minskad energiförbrukning vid användning av it t.ex. användande av skärmsläckare, krav på att datorerna stängs av vid arbetsdagens slut, minskade utskrifter eller energisnål drift	☐	☐	GUSENRG
Vid upphandling av it-produkter eller it-tjänster			
c) Ställa krav på att leverantörerna är miljöcertifierade	☐	☐	GCERT
d) Ta hänsyn till energiförbrukning vid val av system och/eller hårdvara	☐	☐	GBUYNRG

36 Har företaget anställda som arbetar utanför företagets lokaler, i genomsnitt minst en halv dag i veckan, och därifrån har tillgång till företagets it-system (t.ex. företagets e-postsystem)? *(Frivillig uppgift)*

☐ Ja
☐ Nej

GDIST

37 Använder företaget någon av följande it-lösningar för att minska företagets energiförbrukning? *(Frivillig uppgift)*

	Ja	Nej	
a) Intelligent styrning av transport eller logistik	☐	☐	GSOLLOG
b) Intelligent styrning av belysning, värme eller ventilation	☐	☐	GSOLVENT
c) Digitalisering av arbetsflöden	☐	☐	GSOLFLOW
d) Annan energibesparande it-lösning	☐	☐	GSOLOTH

I Företagets omsättning

38 Hur stor var företagets omsättning under 2014?
*Räkna **inte** med mervärdesskatt.*

Tusental kronor TURN

|_|_|_|_|_|_|_|_|_|_| tkr

Exempel: Två miljoner (2 000 000) – skriv 2000.

39 Hur lång tid tog det att ta fram uppgifterna och besvara blanketten? *(Frivillig uppgift)*

|_|_|_| minuter TID

Kommentarer KOM

Företagets kontaktperson

Namn (TEXTA)	Telefon (inklusive riktnr.)
E-post	Mobil

Tack för din medverkan!

A.7 Survey - Expenditures in IT and marketing in firms

Här lämnade uppgifter är sekretesskyddade enligt 24 kap. 8 § offentlighets- och sekretesslagen (2009:400)
Uppgiftsskyldighet föreligger enligt lagen (2001:99) om den officiella statistiken.
Samråd har skett med Näringslivets Regelnämnd (NNR)

Företagens utgifter för it och marknadsföring 2015

DFO / IF

Företagens utgifter för it och marknadsföring

Organisationsnr

UtsOmg
FUFIM

Period
FUFIM2015A

Skicka in efterfrågade uppgifter

Logga in på **www.scb.se/itutgifter** eller skicka in blanketten i bifogat svarskuvert.

Användarnamn:
Lösenord:

- Uppgifterna som lämnas ska endast avse den företagsenhet vars namn och organisationsnummer angivits ovan. För företag som har verksamhet i flera länder ska **svaren endast avse den svenska delen av verksamheten**.
- Besvara blanketten även om företaget inte haft några utgifter för it eller marknadsföring. Om företaget inte haft några utgifter eller investeringar, vänligen skriv 0. Alla svar är viktiga för undersökningens kvalitet.
- Frågorna om reklam och tillväxt ingår i ett regeringsuppdrag för att främja innovationer och tillväxt.
- **BAS-kontohänvisningar** finns med även i årets enkät. Observera att transaktioner för utrustning/mjukvara kan finnas bokförda under flera olika konton och att det kan röra sig om endast delar av det konto vi hänvisar till. Hänvisning till ett konto kan återkomma flera gånger.

  Hänvisningarna till BAS-kontoplanen (BAS 2015) har som främsta syfte att förenkla uppgiftslämnandet.

A Bakgrundsfrågor

1 Redovisningsperiod
Undersökningen gäller kalenderåret 2015 (1 januari – 31 december 2015).
Om ert svar avser annan period p.g.a. brutet räkenskapsår, var vänlig ange detta.

☐ Kalenderåret 2015

☐ Annan period:

År	Mån		År	Mån
		T.o.m.		

2 Ingår företaget i en koncern och/eller är företaget franchisetagare?

☐ Ja
☐ Nej → *Gå till fråga 4*

3a Förser företaget andra bolag inom koncernen /franchisekedjan med it-resurser?
Ta **inte** med hård- och mjukvara som sålts vidare direkt i oförändrat skick inom koncernen/franchisekedjan.

☐ Ja
☐ Nej

3b Köper eller utnyttjar företaget koncern-gemensamma it-resurser av annat bolag inom koncernen/franchisekedjan?
Svara Ja endast om företaget har betalat avgifter till en koncerngemensam it-enhet eller moderbolag för t.ex. gemensamma it-system, service, datadrift, it-tjänster m.m.

☐ Ja
☐ Nej

SCB ES/IFI 531. 2016

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Statistics Sweden
Enheten för investeringar, FoU och IT

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104 51 STOCKHOLM

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08-506 940 50

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itutgifter@scb.se

B Utgifter för it 2015

Uppgifterna avser företagets **utgifter** samt **investeringar** för hård- och mjukvara.

Beloppen anges exkl. moms och i tusental kronor, t.ex. 120 000 kr skrivs 120 tkr.
Om företaget inte har haft några utgifter, vänligen skriv 0.

Hänvisningarna till **BAS 2015** är menade att vara en vägledning. Observera att det kan röra sig om *delar* av de konton vi hänvisar till. Hänvisning till ett konto kan förekomma flera gånger.

Utgifter (exkl. leasing) för data- och telekomutrustning samt mjukvara

– Ta **inte** med kostnader för utrustning/programvara som ska säljas vidare direkt i oförändrat skick.

– Ta **inte** med avskrivningar och förskottsbetalningar eller utgifter för service och driftkostnader av utrustning. Om dessa utgifter inte går att särskilja från utgiften för utrustningen ska de dock ingå.

4 Hur stora utgifter (exkl. leasing) hade företaget under 2015 för...	Kontohänvisningar (BAS 2015) Hela eller delar av.	Tusental kronor
a) ... **datautrustning?** 1	Utgiftskonton (5410, 5490)	tkr
	Tillgångskonton (1210, 1250, 1220)	tkr
b) ... **telekommunikationsutrustning?** 2	Utgiftskonton (5410, 5490)	tkr
	Tillgångskonton (1230, 1220)	tkr
c) ... **mjukvara?** 3	Utgiftskonton (5420, 6540, 6910)	tkr
	Tillgångskonton (1010)	tkr

Utgifter för finansiell leasing och hyra/operationell leasing av data- och telekomutrustning och mjukvara

5 Hur stora utgifter hade företaget under 2015 för...	Kontohänvisningar (BAS 2015) Hela eller delar av.	**Totala utgifter** Tusental kronor
a) ... **hyra/operationell leasing av data-och/ eller telekommunikationsutrustning?** 4	Utgiftskonton (5250, 5220, 5210)	tkr
b) ... **finansiell leasing av data- och/eller telekommunikationsutrustning?** 5	Tillgångskonton (1260, 1210, 1220, 1230, 1250)	tkr

1 **Datautrustning** inkluderar
– alla typer av datorer och servrar
– datorskärmar, projektorer, scanners, skrivare, multifunktionsenheter och andra enheter som kan kopplas till en dator
– datalagringsenheter
– kassaterminaler och bankomater
– andra enheter som behandlar data

2 **Telekommunikationsutrustning** inkluderar
– telefoner (fasta och mobila), telefonväxlar, basstationer och annan utrustning för att sända och ta emot ljud, data och bilder
– modem, routrar, omkopplare, hubbar och annan utrustning för kommunikation i fasta och trådlösa nätverk
– TV- och professionella videokameror
– inbrottslarm, brandlarm och andra typer av larm

3 **Mjukvara** inkluderar
– köpt standardprogramvara
– utgifter för licenser
– molntjänster
– mjukvara speciellt utvecklad för företagets behov av extern leverantör. Ta med utvecklingsarbete från kravspecifikation till test och vidareutveckning. Ta **inte** med drift av systemet eller företagets arbete med att definiera verksamhetsbehov eller utbildning för den personal som ska använda systemet.

Om mjukvara ingår vid köp eller leasing av hårdvara och det inte går att särskilja utgifterna ber vi er uppskatta respektive andel.

4 **Operationell leasing** kan liknas vid en vanlig hyressituation. Leasingbolaget förvärvar utrustning som sedan hyrs ut till leasetagaren mot en avgift. Leasingbolaget står bland annat för service, underhåll och försäkringar.

5 **Finansiell leasing** innebär att de ekonomiska risker och fördelar som förknippas med ägandet av ett objekt i allt väsentligt överförs från leasegivaren till leasetagaren. Det är inköpspriset för leasingobjektet som ska redovisas. Detta finns ofta angivet i leasingavtalet.

Utgifter för köp av it-tjänster

	Kontohänvisningar (BAS 2015) Hela eller delar av.	Tusental kronor
6 Hur stora utgifter hade företaget under 2015 för köp av it-tjänster... 6		
a) ... **från extern leverantör?**	Utgiftskonton (5250, 5420, 6210, 6230, 6540, 6910)	tkr
b) ... **från annat bolag inom koncernen?**	Utgiftskonton (5250, 5420, 6210, 6230, 6540, 6910)	tkr

6 **It-tjänster** inkluderar
– funktionsleveranser av it där man köper it-funktioner utan att själva behöva investera i it-utrustning
– driftkostnad för it, it-serviceavtal, it on demand eller "it på kran"
– it-stöd eller it-support
– applikationshyrning och köp av applikationstjänster
– serverhosting

C Utgifter för reklam och marknadsföring 2015

I de fyra följande frågorna ber vi er att redovisa externa och interna utgifter och investeringar för reklam och marknadsföring under 2015. Vi ber er även att på ett ungefär uppskatta hur länge 2015 års reklam och marknadsföring förväntas ge positiva effekter på intäkterna.

Externa utgifter

	Kontohänvisningar (BAS 2015) Hela eller delar av.	Tusental kronor
7a Hur stora utgifter hade företaget under 2015 för reklam och marknadsföring? 7	Utgiftskonton (5900, 6550, 6860, 6930, 7210)	tkr
	Tillgångskonton (1050, 1070)	tkr

Egen personal

7b Ungefär hur många personår (årsverken) **för arbete med reklam och marknadsföring utfördes under 2015 av egen personal?** 8

Personår (årsverken) är det arbete en heltidsanställd person utför under ett år.

Antal ____ personår

Varaktighet

7c Ungefär hur stor andel av 2015 års reklam och marknadsföring tror du kommer att generera intäkter under längre tid än ett år?

Den reklam och marknadsföring som ni redovisat i fråga 7a och 7b. Redovisa i procent.

____ %

7d Ungefär hur länge tror du att 2015 års reklam och marknadsföring kommer att generera intäkter som ni annars inte skulle ha haft?

Den reklam och marknadsföring som ni redovisat i fråga 7c. Markera ett alternativ.

- ☐ 1-2 år
- ☐ 3-5 år
- ☐ Mer än 5 år

7 **Marknadsföring och reklam** inkluderar
– film-, radio, TV- och internetreklam, annonsering, utställningar och mässor, sponsring, varuprover, reklamgåvor och tävlingar
– utgifter för anskaffande av varumärken, dvs. en bild, ordbehandling eller liknande som gör att en vara kan särskiljas från andra
– goodwill, **dock endast** goodwill som avser värdet av varumärket
– reklam och PR som syftar till att uppmärksamma företagets varor och tjänster eller lämna information om företaget, inkl. marknads- och försäljningspersonal, exempelvis telefonförsäljare och s.k. hemmasäljare
– marknadsundersökningar, marknadssegmenteringar
– konsulter för marknadsföring och PR

8 **Arbete med reklam och marknadsföring** inkluderar
– Marknads- och försäljningspersonal
– film-, radio, TV- och internetreklam, annonsering, utställningar och mässor, sponsring, varuprover, reklamgåvor och tävlingar
– arbete med hemsida för att uppmärksamma företagets produkter
– anskaffande av varumärken, dvs. en bild, ordbehandling eller liknande som gör att en vara kan särskiljas från andra
– reklam och PR som syftar till att uppmärksamma företagets varor och tjänster eller lämna information om företaget
– marknadssegmenteringar

Personår (årsverken) är det arbete en heltidsanställd person utför under ett år.

Vänd!

Kommentarer

Lämna gärna synpunkter på blanketten eller kommentarer till dina svar!

Hur lång tid tog det att ta fram uppgifterna och besvara blanketten? *(Frivillig uppgift)* ___ minuter

Företagets kontaktperson

Namn (TEXTA)	Telefon (även riktnr)	Mobil
E-post		

Tack för din medverkan!

A.8 Survey - Community Innovation Survey 2012 - 2014

Här lämnade uppgifter är sekretesskyddade enligt 24 kap. 8 § offentlighets- och sekretesslagen (2009:400)

Uppgiftsskyldighet för frågorna 1–28 föreligger enligt lagen (2001:99) om den officiella statistiken. Avsnitt M (frågorna 29–34) besvaras frivilligt.

Samråd har skett med Näringslivets Regelnämnd (NNR).

INNOVATIONSVERKSAMHET 2012–2014

DFO/IF

Innovationsverksamhet

Skicka in efterfrågade uppgifter

Logga in på **www.scb.se/innovationsstatistik** eller skicka in blanketten i bifogat svarskuvert.

Användarid:

Lösenord:

- Uppgifterna som lämnas ska endast avse den företagsenhet vars namn och organisationsnummer angivits i adressfältet ovan.
- Samtliga belopp i blanketten ska anges i tusental kronor.

A Allmän information om företaget

1 Ingick företaget i en koncern under år 2014?

En koncern består av minst två juridiska personer med samma ägare. Varje företag i koncernen kan vara verksam på olika marknader, som med nationella eller regionala dotterbolag, eller på olika produktmarknader. Huvudkontoret är också en del av en koncern.

1 ☐ Ja → Om **Ja,** var är huvudkontoret beläget? ☐ Sverige (1) ☐ Utomlands (2) HO

2 ☐ Nej GP

Om företaget **ingår** i en koncern ska uppgifterna som ni lämnar i kommande frågor endast avse ert företag och **inte** hela koncernen. Inkludera **inte** andra delar av koncernen.

2 Under åren 2012–2014, genomförde företaget något av följande?

Markera ett kryss per rad.

	1 Ja	2 Nej	
a) Gick ihop med eller köpte ett annat företag eller köpte delar av ett annat företag	☐	☐	ENMRG
b) Sålde, stängde ner eller outsourcade delar av företaget	☐	☐	ENOUT

3 På vilken/vilka geografiska marknader sålde ert företag varor/tjänster under åren 2012–2014?

Markera ett kryss per rad.

	1 Ja	2 Nej	
a) Lokalt/regionalt i Sverige	☐	☐	MARLOC
b) Nationellt (andra regioner i Sverige)	☐	☐	MARNAT
c) Andra länder inom EU eller associerande länder (1)	☐	☐	MAREUR
d) Övriga länder	☐	☐	MAROTH

4 Vilket av ovanstående geografiska områden utgjorde den största marknaden för ert företag mätt i omsättning 2012–2014?

Ange bokstav (a–d) ☐ LARMAR

(1) Följande länder räknas in: Albanien, Belgien, Bosnien och Hercegovina, Bulgarien, Cypern, Danmark, Estland, Finland, Frankrike, Grekland, Irland, Island, Italien, Kosovo, Kroatien, Lettland, Liechtenstein, Litauen, Luxemburg, Makedonien, Malta, Montenegro, Nederländerna, Norge, Polen, Portugal, Rumänien, Schweiz, Serbien, Slovakien, Slovenien, Spanien, Storbritannien, Tjeckien, Turkiet, Tyskland, Ungern och Österrike.

Statistiska centralbyrån
Statistics Sweden
Enheten för investeringar, FoU och IT

Postadress: **Box 24300** **104 51 STOCKHOLM**
Telefon: Gruppnummer **08-506 941 90**
E-post: **innovationsstatistik@scb.se**

SCB ES/IFI 500, 2014

B Produktinnovationer (varor/tjänster) åren 2012–2014

För att räknas som en produktinnovation ska en **vara eller tjänst vara ny eller väsentligt förbättrad och ha introducerats på marknaden**. Varan eller tjänsten ska vara ny eller väsentligt förbättrad med avseende på dess kapacitet, användarvänlighet, ingående komponenter eller delsystem.

– Produktinnovationer (nya eller väsentligt förbättrade) **måste vara nya för ert företag men behöver inte vara nya för företagets marknad.**

– Produktinnovationer kan ursprungligen ha utvecklats av ert företag eller av andra företag.

En **vara** är vanligen ett materiellt föremål, t.ex. en smart telefon, möbel eller paketerad programvara. Nedladdningsbar mjukvara, musik och film utgör också varor. En **tjänst** är vanligen immateriell, som t.ex. handel, försäkring, utbildning, flygresor, konsultverksamhet etc.

5 Introducerade ert företag under åren 2012–2014...

a) **... nya eller väsentligt förbättrade varor** (varuinnovation)? ..... 1 ☐ Ja
*Räkna **inte** in återförsäljning av varor som köpts in från andra företag och förändringar av endast estetisk natur.* INPDGD 2 ☐ Nej → Om **Nej**, på **både 5a** och **5b**, **gå till avsnitt C**

b) **... nya eller väsentligt förbättrade tjänster** (tjänsteinnovation)? ..... 1 ☐ Ja
INPDSV 2 ☐ Nej → Om **Nej**, på **både 5a** och **5b**, **gå till avsnitt C**

6 Vem utvecklade dessa produktinnovationer (varor/tjänster)?

Markera samtliga alternativ som passar.

		Varu-innovationer	Tjänste-innovationer
a)	Ert företag på egen hand	☐ INITGD	☐ INITSV
b)	Ert företag tillsammans med andra företag/organisationer ❷	☐ INTOGD	☐ INTOSV
c)	Ert företag genom att anpassa eller modifiera varor eller tjänster som ursprungligen utvecklats av andra företag/organisationer ❷	☐ INADGD	☐ INADSV
d)	Andra företag/organisationer ❷	☐ INOTHGD	☐ INOTHSV

❷ Inkludera självständiga företag och andra delar av er koncern (dotterbolag, syskonbolag, huvudkontor etc.). Till organisationer räknas universitet, forskningsinstitut, ideella organisationer etc.

7 Var någon av ert företags produktinnovationer (varor/tjänster) under åren 2012–2014...

a) **... ny för företagets marknad?** ..... 1 ☐ Ja
Ert företag introducerade en ny eller väsentligt förbättrad vara eller tjänst på en eller flera av företagets marknader före konkurrenterna – varan/tjänsten kan ha varit tillgänglig på andra marknader. 2 ☐ Nej NEWMKT

b) **... endast ny för ert företag?** ..... 1 ☐ Ja
Ert företag introducerade en ny eller väsentligt förbättrad vara eller tjänst som redan var tillgänglig på företagets marknad via någon av konkurrenterna. 2 ☐ Nej NEWFRM

8 Ungefär hur stor andel av företagets omsättning år 2014 kom från varor/tjänster som var...

Skriv 0 (noll) om inget värde.

a) **... nya för företagets marknad?** ..... ___ % TURNMAR
Nya eller väsentligt förbättrade varor/tjänster introducerade på marknaden före era konkurrenter under åren 2012–2014. Varan/tjänsten kan ha varit tillgänglig på andra marknader.

b) **... endast nya för ert företag?** ..... ___ % TURNIN
Nya eller väsentligt förbättrade varor/tjänster introducerade under åren 2012–2014 som endast var nya för ert företag men ej på företagets marknad.

c) **... oförändrade eller marginellt förändrade?** ..... ___ % TURNUNG
Varor/tjänster som var oförändrade eller endast marginellt förändrade under åren 2012–2014. Räkna med återförsäljning av varor/tjänster inköpta från andra företag.

Total omsättning år 2014 100 % TURNTOT

9 Såvitt ni vet, var någon av ert företags produktinnovationer (varor/tjänster) under åren 2012–2014...

Markera ett kryss per rad.

	1 Ja	2 Nej	3 Vet inte	
a) **... först i Sverige?**	☐	☐	☐	INPDFC
b) **... först i Europa?** ❶	☐	☐	☐	INPDFE
c) **... först i världen?**	☐	☐	☐	INPDFW

Om svaret på fråga 9c är **Ja,**
ungefär hur stor andel av företagets omsättning år 2014 kom från produktinnovationer, introducerade mellan 2012 och 2014, som var först i världen?

1 ☐ 0 % till mindre än 1 %
2 ☐ 1 % till mindre än 5 %
3 ☐ 5 % till mindre än 10 % FWTURN
4 ☐ 10 % till mindre än 25 %
5 ☐ 25 % eller mer
6 ☐ Vet inte

❶ Följande länder räknas in: Albanien, Belgien, Bosnien och Hercegovina, Bulgarien, Cypern, Danmark, Estland, Finland, Frankrike, Grekland, Irland, Island, Italien, Kosovo, Kroatien, Lettland, Liechtenstein, Litauen, Luxemburg, Makedonien, Malta, Montenegro, Nederländerna, Norge, Polen, Portugal, Rumänien, Schweiz, Serbien, Slovakien, Slovenien, Spanien, Storbritannien, Tjeckien, Turkiet, Tyskland, Ungern och Österrike.

C Processinnovationer åren 2012–2014

En processinnovation är en **ny eller väsentligt förbättrad produktionsprocess, distributionsmetod eller stödverksamhet** som införts för företagets varor eller tjänster.

- Processinnovationer måste vara **nya för företaget** men **behöver inte vara nya för företagets marknad.**
- Innovationen kan ursprungligen ha utvecklats av ert företag eller av andra företag.
- Enbart förändringar i organisationen räknas **inte** som en processinnovation. Dessa behandlas i avsnitt H.

10 Introducerade ert företag under åren 2012–2014...

a) **... nya eller väsentligt förbättrade produktionsmetoder?** *Nya eller väsentligt förbättrade metoder för tillverkning eller produktion av varor eller tjänster.*
1 ☐ Ja INPSPD
2 ☐ Nej →

b) **... nya eller väsentligt förbättrade leveransmetoder?** *Nya eller väsentligt förbättrade logistik-, leverans- eller distributionsmetoder för företagets varor, tjänster eller insatsvaror.*
1 ☐ Ja INPSLG
2 ☐ Nej →

c) **... ny eller väsentligt förbättrad stödverksamhet för företagets processer?** *T.ex. nya eller väsentligt förbättrade underhållsystem eller hantering av inköp, redovisning eller datorteknik.*
1 ☐ Ja INPSSU
2 ☐ Nej →

Om **Nej**, på samtliga tre delfrågor, **gå till avsnitt D**

11 Vem utvecklade dessa processinnovationer? *Markera samtliga alternativ som passar.*

INITPS ☐ Ert företag på egen hand

INTOPS ☐ Ert företag tillsammans med andra företag/organisationer ❷

INADPS ☐ Ert företag genom att anpassa eller modifiera varor eller tjänster som ursprungligen utvecklats av andra företag/organisationer ❷

INOTHPS ☐ Andra företag/organisationer ❷

❷ Inkludera självständiga företag och andra delar av er koncern (dotterbolag, syskonbolag, huvudkontor etc.). Till organisationer räknas universitet, forskningsinstitut, ideella organisationer etc.

12 Under åren 2012–2014, var någon av ert företags processinnovationer ny för företagets marknad?
1 ☐ Ja
2 ☐ Nej INPSNM
3 ☐ Vet inte

D Pågående eller avbruten innovationsverksamhet avseende produkt- och processinnovationer åren 2012–2014

I innovationsverksamhet ingår förvärv av maskiner, utrustning, programvara, licenser och byggnader, konstruktions- och utvecklingsverksamhet, genomförbarhetsstudier, design, utbildning och marknadsföring när denna verksamhet utförs **särskilt för att utveckla och/eller implementera en produkt- eller processinnovation**. Inkludera all **forskning och utveckling (FoU)** som bedrivs i syfte att skapa ny kunskap eller lösa vetenskapliga eller tekniska problem.

13 Hade ert företag under åren 2012–2014 någon innovationsverksamhet som inte resulterade i en produkt- eller processinnovation på grund av att verksamheten...

	1 Ja	2 Nej	
a) **... sköts upp eller avbröts innan de slutfördes?**	☐	☐	INABA
b) **... fortfarande pågick vid utgången av år 2014?**	☐	☐	INONG

Om **Nej** på **samtliga av frågorna 5, 10** och **13**, **gå till avsnitt H.**

E Innovationsaktiviteter och innovationsutgifter avseende produkt- och/eller processinnovationer

14 Bedrev ert företag under åren 2012–2014 någon av följande typer av innovationsverksamhet?

EGFOU

a) **Egen forskning och utveckling (FoU)** ..... ☐ Ja, kontinuerligt *(företaget har fast anställd FoU-personal)* 14
Forskning och utvecklingsverksamhet utförd av ert företag i Sverige.
Forskning: *ett systematiskt arbete för att söka efter ny kunskap eller nya idéer med eller utan en bestämd tillämpning i sikte.*
Utvecklingsverksamhet: *ett systematiskt arbete som utnyttjar forskningsresultat, vetenskaplig kunskap eller nya idéer för att åstadkomma nya material, varor, tjänster, processer, system, metoder, eller väsentliga förbättringar av redan existerande sådana.*
☐ Ja, emellanåt *(endast vid behov)* 15
☐ Nej 16

b) **Utlagd forskning och utveckling (FoU)** ..... 1 ☐ Ja 2 ☐ Nej RRDEX
Forskning och utveckling utförd av andra företag (inkl. företag eller dotterbolag inom koncernen) eller av offentliga eller privata forskningsorganisationer. Verksamheten ska vara inköpt av ert företag.
Forskning: *ett systematiskt arbete för att söka efter ny kunskap eller nya idéer med eller utan en bestämd tillämpning i sikte.*
Utvecklingsverksamhet: *ett systematiskt arbete som utnyttjar forskningsresultat, vetenskaplig kunskap eller nya idéer för att åstadkomma nya material, varor, tjänster, processer, system, metoder, eller väsentliga förbättringar av redan existerande sådana.*

c) **Inköp av maskiner, utrustning, programvara och byggnader** ..... 1 ☐ Ja 2 ☐ Nej RMAC
Inköp av avancerade maskiner, utrustning, hårdvara, programvara eller byggnader för att producera nya eller väsentligt förbättrade produkter eller processer.

d) **Inköp av existerande kunskap från andra företag eller organisationer** ..... 1 ☐ Ja 2 ☐ Nej ROEK
Inköp av existerande know-how, expertis, upphovsrätt, patent eller icke-patenterade uppfinningar etc. i syfte att utveckla nya eller väsentligt förbättrade produkter eller processer.

e) **Utbildning för innovationsverksamhet** ..... 1 ☐ Ja 2 ☐ Nej RTR
Intern eller extern utbildning för företagets personal, särskilt genomförd för utvecklingen eller introduktionen av nya eller väsentligt förbättrade produkter eller processer.

f) **Marknadsintroduktion av innovationer** ..... 1 ☐ Ja 2 ☐ Nej RMAR
Intern eller extern verksamhet inför marknadsintroduktion av ert företags nya eller väsentligt förbättrade varor eller tjänster, inkl. marknadsundersökningar och reklamkampanjer.

g) **Design** ..... 1 ☐ Ja 2 ☐ Nej RDSG
Intern eller extern verksamhet för att ändra formen, utseendet eller användbarheten hos varor eller tjänster.

h) **Övrigt** ..... 1 ☐ Ja 2 ☐ Nej RPRE
Intern eller extern annan övrig verksamhet, för att implementera nya eller väsentligt förbättrade produkter eller processer, t.ex. genomförbarhetsstudier, testning, anskaffning av utrustning, industriteknisk tillämpning etc.

Utgifter avseende produkt- och/eller processinnovationer år 2014

Beloppen anges i tusental kronor. Exempel: 2 000 000 skrivs 2000, 700 000 skrivs 700.

15 Ungefär hur stora var utgifterna 2014 för...

Skriv 0 om företaget **inte** hade några utgifter under år **2014.**

Belopp i tusental kronor

a) **... egen forskning och utveckling (FoU)?** Verksamheten ska ha utförts i Sverige av företagets egen personal eller av konsulter i FoU-projekt som letts av företaget och där företagets personal arbetat tillsammans med konsulterna. Till egen FoU räknas även FoU som gjorts på beställning av andra ❸ ..... | | | | | | | | 000 kr

RRDINX

Inkludera följande typer av utgifter för egen FoU:

Driftskostnader
- *Arbetskraftskostnader* ❹
- *Konsultarvoden* ❺
- *Övriga driftskostnader* ❻

Investeringar ❼
- *Byggnader, mark och fastigheter*
- *Maskiner och inventarier*
- *Programvara/mjukvara*

b) **... utlagd forskning och utveckling (FoU)?** Företagets utgifter för FoU som andra företag (inkl. företag eller dotterbolag inom koncernen) eller offentliga/privata forskningsorganisationer utfört i Sverige eller utomlands. Räkna även med bidrag som företaget lämnat för FoU till t.ex. universitet och högskolor. Konsultarvoden ska ingå i utgifter för utlagd FoU om arbetet sker självständigt i fristående projekt. Övriga konsultarvoden för FoU redovisas i fråga 15a. ..... | | | | | | | | 000 kr

RRDEXX

c) **... inköp av maskiner, utrustning, programvara och byggnader?** Investeringar för FoU-verksamhet i företaget redovisas under egen FoU. Inköp av avancerade maskiner, utrustning, hårdvara, programvara eller byggnader för att producera nya eller väsentligt förbättrade produkter eller processer. ..... | | | | | | | | 000 kr

RMACX

d) **... inköp av existerande kunskap från andra företag eller organisationer?** Inköp av existerande know-how, expertis, upphovsrätt, patent eller icke-patenterade uppfinningar etc. i syfte att utveckla nya eller väsentligt förbättrade produkter eller processer. ..... | | | | | | | | 000 kr ROEKX

e) **... all övrig innovationsverksamhet såsom utbildning, marknadsintroduktion, design och övriga innovationsaktiviteter?** ❽ ..... | | | | | | | | 000 kr ROTRX

f) **Summan av alla innovationsutgifter ovan** ..... | | | | | | | | 000 kr RALLX

❸ **Forskning:** ett systematiskt arbete för att söka efter ny kunskap eller nya idéer med eller utan en bestämd tillämpning i sikte. **Utvecklingsverksamhet:** ett systematiskt arbete som utnyttjar forskningsresultat, vetenskaplig kunskap eller nya idéer för att åstadkomma nya material, varor, tjänster, processer, system, metoder, eller väsentliga förbättringar av redan existerande sådana.

❹ **Arbetskraftskostnader.** Kostnader avseende lön, andra ersättningar t.ex. traktamenten i samband med resor samt naturaförmåner. Vidare ingår kostnader för lagstadgade arbetsgivaravgifter, andra kollektiva avgifter, pensionskostnader och övriga arbetskraftskostnader. Arbetskraftskostnader som avser ledning och administration av FoU-arbete ingår också.

❺ **Konsultarvoden** skall ingå som driftkostnader om:
- FoU-projektet leds och drivs av företaget
- Företagets egen personal arbetar tillsammans med konsulterna
- Företaget står för idéerna och tar de dagliga besluten som krävs för att projektet skall drivas vidare.

Om så inte är fallet betraktas projektet som utlagd FoU och redovisas i fråga 15b.

❻ **Övriga driftkostnader.** Kostnader för värme, elektricitet, städning, reparation och underhåll av egna lokaler och kostnader för hyrda lokaler. Förbrukningsmaterial, försäkringar, porto, telefon, böcker, tidskrifter, kontorsmaterial etc. FoU-verksamhetens andel (eventuell debiterad som pålägg) av kostnader för administration. Räntekostnader ska inte ingå.
Lägg märke till att avskrivningar på byggnader, maskiner/inventarier inte ska ingå i driftkostnader.

❼ **Investeringar.** Utgifter för anskaffning av materiella anläggningstillgångar, och förbättring som väsentligt höjer kapacitet, livslängd eller standard på dessa. Utgifter för anskaffning av programvaror för användning inom företagets FoU-verksamhet. Icke avdragsgill moms ska ingå. **Redovisa hela investeringsutgiften för FoU utan hänsyn till eventuella avskrivningar.**

❽ **Övrig innovationsverksamhet**
- Intern eller extern utbildning för företagets personal, särskilt genomförd för utvecklingen eller introduktionen av nya eller väsentligt förbättrade produkter eller processer.
- Intern eller extern verksamhet inför marknadsintroduktion av ert företags nya eller väsentligt förbättrade produkter eller tjänster, inkl. marknadsundersökningar och reklamkampanjer.
- Intern eller extern verksamhet för att ändra formen, utseendet eller användbarheten hos varor eller tjänster.
- Intern eller extern annan övrig verksamhet, för att implementera nya eller väsentligt förbättrade produkter eller processer, t.ex. genomförbarhetsstudier, testning, anskaffning av utrustning, industriteknisk tillämpning etc.

F Stöd för innovationsverksamhet åren 2012–2014

16 Fick ert företag, under åren 2012–2014, stöd för innovationsverksamhet från...

Räkna in ekonomiskt stöd via offentliga bidrag och lån (t.ex. ALMI, Tillväxtverket, VINNOVA, Innovationsbron) samt EU-medel.

*Räkna **inte** in forskning eller annan innovationsverksamhet som uteslutande utförts för offentlig sektor [9] enligt upphandlingskontrakt.*

		1 Ja	2 Nej	
a)	**... kommuner, landsting, kommunal- och landstingsförbund?**	☐	☐	FUNLOC
b)	**... staten** (inkl. statliga myndigheter eller departement)?	☐	☐	FUNGMT
c)	**... Europeiska unionen** (EU)?	☐	☐	FUNEU

Om svaret på fråga 16c är **Ja,**

deltog ert företag i EU:s sjunde ramprogram för forskning och teknisk utveckling eller EU:s program Horisont 2020?	Ja ☐ 1	Nej ☐ 2	FUNRTD

[9] Offentliga sektorn består av staten, kommuner, landsting, kommunal- och landstingsförbund samt enheter inom ålderspensionssystemet vilket är Pensionsmyndigheten samt AP-fonderna (exkl. den del som hör till premiepensionssystemet såsom 7:e AP-fonden).

G Samarbete i verksamhet avseende produkt- och/eller processinnovationer åren 2012–2014

17 Hade ert företag innovationssamarbete med andra företag eller organisationer under åren 2012–2014?

Innovationssamarbete innebär aktivt deltagande tillsammans med andra företag eller organisationer i innovationsverksamheten. Båda parterna behöver inte dra kommersiell nytta av verksamheten.

*Räkna **inte** in innovationsverksamhet som bara läggs ut på andra företag och inte innebär aktivt samarbete.*

1 ☐ Ja

2 ☐ Nej → **Gå till avsnitt H**

CO

18 Vilken lokalisering hade företagets samarbetspartner under åren 2012–2014?

Flera alternativ får markeras.

Markera efter typ av samarbetspartner	Sverige	[1] Övriga Europa	USA	Kina eller Indien	Övriga länder	Inte aktuell
a) Andra företag inom koncernen	☐ CO11	☐ CO12	☐ CO13	☐ CO14	☐ CO15	☐ CONA1
b) Leverantörer av utrustning, material, komponenter/ programvara	☐ CO21	☐ CO22	☐ CO23	☐ CO24	☐ CO25	☐ CONA2
c) Kunder/klienter från privata sektorn	☐ CO311	☐ CO312	☐ CO313	☐ CO314	☐ CO315	☐ CONA31
d) Kunder/klienter från offentliga sektorn [9]	☐ CO321	☐ CO322	☐ CO323	☐ CO324	☐ CO325	☐ CONA32
e) Konkurrenter eller andra företag inom er bransch	☐ CO41	☐ CO42	☐ CO43	☐ CO44	☐ CO45	☐ CONA4
f) Konsulter, privata laboratorier	☐ CO51	☐ CO52	☐ CO53	☐ CO54	☐ CO55	☐ CONA5
g) Universitet eller högskolor	☐ CO61	☐ CO62	☐ CO63	☐ CO64	☐ CO65	☐ CONA6
h) Privata FoU-institut (t.ex. industriforskningsinstitut)	☐ CO71	☐ CO72	☐ CO73	☐ CO74	☐ CO75	☐ CONA7
i) Offentliga forskningsinstitut	☐ CO81	☐ CO82	☐ CO83	☐ CO84	☐ CO85	☐ CONA8

19 Vilken av ovanstående samarbetspartner var mest värdefull för företagets innovationsverksamhet under åren 2012–2014?

Ange bokstav (a–i)

☐ PMOS

[1] Följande länder räknas in: Albanien, Belgien, Bosnien och Hercegovina, Bulgarien, Cypern, Danmark, Estland, Finland, Frankrike, Grekland, Irland, Island, Italien, Kosovo, Kroatien, Lettland, Liechtenstein, Litauen, Luxemburg, Makedonien, Malta, Montenegro, Nederländerna, Norge, Polen, Portugal, Rumänien, Schweiz, Serbien, Slovakien, Slovenien, Spanien, Storbritannien, Tjeckien, Turkiet, Tyskland, Ungern och Österrike.

[9] Offentliga sektorn består av staten, kommuner, landsting, kommunal- och landstingsförbund samt enheter inom ålderspensionssystemet vilket är Pensionsmyndigheten samt AP-fonderna (exkl. den del som hör till premiepensionssystemet såsom 7:e AP-fonden).

H Organisatoriska innovationer åren 2012–2014

För att räknas som en organisatorisk innovation ska det röra sig om en ny metod att organisera företagets affärsverksamhet (inkl. kunskapshantering), ny organisation av arbetsplatsen eller externa relationer som inte tidigare använts av företaget.

– Den organisatoriska innovationen måste vara resultatet av strategiska beslut av företagsledningen.

– Räkna **inte** in sammanslagningar eller förvärv även om det är första gången.

20 Introducerade ert företag under åren 2012–2014...

a) **... nya affärsmetoder för att organisera förfaranden?** ..... 1 ☐ Ja 2 ☐ Nej ORGBUP
T.ex. försörjningskedjan, omstrukturering av företaget, kunskapshantering, "lean production", system för kvalitetssäkring.

b) **... nya metoder för att organisera ansvar och beslutsfattande?** ..... 1 ☐ Ja 2 ☐ Nej ORGWKP
T.ex. användandet för första gången av ett nytt system för anställdas ansvar, lagarbete, decentralisering, integration eller särskiljande av avdelningar, utbildnings- eller fortbildningssystem.

c) **... nya metoder för att organisera externa relationer med andra företag eller offentliga organisationer?** ..... 1 ☐ Ja 2 ☐ Nej ORGEXR
T.ex. användande för första gången av allianser, partnerskap, outsourcing eller underleverantörer.

I Innovationer inom marknadsföring åren 2012–2014

Med innovationer inom marknadsföring avses **införandet av ett nytt marknadsföringskoncept eller en ny marknadsföringsstrategi.** Denna ska skilja sig avsevärt från företagets tidigare metoder för marknadsföring och inte använts tidigare.

– En innovation inom marknadsföring kräver betydande förändringar i produkters utformning eller paketering, produktplacering, marknadsföring eller prissättning av produkter.

– Räkna **inte** in säsongsbetonade, normala eller andra rutinmässiga förändringar i marknadsföringsmetoder.

21 Introducerade ert företag under åren 2012–2014...

a) **... väsentliga förändringar i den estetiska utformningen eller paketeringen av en vara eller en tjänst?** ..... 1 ☐ Ja 2 ☐ Nej MKTDGP
Räkna inte in förändringar i produktens funktionella kännetecken eller användarprofil – dessa utgör produktinnovationer.

b) **... nya media eller metoder för marknadsföring av produkter?** 1 ☐ Ja 2 ☐ Nej MKTPDP
T.ex. användning för första gången av ett nytt reklammedium, en ny utformning av varumärkets identitet, införandet av lojalitetskort.

c) **... nya metoder för produktplacering eller försäljningskanaler?** ..... 1 ☐ Ja 2 ☐ Nej MKTPDL
T.ex. användning för första gången av franchising eller distributionslicenser, direktförsäljning, ensamrätt att bedriva detaljhandel, nya koncept för produktpresentation.

d) **... nya metoder för prissättning av varor eller tjänster?** ..... 1 ☐ Ja 2 ☐ Nej MKTPRI
T.ex. användning för första gången av rörlig prissättning beroende på efterfrågan, rabattsystem.

J Offentliga avtal och innovationer åren 2012–2014

22 Under åren 2012–2014, hade företaget något avtal för att leverera varor eller tjänster till...

a) **... svenska offentliga organisationer?** ❾ PUBDOM 1 ☐ Ja 2 ☐ Nej →

b) **... utländska offentliga organisationer?** PUBFOR 1 ☐ Ja 2 ☐ Nej →

Om **Nej**, på **både 22a** och **22b**, **gå till avsnitt K**

❾ Offentliga sektorn består av staten, kommuner, landsting, kommunal- och landstingsförbund samt enheter inom ålderspensionssystemet vilket är Pensionsmyndigheten samt AP-fonderna (exkl. den del som hör till premiepensionssystemet såsom 7:e AP-fonden).

23 Har ert företag, under åren 2012–2014, genomfört några innovationsaktiviteter som en del av ett avtal för att tillhandahålla varor eller tjänster till en offentlig organisation?

Inkludera aktiviteter för produktinnovation, processinnovation, organisatorisk innovation och innovation inom marknadsföring.

1 ☐ Ja
2 ☐ Nej → **Gå till avsnitt K**

PBINN

Om svaret på fråga 23 är **Ja**, **vilket/vilka av följande påståenden stämmer för ert företag?**

Om ert företag hade flera avtal, markera samtliga alternativ som passar.

☐ En innovation krävdes enligt avtalet PBINCT

☐ En innovation krävdes **inte** enligt avtalet PBNOCT

K Immateriella rättigheter och licensiering åren 2012–2014

24 Under åren 2012–2014 har ert företag...	1 Ja	2 Nej	
a) **... ansökt om patent?**	☐	☐	PROPAT
b) **... registrerat ett mönsterskydd?**	☐	☐	PRODSG
c) **... registrerat ett varumärke?**	☐	☐	PROTM

25 Under åren 2012–2014 har ert företag...	1 Ja	2 Nej	
a) **... licensierat ut eller sålt ett patent, mönsterskydd, upphovsrätt eller varumärke till ett annat företag, universitet eller forskningsinstitut?**	☐	☐	PROLEX
b) **... erhållit licens ❿ eller köpt ett patent, mönsterskydd, upphovsrätt eller varumärke som ägs av ett annat företag, universitet eller forskningsinstitut?**	☐	☐	PROLIN

❿ Exkludera förvärvet av licenser för vanliga mjukvaruprogram för stationära och bärbara datorer såsom operativsystem, ordbehandling, kalkylblad, osv.

Svara på frågorna 26–28 endast om ert företag **inte** har introducerat en innovation samt **inte** hade någon pågående/avbruten innovationsverksamhet under åren 2012 – 2014 (svarat **Nej** på alla alternativ i frågorna 5, 10, 13, 20 och 21). I annat fall gå till fråga 29.

L Företag utan innovationsverksamhet åren 2012–2014

26 Vilken av följande anledningar beskriver bäst varför ert företag inte hade någon innovationsverksamhet under åren 2012–2014?

*Markera **ett** alternativ.* HCOM_HBAR

1 ☐ Ingen tvingande orsak till att vara innovativ → ***Gå till fråga 27***

2 ☐ Övervägde att bedriva innovationsverksamhet, men hindren var för stora → ***Gå till fråga 28***

27 Hur betydelsefulla var följande orsaker till att ert företag inte bedrev någon innovatonsverksamhet under åren 2012–2014?

Markera ett alternativ per rad.

	Grad av betydelse: 3 Stor	2 Medel	1 Liten	4 Ingen betydelse
a) Låg efterfrågan på innovationer på marknaden HLDEM	☐	☐	☐	☐
b) Inget behov av att bedriva innovationsverksamhet pga. tidigare innovationer HPRIOR	☐	☐	☐	☐
c) Inget behov av att bedriva innovationsverksamhet pga. minimal konkurrens på marknaden HCOMPL	☐	☐	☐	☐
d) Brist på innovationsidéer HIDIN	☐	☐	☐	☐

→ ***Gå till fråga 32***

28 Hur betydelsefulla var följande innovationshinder under åren 2012–2014?

Markera ett alternativ per rad.

	Grad av betydelse: 3 Stor	2 Medel	1 Liten	4 Ingen betydelse
a) Brist på intern finansiering HFENT	☐	☐	☐	☐
b) Brist på kredit eller eget kapital HCRE	☐	☐	☐	☐
c) Brist på kompetent personal inom företaget HPER	☐	☐	☐	☐
d) Svårigheter med att erhålla offentliga bidrag eller subventioner för innovationsverksamhet HSUBS	☐	☐	☐	☐
e) Brist på samarbetspartner HPAR	☐	☐	☐	☐
f) Osäker efterfrågan på era innovationsidéer HDEM	☐	☐	☐	☐
g) För mycket konkurrens på marknaden HCOMPH	☐	☐	☐	☐

→ ***Gå till fråga 32***

M Innovationer med miljövinster åren 2012–2014

En innovation med miljövinster är en ny eller väsentligt förbättrad produkt (vara eller tjänst), process, organisations- eller marknadsföringsmetod som skapar miljövinster jämfört med alternativen.

– Miljövinsterna kan vara antingen huvudmålet med innovationen eller en biprodukt av andra mål.

– Miljövinsterna från en innovation kan uppkomma genom produktionen av en vara eller tjänst, eller under produktens slutanvändning. Slutanvändaren kan vara en person, ett företag, staten m.m.

29 Under åren 2012–2014, introducerade ert företag en produkt- (vara eller tjänst), process-, organisatorisk innovation eller innovation inom marknadsföring med någon av följande miljövinster som följd? *Frivillig fråga.*

Markera ett alternativ per rad.

		1 Ja	2 Nej
Miljövinster inom ert företag			
a)	Mindre material- eller vattenanvändning per producerad/levererad enhet ECOMAT	☐	☐
b)	Mindre energiförbrukning eller koldioxidutsläpp (reducerad totalproduktion av CO_2) ECOENO	☐	☐
c)	Mindre föroreningar till luft, vatten och mark, mindre buller ECOPOL	☐	☐
d)	Bytt ut en del material mot mindre förorenande eller mindre farligt ersättningsmaterial ECOSUB	☐	☐
e)	Bytt ut en del fossila bränslen mot förnybara energikällor ECOREP	☐	☐
f)	Återvunnit avfall, vatten eller material för eget bruk eller försäljning ECOREC	☐	☐
Miljövinster som uppkommit under en varas eller tjänsts slutkonsumtion eller slutanvändning		1 Ja	2 Nej
g)	Mindre energiförbrukning eller koldioxidutsläpp ECOENU	☐	☐
h)	Mindre föroreningar till luft, vatten och mark, mindre buller ECOPOS	☐	☐
i)	Lättare återvinning av uttjänad produkt ECOREA	☐	☐
j)	Längre produktlivscykel pga. mer långlivade och hållbara produkter ECOEXT	☐	☐

→ Om **Nej**, på **alla** alternativ **gå till fråga 32**

30 Berodde någon av dessa miljövinster på följande typer av innovationer inom ert företag? *Frivillig fråga.*

		1 Ja	2 Nej
a)	Produktinnovationer (varor eller tjänster) ECOPRD	☐	☐
b)	Processinnovationer ECOPRC	☐	☐
c)	Organisatoriska innovationer ECOORG	☐	☐
d)	Innovationer inom marknadsföring ECOMKT	☐	☐

31 Under åren 2012–2014, hur viktiga var följande faktorer när det gäller ert företags beslut att introducera innovationer med miljövinster?
Frivillig fråga.

Markera ett alternativ per rad.

		Grad av betydelse 3 Stor	2 Medel	1 Liten	4 Inte relevant
a)	Gällande miljöföreskrifter ENEREG	☐	☐	☐	☐
b)	Gällande miljöskatter eller avgifter ENETX	☐	☐	☐	☐
c)	Eventuella miljöföreskrifter eller avgifter i framtiden ENREGF	☐	☐	☐	☐
d)	Offentliga anslag, bidrag eller annat finansiellt incitament för miljöanpassade innovationer ENGRA	☐	☐	☐	☐
e)	Rådande eller förväntad marknadsefterfrågan på miljöanpassade innovationer ENDEM	☐	☐	☐	☐
f)	Förbättring av företagets rykte ENREP	☐	☐	☐	☐
g)	Ideella handlingar eller initiativ för att skapa goda exempel inom branschen ENAGR	☐	☐	☐	☐
h)	Höga kostnader för energi, vatten eller material ENCOST	☐	☐	☐	☐
i)	Behov av att möta krav i offentliga upphandlingsavtal ENREQU	☐	☐	☐	☐

32 Har ert företag rutiner för att med jämna mellanrum identifiera och minska er miljöpåverkan? (T.ex. upprättande av miljöredovisningar, fastställande av miljömål, ISO 14001 certifiering, ISO 50001 certifiering, osv.)
Frivillig fråga.

1 ☐ Ja ENVID

2 ☐ Nej → **Gå till fråga 34**

33 Om rutiner finns i ert företag, när genomfördes de?
Frivillig fråga.

Om ert företag hade flera rutiner, markera samtliga alternativ som passar.

☐ Vissa rutiner genomfördes innan 2012 ENVBF

☐ Vissa rutiner genomfördes eller påtagligt förändrades mellan 2012 och 2014 ENVBT

Kommentarer

KOM

34 Hur lång tid behövde ni för att ta fram uppgifterna och besvara blanketten? *Frivillig fråga.*

☐☐ minuter TID

Företagets kontaktperson

Namn (TEXTA)	Telefon (även riktnr)
E-post	Mobil

Tack för din medverkan!

A.9 Survey - Current status examination of organisational work and work environment in Swedish working life in 2015 (NU2015) by *work Environment Authority*

ARBETSMILJÖ VERKET

Frågeformulär

Arbetsmiljöverkets Nulägesundersökning 2015 om arbetsorganisation och arbetsmiljö i svenskt arbetsliv (NU2015)

Webbversion

2016-02-02

Innehåll

1. Vilken befattning har du?

1. ☐ VD *(Om du är både ägare och VD, välj VD)*
2. ☐ Ägare/innehavare
3. ☐ Generaldirektör
4. ☐ Förvaltningschef
5. ☐ Personalchef, HR-chef el motsvarade
6. ☐ Annan chef
7. ☐ Annan befattning, nämligen_____

98. ☐ Vet ej

Frågeområden

A. BEMANNING

2. Uppskatta hur stor andel i procent som arbetade deltid 2015? Med deltid menas alla arbetstider mindre än vanlig heltidstjänst.

1. o 0 procent
2. o 1 till 9 procent
3. o 10 till 24 procent
4. o 25 procent eller mer
5. o Deltid förekommer, men vet inte procent

98. o Vet ej

Tidsbegränsade anställningar

Till dem räknas alla som utför arbete på arbetsplatsen med ett slutdatum eller en definierad tidsperiod, även om kontraktet gäller för flera år.

3. Uppskatta hur stor andel i procent av alla i organisationen som hade tidsbegränsade anställningar 2015, i form av timanställda och projektanställda? Räkna ej med inhyrda personer från konsult- eller bemanningsföretag

1. o 0 procent
2. o 1 till 9 procent
3. o 10 till 24 procent
4. o 25 procent eller mer
5. o Tidsbegränsad anställning förekommer, men vet inte procent

98. o Vet ej

4. Uppskatta hur stor andel av alla medarbetare som kom från bemanningsföretag respektive var konsulter, under 2015?

Inforuta: Skillnaden mellan bemanningsföretag och konsultföretag är generellt sett att du som inhyrare är arbetsledaren när det är frågan om bemanningsföretag medan konsultföretag arbetsleder sin egen personal. Konsulten arbetar oftast helt eller delvis tillsammans med medarbetare anställda i den egna organisationen.

	1:0 procent	2:1 till 4 procent	3:5 till 9 procent	4:10 till 24 procent	5:25 procent eller mer	6:Förekommer, men vet inte procent	7:Vet ej
a. Hur stor andel i procent kommer från bemanningsföretag?	o	o	o	o	o	o	o
b. Hur stor andel i procent är konsulter?	o	o	o	o	o	o	o

B. ANSVAR FÖR ARBETSUPPGIFTER

5. Vem ansvarar i normalfallet för den dagliga planeringen av medarbetares vardagliga arbetsuppgifter?

Flera svarsalternativ är möjliga.

1. o Medarbetare som utför arbetsuppgiften
2. o Chef eller arbetsledare
3. o Annan

98. o Vet ej

6. Vem ansvarar i normalfallet för veckoplaneringen av medarbetares vardagliga arbetsuppgifter?

Flera svarsalternativ är möjliga.

1. o Medarbetare som utför arbetsuppgiften
2. o Chef eller arbetsledare
3. o Annan

98. o Vet ej

7. Vem ansvarar i normalfallet för den vardagliga kundkontakten?

Flera svarsalternativ är möjliga.

1. o Medarbetare som utför arbetsuppgiften
2. o Chef eller arbetsledare
3. o Annan
98. o Vet ej

8. Vem ansvarar i normalfallet för de inköp som behövs för det vardagliga arbetet?

Flera svarsalternativ är möjliga.

1. o Medarbetare som utför arbetsuppgiften
2. o Chef eller arbetsledare
3. o Annan

98. o Vet ej

9. Vem ansvarar för den <u>vardagliga kontrollen av kvalitén</u>?

Inforuta: Med kontroll av kvalitén menas att varan eller tjänsten håller den nivå som är bestämd, exempelvis utseende, prestanda och pålitlighet eller tillräckligt trevligt kundbemötande eller att bilen verkligen blev lagad .

Flera svarsalternativ är möjliga.

1. o Medarbetare som utför arbetsuppgiften
2. o Chef eller arbetsledare
3. o Specialistgrupp eller särskild division inom företaget eller myndigheten
4. o Externgrupp – kunder, externa utvärderingsexperter etc.
5. o Kvalitetskontroller utförs ej
6. o Annan

98. o Vet ej

10. Hur stor andel i procent av medarbetarna utan ledningsuppgifter kan anpassa tidpunkten då de börjar eller avslutar sitt dagliga arbete, som exempelvis flextid?

1. o 0 procent
2. o 1 till 24 procent
3. o 25 till 49 procent
4. o 50 till 74 procent
5. o 75 procent eller mer

98. o Vet ej

C. ARBETE I GRUPP (TEAM)

11. Hur stor andel i procent av medarbetarna i organisationen arbetar för närvarande i projekt eller grupper där man gemensamt beslutar om hur arbetet utförs?

Inforuta: Med ” grupper där man gemensamt beslutar” menas självbestämmandegrupp/team

1. o 0 procent
2. o 1 till 24 procent
3. o 25 till 49 procent
4. o 50 till 74 procent
5. o 75 procent eller mer
6. o Ej relevant

98. o Vet ej

12. Hur stor andel i procent av medarbetarna är involverade i förbättringsprojekt inom organisationen?

1. o 0 procent
2. o 1 till 24 procent
3. o 25 till 49 procent
4. o 50 procent till 74 procent
5. o 75 procent eller mer
6. o Ej relevant

98. o Vet ej

13. Hur ofta genomförs möten mellan enhetschef/gruppchef och medarbetare i organisationen, som t ex ”företagsträff” eller ”team-möte”?

1. o Aldrig
2. o Mindre än en gång per månad
3. o Minst en gång per månad
4. o Minst en gång per vecka
5. o Dagligen

98. o Vet ej

D. UTBILDNING OCH KOMPETENSUTVECKLING

14. Hur stor andel i procent av medarbetarna har deltagit i utbildning på betald arbetstid under 2015?

1. o 0 procent
2. o 1 till 24 procent
3. o 25 till 49 procent
4 .o 50 till 74 procent
5. o 75 procent eller mer
98. o Vet ej

Selektion: Om 2-5 på fråga 14:

15. Av de som deltagit i utbildning, hur många dagar har de i genomsnitt ägnat åt denna?

1. o Mindre än en dag
2. o 1-3 dagar
3. o 4-5 dagar
4. o 6-10 dagar
5. o Mer än 10 dagar

98. o Vet ej

Selektion: Om 2-5 på fråga 14:

16. Hur många procent av omsättningen är externa utbildningskostnader?

Externa utbildningskostnader är t.ex. kursavgifter, köpta kurser från andra organisationer, föreläsare från andra organisationer.

1. o inga utbildningskostnader

2. o upp till 1 procent
3. o 1-2 procent
4. o 3-5 procent
5. o om mer än 5 procent, hur stor andel i procent:…….
6 o öppet belopp, utbildningskostnader i svenska kronor:_____

98. o vet ej

17. Hur stor andel i procent av medarbetarna har deltagit i utbildning där arbetsgivaren har beviljat ledighet utan lön under 2015?

1. o 0 procent
2. o 1 till 24 procent
3. o 25 till 49 procent
4. o 50 till 74 procent
5. o 75 procent eller mer

98. o vet ej

18. Har det vardagliga, normala arbetet inslag av organiserad kompetensutveckling?

Med organiserad kompetensutveckling menas att arbetet har lagts upp på så sätt att medarbetaren utvecklar sin kompetens under åtminstone vissa arbetsmoment.

1. o nej
2. o ja

98. o vet ej

Selektion:Om 2 på fråga 18:

19. Hur stor andel i procent av arbetstiden under året består av organiserad kompetensutveckling?

Inforuta: *Med organiserad kompetensutveckling menas att arbetet har lagts upp på så sätt att medarbetaren utvecklar sin kompetens under åtminstone vissa arbetsmoment.*

1. o upp till 1 procent
2. o 1-3 procent
3. o 4-5 procent
4. o 6-10 procent
5. o om mer än 10 procent hur många procent på ett ungefär? ……..

98. o vet ej

20. Hur stor andel i procent av medarbetarna har fått det som kallas on-the-job-training, det vill säga fått instruktion eller utbildning för att förbättra sina färdigheter samtidigt som de utfört sina normala arbetsuppgifter?

1. o 0 procent
2. o 1 till 24 procent
3. o 25 till 49 procent
4. o 50 till 74 procent
5. o 75 procent eller mer

98. o vet ej

Selektion: Om 2-5 på fråga 20:

21. Hur stor andel i procent av arbetstiden under året består av on-the-job-training?

1. o upp till 1 procent
2. o 1-3 procent
3. o 4-5 procent
4. o 6-10 procent
5. o om mer än 10 procent hur många procent på ett ungefär?

98. o vet ej

E. MEDARBETARSAMTAL OCH LÖN

22. Hur stor andel i procent av medarbetarna har ett utvecklings- eller medarbetarsamtal minst en gång om året?

1. o 0 procent
2. o 1 till 24 procent
3. o 25 till 49 procent
4. o 50 till 74 procent
5. o 75 till 94 procent
6. o 95 till 100 procent / alla

98. o vet ej

23. Är medarbetarnas befordran kopplad till utvecklings- eller medarbetarsamtal? Vad av följande stämmer bäst överens.

Befordran kan vara svårare eller mer komplicerade arbetsuppgifter, såväl som högre tjänster eller andra tjänster

1. o Nej, befordran och dessa samtal har ingen koppling
2. o Ja, men utvecklings- eller medarbetarsamtal är endast ett av flera verktyg som används för att diskutera befordran med respektive anställd
3. o Ja, huvudsakligen används utvecklings- eller medarbetarsamtal för att diskutera befordran med respektive anställd

98. o vet ej

24. Hur stor andel i procent av organisationens medarbetare har en del av lönen baserad på sin egen prestation eller prestationen av en större grupp?

1. o 0 procent
2. o 1 till 24 procent
3. o 25 till 49 procent
4. o 50 procent eller mer

98. o vet ej

F. PRIORITERINGAR OCH KVALITETSARBETE

25. Finns system för prioritering av arbetsuppgifter, exempelvis rutiner, instruktioner och dokumentering eller schema för i vilken ordning arbetsuppgifter görs?

1. o nej
2 .o ja

98. o vet ej

26. Är arbetet organiserat så att medarbetare ändrar/byter arbetsuppgifter när organisationen behöver det?

1. o nej
2 .o ja

98. o vet ej

27. Bedöm hur varierande medarbetarnas arbetsuppgifter är i normalfallet, för kvinnor respektive män.

Om det inte finns några kvinnor respektive män i organisationen kryssa ej relevant.

	ingen variation kräver arbetet att de enbart upprepar samma arbetsmoment, många gånger i timmen 1	**låg variation** 2	**hög variation** 3	**mycket hög variation** går en del av arbetstiden åt till att förstå eller lösa krävande problem 4	**ej relevant** 97	vet ej 98
A, Hur varierande är arbetsuppgifterna normalt för de flesta kvinnorna i organisationen?	☐	☐	☐	☐	☐	☐
B, Hur varierande är arbetsuppgifterna normalt för de flesta männen i organisationen?	☐	☐	☐	☐	☐	☐

28. Dokumenterar organisationens medarbetare goda arbetsrutiner eller erfarenheter?

1. o Nej
2. o Ja, men inte regelbundet
3. o Ja, regelbundet

98. o vet ej

29. Följer organisationen upp och utvärderar kvaliteten på produktionsprocesser eller service?

Inforuta: Med kontroll av kvalitén menas att varan eller tjänsten håller den nivå som är bestämd, exempelvis utseende, prestanda och pålitlighet eller tillräckligt trevligt kundbemötande.

1. o Nej
2. o Ja, men inte regelbundet
3. o Ja, regelbundet

98. o vet ej

30. Mäter organisationen kundnöjdhet eller analyserar klagomål, exempelvis genom frågeformulär, fokusgrupper eller andra metoder för datainsamling?

1. o Nej
2. o Ja, men inte regelbundet
3. o Ja, regelbundet

98. o vet ej

Selektion: om 2 eller 3 på fråga 29 eller fråga 30:

31. Uppskatta hur stor andel i procent av medarbetare som medverkar i arbete med frågor om kundnöjdhet och kvalitet. Räkna dock inte med dem som har det som huvudsaklig arbetsuppgift.

1. o 0 procent
2. o 1 till 24 procent
3. o 25 till 49 procent
4. o 50 procent eller mer

98. o vet ej

32. Bedriver organisationen omvärldsbevakning <u>för att utveckla</u> den egna organisationen och dess produkter, processer och tjänster?

Med omvärldsbevakning menas t ex åka på mässor, tala med kunder och studera konkurrenternas produkter.

1. o Nej,
2. o Ja, särskilt utpekade medarbetare (är avdelade för denna uppgift)
3. o Ja, det ingår i det (normala) arbetet för alla medarbetare

98. o vet ej

G. SAMARBETE MED ANDRA ORGANISATIONER.

Samarbete inkluderar köp av varor eller tjänster från företag samt samarbete med offentliga organisationer, exempelvis universitet och högskolor

33. Sköter ni vanligtvis design och utveckling av varor eller tjänster helt själva eller tar ni hjälp av andra företag eller organisationer?

Inforuta: Med design menas ändrad form, utseende eller användbarhet, hos vara eller tjänst. Design är en form av utvecklingsarbete. Med utvecklingsarbete menas alla förbättringar av de varor och tjänster som företaget/organisationen producerar.

1. o Sköter det själva
2. o Tar hjälp
3. o Ej relevant

98. o vet ej

34. Sköter ni vanligtvis administration helt själva eller tar ni hjälp av andra företag eller organisationer?

1. o Sköter det själva
2. o Tar hjälp
3. o Ej relevant

98. o vet ej

H. ARBETSMILJÖARBETE

35. Arbetar ni med medarbetares ansvar och befogenheter i ert arbetsmiljöarbete?

1. o nej
2 .o ja

98. o vet ej

36. Arbetar ni med att förebygga belastningsskador i ert arbetsmiljöarbete?
1. o nej
2 .o ja

98. o vet ej

37. Arbetar ni med ljud, luft, ljus, teknik eller kemikalier i ert arbetsmiljöarbete?

1. o nej
2 .o ja

98. o vet ej

38. Arbetar ni med den sociala arbetsmiljön i ert arbetsmiljöarbete?
Exempelvis samarbete mellan medarbetare eller förebyggande av kränkande särbehandling?

Markera ”Ja” om ni arbetar med minst ett område inom den sociala arbetsmiljön i deras arbetsmiljöarbete.

1. o nej
2 .o ja

98. o vet ej

39. Ingår arbetsmiljöarbete i första linjens chefers arbetsuppgifter?

Med första linjens chef menas den nivå inom organisationen där den löpande verksamheten bedrivs och där chef har ett direkt personalansvar. Första linjens chef har inte andra chefer under sig.

1. o nej
2. o ja

98. o vet ej

40. Ges <u>skyddsombud</u> möjlighet att medverka i organisationens arbetsmiljöarbete?

Gäller även regionala skyddsombud

1. o Skyddsombud saknas
2. o Nej, men skyddsombud finns
3. o Ibland kan skyddsombuden medverka
4. o Oftast kan de medverka
5. o Ja, alltid

98. o vet ej

41. Ges <u>medarbetare</u> möjlighet att medverka i organisationens arbetsmiljöarbete?

1. o Nej, det görs inte
2. o Ibland
3. o Oftast
4. o Ja, alltid

98. o vet ej

42. Har ni anlitat extern sakkunnig hjälp för arbetsmiljöarbetet?

Flera svarsalternativ är möjliga.

1. o Ja, företagshälsovård
2. o Ja, annan experthjälp
3. o Nej

98. o vet ej

I. RISKER OCH HÄNDELSER I ARBETSMILJÖN

43. Hur går organisationen tillväga för att undersöka arbetsmiljön?

Flera svarsalternativ möjliga

1. o Skyddsronder
2. o Rapporteringssystem *(t ex tillbud, ett tillbud är en oönskad händelse som kunnat leda till ohälsa eller olycksfall.)*
3. o Medarbetarundersökningar *(exempelvis enkäter/intervjuer)*
4. o Tas upp på arbetsplatsträffar
5. o Tas upp i medarbetar- eller utvecklingssamtal
6. o Särskilda mätningar *(fysisk miljö)*
7. o Medicinska undersökningar
8. o Nej, arbetsmiljön undersöks inte
9. o annat sätt, nämligen_____(öppet svarsalternativ,)

98. o vet ej

44. Gör ni bedömningar av de risker ni finner i er arbetsmiljö?

1. o Nej, inga riskbedömningar görs
2. o Vissa riskbedömningar görs
3. o Ja, alla risker bedöms

98. o vet ej

Selektion: Om 2 eller 3 på fråga 44:

45. Dokumenterar ni skriftligt de riskbedömningar som ni gör?

1. o Nej, ingen skriftlig dokumentation
2. o Vissa bedömningar dokumenteras skriftligt
3. o Ja, alla bedömningar dokumenteras skriftligt

98. o vet ej

Selektion: Om 2 eller 3 på fråga 44:

46 Åtgärder som inte genomförs omedelbart, det vill säga samma dag eller någon av de närmast följande dagarna, förs de in i en skriftlig handlingsplan?

1. o Nej, det görs inte
2. o Ibland
3. o Oftast
4. o Ja, alltid

98. o vet ej

47. Har någon arbetsolycka (plötslig händelse) inträffat under 2015?

Olycksfall innebär fysisk eller psykisk skada till följd av en plötslig händelse. Ett olycksfall kan leda till såväl en lindrig skada som till dödsfall.

1. o nej
2 .o ja

98. o vet ej

48. Har ohälsa på grund av arbetet, det vill säga sjukdom eller andra besvär som inte är arbetsolycka inträffat under 2015?

Det är styrkan i upplevelserna, varaktigheten och förmågan att fungera som avgör om ohälsa föreligger. Exempel på ohälsa och sjukdom kan vara stressreaktioner och belastningsbesvär.

1. o nej
2 .o ja

98. o vet ej

49. Har allvarligt tillbud som inte lett till olycksfall eller ohälsa, inträffat under 2015?

Allvarliga tillbud är händelser som i sig innebär stor fara för ohälsa eller olycksfall.
Det behöver inte finnas någon fara för person i den aktuella situationen.
Ett exempel är en explosion i en lokal där ingen vistas för tillfället. Annat exempel är hot om våld.

1. o nej
2 .o ja

98. o vet ej

J. RESURSER OCH MÅL I ARBETSMILJÖARBETET

50. Får de personer hos er som genomför arbetsmiljöarbete resurser för detta? Exempelvis utrustning, lokaler, tid eller ekonomiska medel?

1. o Nej
2. o Ja, i viss mån
3. o Ja, i högsta grad

98. o vet ej

51. Följer organisationen <u>årligen</u> upp om arbetsmiljöarbetet har bedrivits som det var tänkt?

1. o nej
2. o ja

98. o vet ej

52a. Känner du till att det finns en föreskrift som benämns ”Systematiskt arbetsmiljöarbete”?

1. o nej
2. o ja

98. o vet ej

52b. Bedrivs ert arbetsmiljöarbete enligt föreskriften om ”Systematiskt arbetsmiljöarbete”?

Inforuta: Om du inte känner till föreskriften enligt frågan ovan så kan du ändå känna till att arbetsmiljöarbetet som utförs av andra i organisationen bedrivs enligt föreskriften.

1. o Nej, det görs inte
2. o Planerat eller beslutat, men ännu inte startat
3. o Under införande
4. o Ja, i viss mån
5. o Ja, i högsta grad

98. o vet ej

53. Kontrollerar ni att genomförda arbetsmiljöåtgärder haft avsedd effekt?

1. o Nej, det görs inte
2. o Ibland
3. o Oftast
4. o Ja, alltid

98. o vet ej

K. FÖRÄNDRINGSARBETE

54. Har det skett en större förändring inom något av följande områden, under 2015?

En förändring har skett oavsett om det ökat eller minskat, blir bättre eller sämre

	1. Nej	2. Ja	98. Vet ej
a. Proportionen mellan medarbetare anställda i den egna organisationen och inhyrda?	☐	☐	☐
b. Ansvarsfördelning av arbetsuppgifter?	☐	☐	☐
c. Arbete i grupp (team)?	☐	☐	☐
d. Dokumentation av arbetsrutiner?	☐	☐	☐
e. Kunskapskrav (kvalifikationskrav, krav i arbetet)?	☐	☐	☐
f. Medarbetarnas utbildning och kompetens?	☐	☐	☐
g. Medarbetarsamtal?	☐	☐	☐
h. Arbetsmiljöarbete?	☐	☐	☐
i. Tekniska system/it-lösningar?	☐	☐	☐
j. Arbetstidens förläggning?	☐	☐	☐

55 Har ni genomgått en betydande omorganisation under 2015?

1. o ja
2. o nej

98. o vet ej

Selektion: Om 1 på fråga 55:

56. Ungefär hur många av medarbetarna ansvarade för omorganisationen under 2015?

1. o antal (i siffror)

98. o vet ej

Selektion: Om 1 på fråga 55:

57. Ungefär hur många arbetsdagar lade de i genomsnitt på omorganisationen?

1. o antal dagar(i siffror)

98. o vet ej

Selektion: Om 1 på fråga 55:

58. Hur stor andel i procent av medarbetarna har påverkats av omorganisationen? Räkna med exempelvis utbildningar, att delta på möten eller att lära sig arbeta annorlunda.

1. o 0 procent
2. o 1 till 24 procent
3. o 25 till 49 procent
4. o 50 till 74 procent
5. o 75 procent eller mer
6. o ej relevant

98. o vet ej

Selektion: Om 2-5 på fråga 58:

59. Ungefär hur många arbetsdagar lade övriga medarbetare i genomsnitt på omorganisationen, det vill säga dagar som de inte arbetade med sina ordinarie arbetsuppgifter?

En person ska ha arbetat minst en dag (åtta timmar) för att räknas med.
Räkna med exempelvis utbildningar, att delta på möten eller att lära sig arbeta annorlunda.

1. o antal dagar

98. o vet ej

Selektion: Om 1 på fråga 55:

60. Ungefär hur många procent av organisationens omsättning var externa kostnader för omorganisationen under 2015?

1. o inga externa kostnader
2. o upp till1 procent
3. o 1-2 procent
4. o 3-5 procent
5. o om mer än 5 procent, hur stor andel i procent……..

98. o vet ej

Selektion: Om 1 på fråga 55:

61. Har ni gjort någon bedömning av hur genomförda förändringar påverkar arbetsmiljön för medarbetarna?

1. o nej
2. o ja

98. o vet ej

L. BAKGRUNDSFRÅGOR

62. Ange om du är man eller kvinna

1. ☐ man
2. ☐ kvinna

63. Är du tillsvidareanställd i din organisation eller har du en visstidsanställning, exempelvis konsult eller projektanställd?

1. o ...tillsvidare, i den aktuella organisationen
2. o ...visstidsanställd, exempelvis konsult eller projektanställd