Learning at Work and Productivity in Swedish Business Firms

Based on the Swedish MEADOW Survey 2009/2010

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Abstract
The background of the thesis is the ongoing struggle for better understanding of driving forces for economic growth. Some important and rewarding new steps have been taken the last decades in the research of economic growth theory. For example, the theory includes not only the use of technology but also the creation and implementation of new technology intertwined with management and learning practices at work. However, the development of knowledge on the matter can be described as slow. The explanation is argued to be the lack of data, which complicates and prevents the development of theory. The lack of data and the intertwined dependence with the development of theory in the matter constitutes the starting point for the research in the thesis.

The purpose of this thesis is to contribute to the development of measures of management of work and learning practices at work that can be used in productivity models. The analyses are based on the micro-level data from the Swedish MEADOW Survey 2009/2010, at Statistics Sweden. Factor and regression analysis are performed, other analytical techniques are also used.

Some key findings of how management and learning practices at work can be described and measured show that the business firms use the different practices in bundles. The findings indicate synergy effects on performance when more than one management and learning practice is applied. Two different management approaches are tested, both models predict productivity. However, there is a difference in the productivity model a such when it includes the two management approaches; the measure of the contemporary use has a better fitness then the theoretical model. Focus and delimitations of research questions in the forthcoming doctoral dissertation are discussed, see Future Research – the Logic Next Step, in Chapter 6. Final Reflections.

Keywords: productivity, management, learning, competence, development, practices, at work, bundles, factor analysis, regression analysis.
Sammanfattning


Några nyckelresultat om hur ledning och lärande i arbetet kan beskrivas och mätas visar att företagen använder de olika sätten i grupper av praxis ”bundles”. Resultaten visar synergieffekter på företagets prestationsförmåga när mer än en lednings- och inlärningspraxis tillämpas. Två olika sätt för hur att mäta ledning och lärande i arbete används, båda förutsäger produktivitet. Dock finns det en skillnad i produktivitetsmodellen mellan de två olika sättet att mäta: när faktisk användning mäts ger det högre förklaringsgrad än den teoretiska modellen. Inriktning och avgränsning av forskningsfrågor i den kommande planerade doktorsavhandlingen diskuteras, se Future Research – the Logic Next Step, i Chapter 6. Final Reflections.

Sökord: Produktivitet, ledning, lärande, kompetens, utveckling, i arbete, grupper, praxis, bundles, faktoranalys, regressionsanalys.
Acknowledgement

To my supervisors: Thank you for your valuable support and for being demanding when needed. This thesis would not have been completed without you. Especially thank you for your patience with my half time speed due to non-resistible work outside the university, alongside more sad reasons for holdups due to sickness in the family. Special thanks to Professor Emeritus Jan Forslin at the Department of Industrial Economics and Management, INDEK, Division of Industrial Work Science. Royal Institute of Technology, KTH, for letting me join the program and for being my head supervisor until retirement 2009/2010. Thanks to Assistant Professor Matti Kaulio, Associate Professor of Work Organisation and Leadership at the Department of Industrial Economics and Management, INDEK, Division of Industrial Work Science. School of Industrial Engineering and Management, at Royal Institute of Technology, KTH. You took over the responsibility as the head supervisor and made it possible for me to finish the thesis. Thank you for all good and useful suggestions and support with the comprehensive summary. Also, thank you Professor Emerita Annika Härenstam at the Department of Work Science, Faculty of Education, University of Gothenburg. At present affiliated to the University of Stockholm. Assistant supervisor, from the year 2011. Thank you for your support with the structure of the final thesis and valuable insights in work organisation, your knowledge has been crucial. I am honoured to have had your support as an Assisting supervisor since 2011. Thank you, Doctor Hans-Olof Hagén PhD in Economics, at the time, Senior Advisor at Statistics Sweden National Accounts until the summer 2014 and from the autumn at the Department of Economics, Statistics Sweden. Project leader at Statistics Sweden project: Organisation, growth and work environment, aiming to contribute to the work of improving the economic statistics. I am blessed to have had your support as an Assisting supervisor. It has been invaluable to participate in the Statistics Sweden productivity project and to
have your support in the statistical analysis and also for letting me struggle with it. Last but not least, thank you for the access to data from the Swedish MEADOW Survey 2009/2010.

The studies have been part-time as an industrial doctoral student financed by the Swedish Institute for Growth Policy Analyses, ITPS, and later by the social partners. One year has been an important full-time work at Statistic Sweden in the productivity project. The last years have been performed in parallel with work at the Swedish Work Environment Authority.

*Statistics Sweden; Productivity Conference 2010*

Thank you to all participants at Statistics Sweden Productivity Conference; Analyses and development, 6-7 October 2010, for valuable comments on earlier version of the Paper I. Especially discussant Professor Peter Nielsen, Aalborg University; Graham Vickery, Information, Communications and Consumer Policy Division, OECD, and Elif Köksal-Oudot, Economic Analysis and Statistics Division, OECD; Professor Emeritus Kurt Lundgren, at KTH.

*Statistics Sweden; Learning Organisations Matter Conference, 2011*

Thanks to participants at Statistics Sweden Conference, 30 March, in Hilton Hotel in Stockholm. The book Learning Organisations Matter was presented. The discussion focused on the need for continues data. The audience represented the ministry of industry and labour market, and governmental authorities such as The Swedish Work Environment Authority, as well as several representatives from the universities in Sweden. One of the two project leaders on the European Union Meadow-project participated in the seminar. Altogether about 20 people attended the seminar. My Paper I and Paper II was presented and discussed at the conference.

*Statistics Sweden; Productivity Conference 2011*

Thanks to participants at Statistics Sweden Productivity Conference; Analyses and development of its statistical base, 5-6 October 2011, for valuable
comments on earlier versions of the Paper III. Special thanks to discussant Elif Köksal-Oudot, Economic Analysis and Statistics Division, OECD, and Fredrik Voltaire the Swedish Trade Federation.

*European Union Project; Meadow, 2007-2010*

Thank you for inviting me as an observer to learn from the project, it has been most valuable for me. See further in *Chapter 1. Introduction* and *Chapter 2. Theoretical Frame.*

*PhD Seminars*

Thanks to all participants at the Department of Industrial Economics and Management, INDEK, Division of Industrial Work Science, for valuable comments on my thesis proposal and mid-term papers.

*Family and friends*

To all of you, wonderful and beautiful and loyal and intelligent persons, that cheered for me and endured my insurances when I argued - that now is the thesis finished! It happened on more than one occasion. Mum and dad, I sense that you are with us in the spirit, side by side and that you appreciate the achievements. Especially, since the present licentiate thesis is the first one in the family for a very long time. Finally, dear sister, you must be acknowledged for the struggle with me over the language, time and again, sometimes my expressions in Swenglish has been more peculiar than the other. Thank you for sharing your excellent touch in languages, and your hawk eye for spelling and grammar mistakes. I hope you will have some use of this scrutinising in your studies in the education of mathematics (didactics). Let us also continue to laugh at our creed for definitions and at all surprisingly old fashion and bizarre suggestions from ‘Grammarly’.

All remaining mistakes in the thesis are of course to blame on me.

Stockholm, November 2017

Annette
The Thesis
This compilation licentiate thesis is based on a comprehensive summary of three papers; two articles and one chapter in a book, all three are published by Statistic Sweden. The papers are synthesised, and the theoretical frame and methodology are further developed and presented in the thesis. The three papers are appended in full at the end of the thesis. They will be referred to in the text as; the Paper I, and Paper II, and Paper III. All these publications are available in electronic form on www.scb.se.

The Paper I

Also published in a book:

The Paper II

The Paper III
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Chapter 1. The Introduction

Area of Inquiry

The ongoing struggle for better understanding of driving forces for economic growth is the main argument, the reason, and the background behind the thesis. The development of drivers for economic growth is not easy to narrow down, though, it is a documented opinion that a lot of the focus in the area should be on management and learning at work. These aspects also include management of technology changes. The research of economic growth often focuses on the measures, and especially those that can be used in models of productivity. The development of measures need data that have to be valid and reliable for concurrent measures. The economic growth theory has taken some major steps the last decades, and is pointing towards management and learning at work, but also argue the lack and need of data on the matter. The intertwined dependence between the development of knowledge about learning at work, alongside the need for the development of data and measures, constitutes the starting point for the research in the thesis.

The Research Problem

The struggle for better understanding of driving forces for economic growth is based on theory development and the development of models of productivity, that in economics often are based on empirical data from many observations. But the data in the matter in focus are scattered and poor, and this gap is argued to constitute an intertwined problem between theory and data development.
Despite this problem, researchers continuously work with the theory concerning the drivers for economic growth, and essential achievements have been performed in the growth economics. The modern version of the theory development goes back to the classical economic theory that describes the main driver for economic growth as new technology (Solow, 1956; 1957). This hypothesis of growth is still an essential part of the models today. However, this is also the case concerning the contradiction between the new hypothesis of technology and the desired impact on output measures, such as productivity and on employment. None or only small effects were detected. This inconsistency became commonly known as the Solow paradox, and it has been the main argument for developing the theory of drivers for economic growth. Another aspect of the theory that has changed is that growth is not only seen as exogenously determined, also endogenous aspects are of importance. The lack of knowledge concerning these matters is described as a “black box” (Rosenberg, 1982). The metaphor is famous and worldwide spread. For a long time, the hypotheses about new technology and endogenous aspects could not be fully confirmed.

Today, economic growth theory describes the drivers for economic growth as the use of new technology in combination with the development of competence needed for technology implementation, and it includes new forms of organisation and production. Learning and other work practices within the firm have become recognised as important for the technological progress. These developed hypotheses are called endogenous growth theories (Acemoglu, 2009, Part 3 Part 3. Neoclassical Growth, pp. 371-534; and Part 4 Endogenous Technological Change pp.535-704; Vickery and Wurzburg, 1998, tot. 21 pp.). Still, even if theories and models are more capable today, there is a lack of common measures embracing the contemporary aspects of learning within the firms.

Economists have not abandoned the area of developing measures in the matter. Growth economists that are involved in developing economic growth
theory are engaged in how to measure activities, as well as how to implement these into practical use in the growth models. For example, in macroeconomics when accounting for the national growth product; that is described as the sum of activities in the economy. Of course, there have been significant achievements the latest years in the system of national accounts developed by the Institute OECD\(^1\) (2010b). For example, expenditures on research and development (R&D) are now recognised as assets\(^2\). Also, the follow-up of economic growth is broadened from the financial and tangible capital (tangible assets) to include intellectual assets. These achievements are for example described in the follow-up of the so-called Kaldor Facts from 1961, by the World Bank\(^3\). The report shows the importance of developing new measures (Jones and Romer, 2009). OECD has taken several initiatives. Still, most of them have mainly included measures concerning innovations in products and processes and markets. Only a few are about management practices and learning at work (OECD, 2010; 2011a; b). Concluding findings in research about the development of the economy state that more focus has to be on the innovation system and the learning economy (Lundvall, 2016). For instance systematic evaluations of the effect of specific modes of work organisation on national innovation performance. Research on innovation has started to argue that there is a need to further explore the linkages between workplace organisation and the dynamics of innovation at the level of the firm as well

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1. The mission of the Organisation for Economic Co-operation and Development (OECD) is to promote policies that will improve the economic and social well-being of people around the world. The OECD provides a forum in which governments can work together to share experiences and seek solutions to common problems. The work is to support governments to understand what drives economic, social and environmental change. OECD measure productivity and global flows of trade and investment, and analyse and compare data to predict future trends. OECD set international standards on a wide range of things, from agriculture and tax to the safety of chemicals.

2. These assets are mineral exploration and evaluation, computer software and databases, entertainment, literary and artistic originals. Other Intellectual Property Products, IPP, fixed assets that are not captured in other items are now taken into consideration.

3. The World Bank comprises two institutions: the International Bank for Reconstruction and Development (IBRD), and the International Development Association (IDA). The World Bank belongs to the World Bank Group, which is part of the United Nations. The goal is the reduction of poverty, by providing loans to developing countries.
as at the level of sectoral, regional and national innovation systems. (Arun-del, Lorenz, Lundvall, Valeyre, 2016).

There has been one major initiative concerning indicators for work organisation and learning at work, as part of the OECD Jobs Strategy (OECD, 1996). The initiative was part of the ambition to turn the decades of low productivity to economic growth. The Institute Statistics Canada gain the leading role in the OECD-project too developed a guiding survey, including insights on the relationship between employment practices and firms' performance; and in-depth information on the effect of technology, training, and human resource practices. The survey was performed in the years 1999-2006, reconstructed and performed once again in 2011, in business firms in Canada. According to Statistics Canada, the work with data from the survey has been delayed until 2015, due to economic restriction (Statistics Canada, 2015a). The survey is focusing on the workforce characteristics, and vacancies, and skill shortages (Statistics Canada, 2015b). It can be argued that it took Canada 20 years to fulfil the task.

The former Swedish government agency The National Board for Industrial and Technical Development (called NUTEK) contributed to the OECD initiative on developing new measures for work organisation and learning at work with new indicators (NUTEK, 1996; 2000; ITPS 2001). The Swedish government agencies in the area were reorganised, for example, Vinnova, NUTEK and Swedish Growth Policy Studies, ITPS. No further work on developing measures has been performed at any of the new agencies.

About the same time, the OECD-Secretariat (Vickery and Wurzburg, 1998) summarised the knowledge in the matter. When it comes to knowledge about new organisational structures Canada was the country focused on; the lack of management know-how and human resources, as well as workers skills that assume hamper investments in new organisational practices. About the new

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4 This OECD-study was an assignment from the G-7 meeting in 1994 “Job Creation”.
structures, such as autonomous self-managed work teams, the OECD-Secretariat turned to Europe. Studies in the Netherlands and the Nordic countries and the work at institute the European Foundation for the Improvement of Living and Working Conditions was highlighted. The OECD concluded the scattered knowledge in the area both as management conservatism and lack of strategic orientation and the existence of hindrances to the adoption of new forms of production and organisation.

The scattered knowledge in the area is argued to be a consequence of the lack of measures that is constituted by the poor theory. The lack of databases that provide nationally representative statistics covering the full range of variables over time, which also is controlling for relevant external developments, was argued to be of significant importance. The data need to be based on broad surveys, not narrow only covering limited aspects. Therefore, the OECD stated – the front of these matters still lies ahead.

Policymakers have not abandoned the matter of unifying theories and measures. For example, the latest years the OECD has updated it’s Innovation Strategy 2010, and its agenda is recognised at the highest level at the OECD, the Council at Ministerial Level (OECD 2015a). The focus lies on skill-biased technical change: new measures, and the design of new statistical methods, and interdisciplinary approaches to data collection. Organisational innovation and knowledge management and creation, these are examples of appointed focus in measures (OECD 2015b). The economic crisis 2008/2009 is argued to be the reason behind the slowed down of the agenda of the new OECD Strategy (ibid.).

**New Opportunities in the MEADOW Guidelines**

Policymakers in Europe has also acted in the area. The Commission of the European Union launched a program for development of new indicators in the year 2008. The initiative address issues of the knowledge economy and society, welfare, and demography. It aims to play a major role in evaluating
the relevance, costs, and benefits of, for example, the challenges of globalisation, and the impact of an ageing population, Community immigration policy and the reform of the EU budget. The initiative includes the development of new and improved databases and new indicators in Europe. The activities were financed by the European Commission DG Research by the Sixth and the Seventh Framework Programmes, Citizens & Governance, (European Commission, 2008), founded by the European Commission.

The initiative is an example of growing demand of evidence-based decision-making in the European Union, and that more hard facts are required. It is argued that the availability of complete, harmonised and innovative data is a pre-requisite for evidence-based European policies.

The Meadow-project, Measuring the Dynamics of Organisations and Work (Meadow Consortium, 2010a) was one of the projects in the European Commission's research program concerning new indicators. The purpose was to harmonised statistics concerning organisations and organisational changes so that harmonised indicators for work and learning in business firms in the European Union could be developed. The project was organised as a multi-disciplinary consortium of 14 partners⁵, from universities in 9 European countries, supported by key institutions: OECD, Eurostat, and the European Foundation for the Improvement of Living and Working Conditions, and the European Agency for Safety and Health at Work, and DG employment. Swedish researchers participated⁶ in the MEADOW project. The EU-project was running from the last quarter of 2007 to the first quarter of 2010.


⁶ Swedish Coordinator Annika Härenstam, at the time, professor at the Department of Work Science University of Gothenburg Sweden. Hans-Olof Hagén Dr. Ec. Project leader of the productivity project at Statistics Sweden; and myself, Annette Nylund, both as observers due to earlier responsibilities of two NUTEK Surveys.
The major outcome of the project is guidelines, the MEADOW Guidelines (Meadow Consortium, 2010b). It is a schema for harmonised collection and interpretation of information about work organisation and competence development; such as learning at work. It promotes comparative large-scale data sets and enables comparative research across disciplines and countries. The guidelines include two questionnaires; they are the employer and the employee questionnaire. The guidelines are further described in Chapter 3. Methodology.

There is still no decision about a general European study on the matter. Each member country has to take own initiatives. There are member-country of initiatives.

The four of the Nordic countries have performed full-scale MEADOW Surveys, even thus they differ according to if both questionnaires are included or not. The government institute Statistics Sweden conducted the first full-scale MEADOW Employer Questionnaire in year 2009/2010. The government institute Statistics Norway conducted the MEADOW Employer Questionnaire in the year 2011. Aalborg University in Denmark, in the year 2010, and the government research institute TEKES in Finland, in the year 2012; they both conducted the MEADOW Employer and Employee Questionnaire (The Swedish Work Environment Authority, 2014b).

The Swedish MEADOW Employer Questionnaire was performed in the Swedish business sector. Besides, the including of primary Meadow-data, the Swedish Survey also include secondary data, the latter about innovation (CIS) and ICT-use, as well as firm and workforce characteristics (Statistics Sweden, 2010a; 2011). See the forthcoming section called within Chapter 3. Methodology. Further work based on the MEADOW Guidelines has been performed at The Swedish Work Environment Authority, see below sections.
Another initiative is the Luxemburg Survey, the TWAIN project, follow-up of the Meadow project, according to the website for the Meadow-project (Meadow Consortium, 2010a).

The overviews in the area are scattered, the MEADOW Guidelines are hard to find in overviews of presentations of literature and surveys that deal with the issue of work organisation and learning at work7.

Still, the presented EU program for development of new indicators including the MEADOW Guideline and OECD-initiatives aim to constitute another major step towards evidence-based innovation policy making. It also aims to complement traditional “positioning”-type indicators with ones that show how innovation is or could be, linked to policy (OECD, 2010; 2011a; b).

Research in social science often ends up in being part of evidence-based policy making for making the society better. As pointed out by OECD, see above, the lack of data makes it difficult to separate the problem of lack of data with for example the understanding of the use of different work practices as well as its further impact on firms and employees.

**Room for initiatives in Sweden**

First, it is of interest to state, that highly developed countries like Sweden show a faster economic growth in investment in knowledge assets than in physical assets (OECD, 2010; 2011a; b). Expenditure on knowledge assets exceeded physical already in the mid-1980s and; investments in information technology exceeded production technology in the mid-1990s. (Reinhardt, Bornemann, Pawlowsky, Schneider, 2001 Part VII. Developing Learning Practices. Ch. 36. Intellectual Capital and Knowledge Management: Perspectives on Measuring Knowledge. pp. 794-822.). Because of Sweden's fast-growing knowledge economy, one would expect well-developed statistics in

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7 See for example: Recent developments in work organisation in the EU27 Member States and Norway (The European Foundation for the Improvement and Living and Working Conditions (2011)).
the area of work and learning practices within organisations, but alas there is need of initiatives in Sweden.

Further, the research in focus in the thesis can be argued to belong to an area that in Sweden is claimed to have developed from the field of the work environment (Lennerlöf, 2008). The field grew and broadened from the 1970s to the 1990s; it also came to include work organisation and labour market and equality (Forskningsrådet för arbetsliv och socialvetenskap, 2004). After that, the area is diminished and the main research institute in the area the National Institute of Working Life was declined by the government in 2007 (Forskningsrådet för arbetsliv och socialvetenskap, 2009; Håkansta, 2014). The social partners have had a rather large possibility to impact on the area in Sweden, because of the general agreement on the labour market.

When it comes to research today in the area in Sweden, the national responsibility concerning innovation in working life science is at the government institute Vinnova, founded as an independent Institute 2001. The major initiative in the area is a ten-year program started in 2005 known as the excellent Swedish centre: HELIX\textsuperscript{8} - Managing Mobility for Learning, Health and Innovation (Vinnova, 2016a). The focus is sustainable innovation development and the spreading of research results. In matters of production and organisation development; learning for change and innovation; health, competence and workability, new forms of organisation, entrepreneurship and innovation. The program is prolonged for five more years (Vinnova, 2016b). There are some statistics concerning innovations in products and processes and markets but not specifically about learning at work and management. Statistics Sweden has the responsibility of official contemporary statistics (see for example 2009a; and 2010b), and Vinnova has the responsibility of knowledge about innovation systems in the society. Still, new harmonised measures are not in site.

\textsuperscript{8} HELIX located at the University of Linköping, was co-financed by the Swedish government agency VINNOVA in partnership with the university and others.
The Swedish Work Environment Authority is responsible for official statistics in the area of work environment since many years back and the later years also some smaller tasks concerning research and analysis on the matter. The task in research is rather new and described as limited to commission systematic research overviews in the area of work environment research\(^9\). These overviews include, for example, three of the overviews are partly targeting the same questions as the thesis. One overview covers definitions, introduced in the research discourse (Lindberg and Vingård, 2012). For example of a good work environment and a healthy workplace, including beneficial effects on both individuals and business. The second focuses on research on relationships between organisational and psychosocial factors at work and various work- and health-related outcomes among working women and men. It argues that the importance of these factors are comparable for women and men. For example, high demand and a lack of job resources, are associated with lower job satisfaction. (Sverke, Falkenberg, Kecklund, Magnusson Hanson, Lindfors, 2016). The third overview describes lean production, and state that there are both possibilities and risks related to lean production (Fagerlind Ståhl and Ekberg (2016).

The task in the analysis is also rather new and limited in the Authority. Some small but fruitful initiatives have been taken according to analyses that aim to develop new measures in the matter in focus, see the list of published reports on analysis\(^10\). The Swedish Work Environment Authority has performed two surveys based on the MEADOW Guidelines, covering both the business and public sector. The first survey NU2012 is partly covering the MEADOW Guidelines and partly about systematic work environment management (The Swedish Work Environment Authority, 2014a; b; Stelacon AB, 2013). The second survey NU2015 covers all teams in the MEADOW Guide-


\(^10\) List of analysis reports https://www.av.se/arbetsmiljoarbete-och-inspektioner/arbetsmiljostatistik-officiell-arbetsskadestatistik/analysrapporter2/?hl=analysrapporter.
lines and is performed in collaboration with Statistics Sweden (Statistics Sweden, 2016). The latter survey also aims to contribute to the work with the innovation strategy in Sweden. Analyses based on NU2015 are in progress (Swedish Work Environment Authority, 2017a; b; w.y.). See also the forthcoming chapters in the thesis.

The main mandate at the Swedish Work Environment Authority is to monitor companies and organisations regarding laws about the work environment and working hours.

Concerning research in the Swedish Work Environment Authority, a government committee has been investigating a national centre for knowledge and evaluations of the work environment policy (Government Offices of Sweden, 2016a; b). The proposal submits that the centre should either be a small independent government agency or organised within the Stockholm University. There are no new resources; the centre is suggested to be financed by reallocation of existing resources in the work environment area. Some of the resources are suggested to be taken from the Swedish Work Environment Authority (Government Offices of Sweden, 2017).

AFA Insurance, owned by Sweden's labour market parties complement the government initiatives. AFA aims to provide preventive research actions for the work environment at workplaces and is the Sweden's largest private R&D financier in its area.

The presentation of research and about the work environment and working life in Sweden is not by any means a systematic overview of the area. Still, the conclusion is that research combining knowledge about management with a focus on learning at work and economic growth is limited, and more

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11 Myself, Annette Nylund, the senior analyst at The Swedish Work Environment Authority, Department of Administration and Analysis, Unit for Statistics and Analysis, has been the project leader of the referred analyses, including the two surveys NU2012 and NU2015.

12 AFA has 150 million SEK earmarked each year for research in work and health environment (AFA Försäkring, 2015) today. It was formed at the beginning of the 1960s Further, see AFA-FoU Programs; for example about a sustainable working life (https://www.afaforsakring.se/forskning/fou-program/).
or less mostly concerning the dissemination of information on research. Still, the Swedish participation in the Meadow-project is a contribution to the area of focus, and the work at Swedish Work Environment Authority can be seen as a starting point for new initiatives in the area.

**Purpose of the Thesis**
The overall purpose of this thesis is to contribute to the developing of measures of management and learning practices at work that can be embraced in models of productivity. This is done ultimately to understand economic growth better. The focus is on new measures in the matter, and the aim is to examine them according to their use in business firms in general as well as their use as predictors of productivity. The analyses include different approaches to the matter in focus, alongside to better understand the relationship between the firms' environment, business and workforce conditions, with the practices in focus. Further, the analysis in the thesis are simplified, and they will most probably need to be further elaborated before finally used in economic models. Still, the simplified analysis is often used as a starting point in economic growth analysis.

The new measures are based on the micro-level data from the Swedish MEADOW Survey 2009/2010, at Statistics Sweden. I was provided a unique opportunity to explore these data. The access to the data also explains the ambition to use complementary statistical methods in the analyses.

An additional contribution of the thesis is an attempt to provide some information about the linkages between the data, here the Swedish MEADOW Survey, and the hypotheses behind the data; the MEADOW Guidelines. It is of interest since the MEADOW Guidelines are specially designed to provide measures within the matter of focus of this theses. The need for further studies about these linkages is argued in the guidelines.
Feasible research questions are designed to help to frame and sharpen the analysis in the thesis to reach the purpose. They are presented at the end of Chapter 2. *Theoretical Frame.*

Finally, one further ambition is that the thesis aims to be of interest to policymaking. The analysis in statistics and economics are often mainly described in the form of mathematical functions of a multiple factor model, and the results are figures in an output table. Here, the analyses and their results are described more fully both in writing and in tables and figures. Hopefully, this approach can promote further discussions both in the policy- and research communities.

**History of Research Events**

The research studies have mainly been performed part-time as an industrial doctoral student.\(^{13}\)

The beginning of the work with the thesis started with preliminary plans to develop a new survey collecting data on management and learning practices at work, in the first half of the 2000-decade. At the time, contemporary data was eligible. The alternative was to use earlier collected data from the 1990s that was available from Swedish business firms (NUTEK, 1996; 2000). A new and third alternative arose with the European Union project MEADOW - Measuring the Dynamics of Organisations and Work (Meadow Consortium, 2010a). The project was running during 2007 and 2010. The main outcome of the project is the MEADOW Guidelines (Meadow Consortium, 2010b). I have had the privilege to participate in the EU-project MEADOW as an observer, due to earlier responsibilities at the Swedish National Board for Industrial and Technical Development, NUTEK, in the two NUTEK-Surveys.\(^{14}\)

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\(^{13}\) The first years was financed by the Swedish Institute for Growth Policy Analyses, ITPS, and later by the social partners, and in the end the research studies was combined with work at the Swedish Work Environment Authority.

\(^{14}\) I was a co-project leader in the first NUTEK Survey Flex-1 (Swedish National Board for Industrial and Technical Development, NUTEK, 1996); and the project leader in the second NUTEK Survey Flex-2 (Swe-
both with the similar agenda as the new EU-project. This third alternative of data became the natural option of which data to use in the analyses in the thesis, despite that it prolonged the timetable for the thesis quite a lot. Still, the prolonged timetable has been worthwhile. See also the discussion in Chapter 6. Final Reflections.

Statistics Sweden decided to perform the first full survey based on the MEADOW Employer Guidelines; the Swedish MEADOW Employer Survey 2009/2010. During the work with the Swedish survey, I have had the privilege to participate full-time in the Swedish project\(^{15}\) at Statistics Sweden: "Organisation, growth and work environment". My work mainly included the performance of two of the papers in the thesis. The participation in the project provided full access to data from the Swedish MEADOW Employer Survey 2009/2010, which has been vital for the analyses in the thesis.

The first Paper I in the thesis was written within the Swedish Meadow-project, and published in the Statistics Sweden's Yearbook on Productivity 2010, and presented at the annual Productivity Conference at Saltsjöbaden 2010. It was written in parallel with other papers at Statistics Sweden, and it was also published together with them in the Statistics Sweden's book Learning Organisations Matter, see (Statistics Sweden, 2011). The first paper aims to contribute to the operationalisation of the indicators of management and learning practices, alongside analyses of their incidences across the Swedish business firms. One of the four composite indicators called structural competence used in the project at Statistics Sweden is a contribution from the analyses in the first paper in the thesis.

The second Paper II in the thesis was also written within the Swedish Meadow-project, and published as a chapter of Statistics Sweden's book Learning Organisations Matter. The second paper specifically aimed to investigate the

\(^{15}\) The project leader was Economie Doctor Hans-Olof Hagén also assisting supervisor for this thesis.
relationship between the management and learning practices and the firm’s business precondition, alongside that it investigated how to include such information into analyses of productivity. The project at Statistics Sweden was ended with the book in spring 2011, presented at the Hilton Hotel Conference in Stockholm, see Acknowledgement.

The third paper, Paper III, was written in autumn 2011, and it was published in Statistics Sweden’s Yearbook on Productivity 2011, as well as presented at the annual Productivity Conference at Saltsjöbaden 2011. Therefore it was a part of the Statistic Swedens initiative to contribute to the knowledge development of economic growth and statistics.16

I have used the above-described knowledge of the work at Statistics Sweden with the Swedish MEADOW Survey 2009/2010 in my more recent responsibilities to perform three new surveys NU2012 and NU2015 at The Swedish Work Environment Authority, in parallel with the work in the thesis, but outside the University. The work with the NU2012 and NU2015 has included improving the questionnaires, collecting data and performing the analysis.17 Both these later surveys are based on the MEADOW Guidelines and the Swedish MEADOW Employer Questionnaire. Still, both surveys are extended with further questions about the work environment and include the entire working life. The third survey is costumed to the municipality in the public sector for one industry and also extended with a linked employee questionnaire. The knowledge gained from the three papers in the thesis was used in work with all three new surveys. The new data are used in a handful of advanced analyses concerning management and learning practices in firms. These are published by the Swedish Work Environment Authority (2017a;b;c). Another handful of analyses based on the data concerning

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16 The objectives and priorities for the work in the yearbook and the conference were outlined by the Commission on the Review of Economic Statistics.

17 I am the project leader at the Swedish Work Environment Authority of the NU2012 and NU2015. The next and probably the final publication of work in NU2012 is planned during autumn 2017. Further analyses are planned based on NU2015, which will not exclude that they also include some data from NU2012.
systematic work environment management was performed (the Swedish Work Environment Authority 2013a;b; 2014a;b; and the Swedish Work Environment Authority w.y). The knowledge from these analyses supports the interpretation of the results of the analyses in this comprehensive summary of the three papers in the thesis.

The knowledge I have gained from the EU-project, in combination with the knowledge from the Swedish MEADOW Survey 2009/2010, and also the further work with the two surveys NU2012 and NU2015, at the Swedish Work Environment Authority, has been vital for the methodology frame in the analysis of the thesis. The use of the Swedish MEADOW-data has been of great importance for the performance of the analyses in the thesis. Also, the knowledge of the performed advanced analyses outside of the university that is based on the knowledge gained from the analysis in the thesis has severely contributed to the comprehensive summary of the thesis. Altogether, the knowledge from work outside the university has very much improved on the possibility to judge on the quality of the MEADOW Guidelines based data, and therefore on its validity and reliability, which is referred to in the thesis, see the section Limitation and Strength in Data, in Chapter 3. Methodology.

The forthcoming plan is to explore the data from especially NU2015 further, see Chapter 6. Final Reflections.

In summary. The overall timetable for the thesis has been prolonged by using MEADOW-based data, but it has also provided benefits that otherwise would not have been. The most obvious benefits are the actual data and the deeper understanding of the guidelines as such, and its theoretical and methodological frame. Other advantages are the dialogues with the participants in the EU-project and within the Swedish Meadow-project, as well as the dialogue with the participants (researcher) in the Statistics Swedens Productivity Conference 2010 and 2011. Other obvious advantages are the two assisting supervisors that took part in the Meadow-project, in different and complementary ways.
**Remaining Chapters**

The analysis in the thesis has been organised into three different papers, and the different papers are assumed providing with cumulative knowledge. The papers are partly overlapping each other in answering the three research questions. This way, the three papers complement each other, in research questions and methods. Each paper specifically aims to answer at least one specific research question, and the analyses in the different papers are using different analytical techniques and approaches. Further and finally, the comprehensive summary of the thesis is using all information in parallel regardless of the organisation of the three papers when concluding the answers of the three research questions.

Here are the remaining chapters in the comprehensive summary:

Chapter 2. Theoretical Frame

The area of inquiry is inter-disciplinary and include more than one research field, which is discussed at the beginning of the chapter. The ambition is an objective and neutral presentation as possible of some of the key hypotheses. This doesn’t mean that the presentation is unprejudiced. In other words, the presentation does not aim to be in full balance, within the meaning of that all perspectives will have equal room in the thesis. The hypothesis behind the MEADOW Guidelines basic measurement framework is of great importance and therefore presented. Beyond, the hypothesis of the firm’s competence boundaries, as well as a complementary model of the firm’s competence portfolio, are presented. Further, the main hypotheses of drivers behind economic growth are described aside. The sum of the collection of theories and hypotheses comprise the theoretical framework. It aims to support the selection of feasible research questions in the thesis, which is developed at the end of the chapter. The presentation of theory goes beyond the theory presented in the three papers.
Chapter 3. Methodology

The third chapter mainly describes the primary data that is used in the analyses, from the Swedish MEADOW Employer Questionnaire 2009/2010, alongside, the used secondary data. The analytical technics are introduced, they are mostly based on statistical methods. Some aspects concerning the quality of data and how the indicators are constructed are also included. The presentation is further developed compared to the performance in the three papers.

Chapter 4. The Content of the Papers

The chapter gives an overview of how the analyses are organised in each paper in the thesis, which is not the same as the division of the research problem to the three research questions. The summary of each paper includes a list of the main analyses in the paper, together with information about in which original table the results can be found and used analytical techniques. The three papers in the thesis are appended in full, chronologically at the end of the thesis.

Chapter 5. Findings and Conclusions

The chapter presents the main answer to the three research questions. Key findings are presented according to each research question. This way, the analyses are rendered more in full. The main results are highlighted with tables and figures.

Chapter 6. Final Reflections

The chapter reflects on the progression of the analysis in the thesis, followed by reflections on the choice between data in the thesis. The chapter ends with a suggestion of research in the planned forthcoming doctoral thesis.
Chapter 2. Theoretical Frame

The area of inquiry is inter-disciplinary and include more than one research field, which is discussed at the beginning of the chapter. The ambition is an objective and neutral presentation as possible of some of the key hypotheses. This doesn’t mean that the presentation is unprejudiced. In other words, the presentation does not aim to be in full balance, within the meaning of that all perspectives will have equal room in the thesis. The hypothesis behind the MEADOW Guidelines basic measurement framework is of great importance and therefore presented. Beyond, the hypothesis of the firm's competence boundaries, as well as a complementary model of the firm's competence portfolio, are presented. Further, the main hypotheses of drivers behind economic growth are described aside. The sum of the collection of theories and hypotheses comprise the theoretical framework. It aims to support the selection of feasible research questions in the thesis, which is developed at the end of the chapter. The presentation of theory goes beyond the theory presented in the three papers.

Inter-Disciplinary Fields of Theory

The area of inquiry is argued in the thesis to be inter-disciplinary, which by the nature and purpose of the research includes more than one field of theory. In the thesis, these fields can be described as economic growth theory and theory of management practices, both with a focus on learning at work. The knowledge from different fields concerning learning is presupposed assumed to fertilise the knowledge on the matter. Though, the research problem in the thesis is described as the lack of data and measures about management and learning practices at work possible to embrace in economic growth models. Therefore the area of inquiry might also be described as in-between the
research fields, or at least partly between the fields. In economic growth theory, the lack of data and knowledge has been described as a ‘black box’. Further, when it comes to how to contribute to the solving of the research problem, the analysis might be argued to be an analogy (Collis and Hussey, 2009 p.41). It means that research development in one field, growth economics, become richer by importing knowledge from other research fields, learning and management.

The research area as such, as well as the ambition to combine knowledge from more than one field, both can be described as part of the research problem. The research problem and the purpose of the thesis are further discussed in the first chapter of the thesis.

**Economic Growth Theory**

In economic growth theory, the concept called ‘hypothesis’ is often used as a synonym to the concept called ‘theory’; both are describing phenomena. Still, the basic is that theory is interrelated verified principles; they can be a set of tested hypotheses. A hypothesis is a proposition that can be tested against empirical evidence, often against real-life examples, or causality (Collis and Hussey, 2009 P 118, 188). A model is a way to simplify and often generalise complex theories and hypotheses; in economics frequently with the help of econometrics, statistical models; that specifies the statistical relationship between various parts in the model.

The presentation of economic growth theory in the thesis includes the basic hypotheses in economic growth models as well as those hypotheses that are oriented towards learning at work, including theories supporting technical changes and policy institutions. Together they contribute to the overall theoretical framework of the analysis in the thesis. The focus in basic theory is the three main drivers for economic growth; they are labour, which is people; and capital, and technology. The basic theory assumes exogenously determined changes. Modern economic growth theories include endogenous
development within a firm, including management practices with a focus on learning at work. The hypotheses oriented towards learning at work are also presented.

Introduction to economic theory - classical models

What can be learned from classical economic growth models? First, it can be said that these models are more or less based on assumptions that changes in the economy are exogenous; based on inputs. Still, the Solow-Swan neo-classical growth model is a starting point and a springboard for modern models, even according to modern economists (Acemoglu, 2009 Part 1. Neoclassical Growth. Ch.2. The Solow Growth Model, 2.1. The Economic Environment of the Basic Solow Model). It defines the determinants of economic growth as increases in inputs of labour and capital. The first model focused on physical units of capital and human capital accumulation (Solow, 1956). Growth is the capital-labour ratio. The first model was almost directly followed by a second; and the incorporating of the hypothesis of technical changes as the new primary determinant of economic growth (Solow, 1957).

It is described as shifts in the production function, for example; changes in the education in schools, exogenous and therefore equal to all firms by the labour market. Further, Solow defined human capital as the stock of skills, education, competencies and other productivity-enhancing characteristics as embedded in labour in the model. He described that new tangible capital is more efficient than old capital. New is more developed than old. Still, all changes were assumed to take place outside the firm.

It was stated in these first models that the main components are equal to all organisations and therefore concluded as that what is happening within the firm is not needed to be in focus. The idea was that the models do not need to include information about management and learning and so forth. Later on, this lack of knowledge is described already in the 1980s as a “black box” (Rosenberg, 1982 Preface and part II Ch. 6). The metaphor is famous and
worldwide spread. Rosenberg argued that knowledge of what is taking place in the “box” will reveal differences in the rate of productivity improvement. It includes the nature of learning processes underlying technological change itself, and the speed of technology transfer, and the characteristics of newly emerging technologies, as well as the understanding of the effectiveness of government policies that are intended to influence the technologies.

Therefore, the new ideas about what is happening inside the firm concern the firm’s assets, including management and learning practices; it is heterogeneous according to its environment (Acemoglu, 2009 Part 1. Neoclassical Growth. Ch.2. The Solow Growth Model, 2.1. The Economic Environment of the Basic Solow Model).

*Modern growth theories include endogenous changes*

Modern economic growth theories are richer than the neo-classical theories since they see endogenous changes as necessary for the technological progress in the firm. Endogenous change also emphasise the need for micro-level data since it includes what is happening within the firm. Though, these data also has to be possible to aggregate for the business sector and compared to other countries (Xavier, 2002). Endogenous assumptions of determinants of the causality of growth are assumed, and they are assumed correlated not orthogonal (parallel). Altogether modern economic growth theories are often branded endogenous growth theories. For further discussion about data in *Chapter 3. Methodology*.

Human capital and learning

Leading economists suggests an endogenous theory about the changes in competence when including it in the production function. They argue that it goes beyond formal education, that it also include the learning that takes place when solving problems and experience that is a result of activities at work. These hypotheses were formulated already in the 1960s (Arrow, 1962).
It took about 30 years to build a model that included these aspects. Lack of data on micro-level is one explanation.

What hypotheses have leading economist argued? The discussion in the 1960s among leading researchers emphasised theories concerning investment in human capital and the economic system, including several aspects of human capital as embedded resources in people and formal schooling and on-the-job training. Investment in the human capital did become closely related with the new emphasis on intangible resources and that it may be useful in the attempts to understand the inequality in income among people (Becker, 1964).

A discussion of on-the-job training can illustrate the effect of human capital on earnings, employment, and other economic variables. Training at work differs from education in school since the investment is made on the job. The assumption is that workers increase their productivity by learning new skills and perfecting old ones while on the job.

The firm's investments in training are mainly explained as a decision of the allocation of the employee's time for work and time for training due to the expected return of profit from the training. The firm is willing to invest in training if it can benefit from it, or if someone else will pay the cost or if it will be compensated with a lower wage. Empirical evidence at the time showed that the firm better pays the market salary even when offering training, otherwise the trained persons tend to leave after the training is ended (ibid.). The hypothesis is argued relevant when it comes to investment in general training useful in any firms.

Specific training, useful only for the investing firm, is of great importance. Still, the firm can hesitate to invest because the employee can leave the firm, even if there are non-incentive for this since then they will not gain from the investment. It is argued, that if both the employee and the employer invest in
training and share the return from the training due to their investment, equi-
librium can be reached (ibid.).

As in the 1960s, it's argued in modern economic theory that “the major role of human capital is not to increase productivity in existing tasks, but to ena-
ble workers to cope with change, disruptions, and especially new technolo-
gies.” (Acemoglu, 2009 Part 3. Neoclassical Growth. Ch. 10. Human Capital and Economic Growth, Ch. 10.8. Nelson-Phelps Model of Human Capital, p. 495.). The facilitating of technology within the firm was stimulated by on-
the-job investments, according to the Ben-Porath model (Ben-Porath, 1967). Further, the more highly educated the person are the better equipped for learning. This argument suggests a correlation between formal education and on-the-job investments. If this is the case, the present empirical measures may be underestimating the contribution of human capital to productivity. The question of underestimation of the contribution of human capital to productivity is proposed to be an area for future research according to Acemoglu (2009, Ch. 10.9. Taking Stock, pp. 498-499). The assumption is that in general on-the-job training is often underrated since the firm doesn't own the investments in employees, people, in the same way as the firm can own investments in new product or processes, etc. See also the discussion (Becker, 1964) in the sections above.

Technological change

What are technological changes and how does it distinguish between changes in human and physical capital? Modern economic theories put innovations in the centre of the growth process. The theory and the models that measure innovations make distinctions between changes in processes and products. The former is often concerned with cost reduces of production of existing products (for example, the introduction of new machines to produce existing goods). The latter refers to the introduction of a new product. The third type of innovation involves the introduction of higher-quality versions of an exist-
ing good. Technology that pushes forward, "frontiers", is emphasised, and it is assumed distinguished from so-called “imitations”. The latter is often the case in non-advanced countries. The two types of innovation can explain the different growth rate (Acemoglu, 2009 Part 4. Endogenous Technological Change. Ch. 12. Modelling Technological Change, 12.1.1. Types of Technological Change, pp. 537-539). Modern economic theories also put firms and entrepreneurs (often innovators) in the centre of the growth process, alongside investments in innovations and skills concerning innovations and rules about innovations.

Acemoglu formulates “the key to endogenous technological progress is that the R&D is a purposeful activity, undertaken for profits, and the knowledge (machines, blueprints, or new technologies) that it generates increases the productivity of existing factors.” (Acemoglu, 2009, Part 4. Ch. 13. Expanding Variety Models, p. 571). Basic models focused on expanding input or product varieties, and advanced models on competitive innovations. The latter include significant changes in the production process, the tools and the machinery replacing old firms and incumbents, as the Schumpeterian models (Acemoglu, 2009, Part 4. Ch. 14. Models of Competitive Innovations, pp. 609-610). These hypotheses assume decisions about how to invest in research projects, including calculations about the probability of success and quality of the research project. The management of the firm and employees have to be able to make own decisions about innovations and research (Acemoglu, 2009, Part 4. Ch.12.1.2. A Production Function for Technology. pp. 539-540). A further assumption is that successful innovations can obtain a patent, once this happens the new better technology provide monopoly power. That in turn, can enable higher profit. (Acemoglu, 2009, Part 4. Ch. 12.1.3. Non-Rivalry of Ideas. pp. 540-542). An intimate link between ex post-monopoly power and innovation is argued by well-known researchers, as first by Aghion and Howitt, Grossman and Helpman, based on initial find-
ings by Schumpeter and Arrow, and in the breakthrough in calculations of endogenous growth models by Romer (ibid.).

Policy institutions

Institutions are human-made social and economic structures. The economic historian, Douglass Norths, work defined institutions: “Institutions are the rules of the game in a society or, more formally, are the humanly devised constraints that shape human interaction.” (North, 1990). They are about placing restrictions on individuals that will shape human interaction and affect incentives. Institutions, much more than the other causes, are about the importance of incentives: economic, political and social relations among households, individuals, and firms.

Modern endogenous economic growth models relate the process of technological change to market structure, anti-trust and competition policy, and intellectual property rights policy, etc. It is assumed that capital, also endogenous capital, will respond to (profit) incentives. The idea is that institutions shape incentives, for example, rules, regulations, laws, and policies. They, in turn, aim to affect for example incentives to invest in technology, physical and human capital. The conclusion is that decisions in the economy include economic reward and profit, but also goes beyond. (Acemoglu, 2009 Part 1. Introductions. Ch. 4. Fundamental Determinants of Differences in Economic Performance). Differences in economic institutions are assumed a fundamental cause of different patterns of economic growth in the world. This definition encapsulates the essential elements that make institutions (Acemoglu, 2009 Part 1. Introductions. Ch. 4. Fundamental Determinants of Differences in Economic Performance. 4.3.3. Institutions).

Some ways of organising societies encourage people to innovate, to take risks, to save for the future, to find better ways of doing things, to learn and educate themselves, to solve problems of collective action and to provide public goods. Others do not. Specific policy and institutional variables are
important in retarding or encouraging economic growth. Property rights are assumed to be an indispensable element of good economic institutions, alongside other aspects of economic institutions that matter as well. This assumption also recognises conflicts of interest within the society. It argues that there are no reforms, no changes, and no advances that would make everybody better off. The argument has references to Schumpeter creative destruction stories, every reform, every change and every increase creates winners and losers (ibid.).

Further, advanced innovations demand more advanced institutions to fostering these innovations and skills (Acemoglu, 2009 Part 4. Endogenous Technological Change. Ch. 12. Modelling Technological Change; and Ch. 13 Expanding Variety Models). Even further references are made by Acemoglu (2009 Part 3. Neoclassical Growth. Ch. 11. First-Generation Models of Endogenous Growth) to Romer's theories that provided the first generation of endogenous approach to the process of economic growth, the key idea is about non-rivalry inputs. Romer explains the origin of endogenous economic growth with five basic facts (Romer, 1994): These facts concern the important aspects of human capital and technology and policy institutions.

First generation of endogenous economic growth theory

First: there are often many firms in a market but not perfect competition.

Second: discoveries or new ideas exist, separated from other inputs, like the principles behind the transistor, or new structure behind modern cooperation and firms.

Third: these new ideas are non-rival, at least in the short run, in the long run, the use by a firm will not exclude others, like in the use of information.

Fourth: and new ideas occur when more people are involved, and often as accidental side effects of other activities.
Fifth: new ideas can be controlled by individuals and firms, at least over a period, and during this period monopoly prices can be taken.

Management Practices on Learning
Economists involved in endogenous economic growth theory recognise learning activities in firms as important and include knowledge about learning at work into economic models, as described in the above paragraphs in the chapter. However, it is more or less a common argument in almost all research fields that in-depth knowledge of learning at work is developed in other research disciplines. See also Handbook of Organizational Learning & Knowledge (Berthoin Antal, Dierkes, Child, Nonaka, 2001, Introduction. Finding Paths through the Handbook. Page 1-7). In other words, economic growth theories are assumed to need and also gain from the development of hypotheses in the matter in other research fields (Boerner, Macher, Teece, 2001 Ch.4. pp. 89-117). The hypotheses behind the MEADOW Guidelines are shortly described as a consequence of the primary data being based on the Guidelines. It is complemented with hypotheses based on actions for intended competence development and some additional hypotheses concerning organisational learning, including HRM, and theory about the competence boundaries in the firm are added.

In analogy with growth economics, the management theory is seen as interrelated verified principles and a set of tested hypotheses. A hypothesis is a proposition that can be tested against empirical evidence, often against real-life examples or causality, but often regarding cases, and they do not aim to be generalised (Collis and Hussey, 2009 P 118, 188). The concept of the model is used, but often not with the help of statistical methods, as often the occasion in economics and quantitative approaches in social science.

There is an ongoing discourse about qualitative and quantitative approaches and their limitations, respectively. There are researchers in management that argue that a qualitative approach is the only possible approach since every
organisation is unique, but in reality, it might be a matter of research question, or it is an argument for or against positivism (Collis and Hussey, 2009 P 7; 56). Still, besides the argument in the guidelines, also others in management argue that evidence-based analyses concerning firms have to be built on a large number of cases and time-series analysis for explanation-building and that they also should be used in conjunction (Yin, 1990).

The MEADOW Guidelines also discuss the differences according to quantitative and qualitative research. For instance, it concludes that surveys can provide a wide range of information on organisations and organisational change; the structure of organisations, the decision-making of inter-firm relations and the nature of the dependencies that may exist between an organisation and external suppliers or partners. Further, surveys can contribute to management policies and techniques in the areas of human resources management, work organisation, working time and the quality of work (Meadow Consortium, 2010, Ch. 1. Organisational theory and measurement framework P17-45. II. The basic measurement framework. IV. Areas for investigation and the relevance of linked data. IV.1. What can be measured?).

*The MEADOW Guidelines*

The main hypothesis behind the MEADOW Guidelines is presented here. Both the suggested management models aiming to support the development of the organisation and the basic measurement framework behind the MEADOW Guidelines argued to capture the models are presented. Some hypotheses that go beyond the Guidelines that are of interest and relevance to the thesis are also presented. The MEADOW-data are presented in *Chapter 3. Methodology*.

The MEADOW Guidelines aim to contribute to the harmonisation of the collection and interpretation of information about work organisation and competence development, and their impact on people and firms, in Europe
The aim of the guidelines also establishes its scope.

The Guidelines address the best way to perform the Employer Survey. For example, that the sample of firms is based on high-quality register data, and that it is stratified according to industry and size class. It should also be complemented with other high qualitative survey and register data, and it also argues the need of that all the data is on micro-level (Meadow Consortium, 2010, Ch. III. Measuring the dynamics of organisations and work employer-level survey, P97-132. II. II. Concepts and indicators.

The guidelines include two questionnaires: the MEADOW Employer Questionnaire and the MEADOW Employees Questionnaire; they are proposed to be organised as linked surveys.

The analyses in the thesis are using the suggested methodology in the MEADOW Guidelines. Therefore, and as a consequence of that, the primary data in the analyses in the thesis is from the Swedish MEADOW Employer Questionnaire 2009/2010, and complemented with secondary data from two mandatory surveys about innovation (CIS) and the ICT-use, as well as high-quality register data, both suggested in the Guidelines. The Sweden MEADOW Survey 2009/2010 is described in Chapter 3. Methodology, and appended in full at the end of the thesis.

The use of the Swedish MEADOW Employer Questionnaire in private firms and not the MEADOW Employees Questionnaire will provide a demarcation for the theory discussed in the thesis.

Basic measurement framework

The guidelines measurement framework aims to describe and capture the existing diversity of organisational types and its drivers. It aims to include several perspectives on the organisation at the same time and its output. The guidelines point out that there is “no universal best way of organising”
(Meadow Consortium, 2010b, Ch. I. Organisational theory and measurement framework. Part III. Theories if organisations and organisational change III.1 Organisational context and socioeconomic drivers of change, pp. 22-24). This statement will play a significant role in the explorative investigations in the thesis.

The MEADOW Survey includes several phenomena and activities based on a rather wide range of hypotheses and theories of organisation and organisational changes. They draw upon a multitude of disciplines and more than one paradigmatic approach. For example economics, industrial sociology, psychology, organisation studies, and management science and labour studies. It is argued theoretically pluralistic because and designed for testing hypotheses from a range of theoretical approaches (Meadow Consortium, 2010b, Ch. I. Organisational theory and measurement framework. III. Theories if organisations and organisational change pp. 22-33). At the same time, the multitude of disciplines is also recognised as a difficulty and as a lack of well-developed cognitive foundation which limits theoretical cumulativeness in the knowledge management literature (ibid.).

In reality, the guidelines are based on knowledge from 21 surveys in the relevant fields, they are summarised in the MEADOW Grid Report (Meadow Consortium, 2010c,d).

Measuring organisational change in the business sector is focal, but comparison with organisations in the public sector is argued to be of interest. It is argued in the guidelines that the grey zone between public and private sector organisations has increased and also that the new public management based on experiences in business firms are increasingly adopted in the public sector. Further, it is argued, that sectors look differently in the member countries in the European Union. (Meadow consortium P123).

Due to the fact that business sector is focal, the performance of the organisation is described as economic output, and also social performance, both de-
pended on techniques and practices in the organisation. Success is described as the possession of a superior set of resources, as the economic resource-based point of view of the organisations. (Meadow Consortium, 2010b, Ch. I. Organisational Theory and Measurement Framework. Part II. The Basic Measurement Framework pp. 20-21).

Context-driven change

The guidelines highlight external forces as drivers for change. The organisation is described as determined by the context, encapsulated via policies of steering the management practices. The great importance of knowledge about how competitive pressures affect the organisation's structure and changes, alongside other institutional dimensions and political decision-making is argued in the guidelines (Meadow Consortium, 2010b, Ch. I. Organisational theory and measurement framework. Part III. Theories if organisations and organisational change III.1 Organisational context and socioecconomic drivers of change, pp. 22-24). The Guidelines refer to theories supporting the argument of structural aspects of organisations and how these are related to the environmental context: contingency theory, open system theory and organisational design theory. It is interpreted as that changes in competition, resources and technology call for organisational changes and adjustments. The dimension of context-driven changes also includes evolutionary-oriented theories and gradual changes, and interaction between organisations and their environment and inertia.

Further, the Guidelines define organisational changes regarding intended changes in the organisational design which is understood as being composed of the organisational structure and the organisation of work. Further, it is argued that the informal nature of non-planned incremental changes often go unrecognised by management and other actors and are therefore difficult to measure with the use of a survey (Meadow Consortium, 2010, Ch. 1. Organisational theory and measurement framework P17-45. II. The basic
measurement framework. IV. Areas for investigation and the relevance of linked data. IV.1. What can be measured?).

Concerning organisational innovation, for instance, changes are assumed to differ according to dependence on intentional processes, or not. One perspective on this is the intentional breaking down of regular patterns of behaviour to create new institutional patterns. Complementary perspectives on implementation are the speed of processes. The discrepancies between what the organisation could do and does, i.e., the performance gap, is another perspective. The further argument about innovation is, that, if it involves a combination of different goals and methods, simultaneously, it is seen as complex. If only some are involved the innovation is described as easier. In both cases, it is argued that there can be ramifications for the coherence of the organisation. Coherence is an approach in itself (Meadow Consortium, 2010d).18

Management techniques and practices

The centre of the MEADOW measurement framework is the management techniques and practices, described as models used by managers to organise activities and to rationalise decision-making. Features concerning these practices are based on the increasing importance of knowledge, learning, and innovation. These are seen as indicating changes in firms work organisation and structures, such as developed hierarchies and communication and task coordination. They include management initiatives aiming towards greater employee involvement through delegation of responsibility. These features are described as important when it comes to organisational change. Still, the importance to take into account the continued use of high levels of standardisation of tasks and skills is also argued (Meadow Consortium, 2010b, Ch. I. Organisational theory and measurement framework. Part III. Theories if or-

18 See the MEADOW background document no1. MEADOW Multilevel Theoretical Framework.
ganisations and organisational change III.2 Management practices and techniques, pp. 25-27).

The practices referred to in the Guidelines are divided into three dimensions: *structure*, for example including sub-units and systems for control; *work organisation*, including location, the division of labour, tasks and skills required, and so forth; and *practices* such as recruitment, contracts, and training. The hypothesis is that there are synergy effects on performance when these three dimensions are adopted together. Relations between skills and competence and rapid change in IT is recognised as especially important. For further information about the measures of the data and the observation units as such see the section *Data – Swedish Meadow Survey 2009/2010*, see also the chapter of methodology in the thesis.

**Management models in the guidelines**

The MEADOW Guidelines provide suggestions of indicators of management models that are aiming to support development. The presented measures are argued to capture these models. The models as such are selected since they are argued by the Guidelines to provide strategies for greater organisational flexibility and innovativeness, and they are argued to be relevant for understanding the direction of the organisational change.

*Flexible organisations*. Flexibility is addressed, in the Guideline, both with the argument about the lack of an accepted definition and with the argument that it still is a widely used notion (Meadow Consortium, 2010b, Ch. III. Measuring the dynamics of organisations and work: an employer-level survey. Part II. Concept and indicators. II.4 Types of organisational designs pp. 112-116). The concept of the flexible firm is seen as an aspect of flexible organisations, see above. The concept also addresses the division of labour (Meadow Consortium, 2010b, Ch. III. Measuring the dynamics of organisations and work: employer-level survey. Part II. Concept and indicators. II.3 Organisational structure and work organisation pp. 108-112).
The description of the concept of flexible firms is complemented with a further argument concerning the dividing of the workforce. It can be divided into the core, gaining from developed work practices and learning processes, and the peripheral workforce, organised with short time and temporary work contracts (Atkinson, 1984a; b). These aspects are not discussed in detail in the MEADOW Guidelines concerning the employer questionnaire.

**HRM-indicators.** HRM is the management of work and people; it is presented as a key perspective (Meadow Consortium, 2010b, Ch. III. Measuring the dynamics of organisations and work: employer-level survey. Part II. Concept and indicators. II.5 Employment Relations pp. 116-117). The guide emphasises the development of humans, based on the human's commitment when they are more fully involved in problem-solving activities. Also, the combining of specific HRM practices with managerial practices is addressed, see also the discussion below about ‘hard’ and ‘soft’ approaches in knowledge management (KM). HRM has long played an important role in bridging the science and practice of human resource management. HRM-strategies are also emphasised in the guidelines concerning how these strategies are used, see also further references to the research of bundles of new HRM practices that have been found to affect productivity and financial performance positively (Huselid, 1995; Huselid, Jackson, and Schuler, 1997; Huselid, 2011). Changes towards decentralisation are seen as crucial, alongside self-governing and team-based jobs. Further, control and quality improvement are all seen as promoting continuous learning (Meadow Consortium, 2010b, Ch. III. Measuring the dynamics of organisations and work: employer-level survey. Part II. Concept and indicators. II.5 Employment Relations pp. 116-117).

**Indicators of learning organisations.** The MEADOW Guidelines debates that the literature on learning organisations is disparate. Still, it is argued that there is some common definitional ground beyond the obvious point. For example, learning organisations are those with a capacity to adapt and
compete through learning. Further, interrelated dimensions of individuals, team, and organisation or system level are proposed to capture these dimensions. (Meadow Consortium, 2010b, Ch. III. Measuring the dynamics of organisations and work: employer-level survey. Part II. Concept and indicators. II.5 Employment Relations pp. 116-117).

High-performance work systems are characterised as a holistic team-based, flat, organisation based on skilled employees (Meadow Consortium, 2010b, Ch. III. Measuring the dynamics of organisations and work: employer-level survey. Part II. Concept and indicators. II.4 Types of organisational designs pp. 112-116). Also, knowledge management is addressed.

Knowledge Management (KM) tackles the integration of data accumulation, diffusion, and implementation, to transfer and transform knowledge, for example from tacit skills to codified information, and between different levels, for example from the individual to the collective. It is possible to identify ‘hard’ and ‘soft’ approaches; the hard about the use of formal systems often involving the use of ICT for codification; the soft about the social processes and tacit knowledge, and on learning processes and how the internal enterprise governance mechanisms regulate training, careers and compensation. (Meadow Consortium, 2010b, Ch. I. Organisational theory and measurement framework. Part III. Theories if organisations and organisational change III.2 Management practices and techniques, pp. 25-27).

The knowledge management is often also defined as an intentional and systematic process of acquiring, sharing and using knowledge to enhance learning and performance in organisations (OECD 2003). Knowledge management deals with explicit, not explicit, tangible, intangible, tacit, knowledge that is oriented towards both individuals and organisations.

A specific work organisation is a lean production; it is defined as process-oriented “precisely specify a value by specific product, identify the value stream for each product, make value flow without interruptions, let the cus-
customer pull value from the producer, and pursue perfection” (Womack and Jones and Roos, 1992). The practical use of lean is often described as cost reduction, empowerment, value chain orientation, and customer focus, and with a product innovation perspective, referred to as the Toyota-model, in the MEADOW Guidelines. (Meadow Consortium, 2010b, Ch. I. Organisational Theory and Measurement Framework. Part III.2 Management practices and techniques pp. 25-27). The MEADOW Guidelines proposes a single indicator to capture the organisation’s use of systems to minimise inventories, supplies, or work-in-progress.

TQM, Total Quality Management, its core is described as the customer-supplier interface, internally and externally and with a focus on work processes (Meadow Consortium, 2010b, Ch. III. Measuring the dynamics of organisations and work: employer-level survey. Part II. Concept and indicators. II.2 Management techniques and organisational practices pp. 103-107). Complementary description of TQM is presented that assumes profit to achieve better, still with a focus on the customer and the relation on supplier and partners, and its regards to high quality, not the lowest price. Further, it argues that scientific methods should be used to monitor needs and performance in the firm. Problem-solving methods and functional teams must be used to identify and diagnose causes of problems, and employees who are routinely performing the processes know best how to improve them. Therefore, the employees should be equipped and qualified with the necessary skills by training and education. However, all quality improvement shall be confirmed by the top management to create priority and persistence in changes. (Hackman and Wageman, 1995), see also Paper III. Bundle of practices versus TQM principles and their prediction for productivity.

Further, it is argued that the name TQM is a buzzword “(...) there is no such thing. It is a buzzword. I have never used the term, as it carries no mean-
ing”, stated by one of the authorities Deming (Hellsten and Klefsjö, 2000), see also Deming (1986).

Finally, science and technology-based learning (STI) distinguish from informal processes of learning based on doing, using and interacting (DUI) is also a model suggested to be captured by the MEADOW Guidelines. It is argued in the thesis that data for creating indicators for advanced use of ICT exists as secondary data, and they have to be more elaborate than what was the case when the analysis in the thesis was performed. Therefore, such analyses have to be performed in the future.

Organisational learning

The Guidelines states that organisations with a capacity to adapt and compete through learning can be called learning organisations. Further, it is argued that interrelated dimensions of individuals, team, and organisation or system level are proposed to capture these dimensions (Meadow Consortium, 2010b, Ch. III. Measuring the dynamics of organisations and work: employer-level survey. II.4 Types of organisational designs pp. 112-116). The MEADOW Guidelines also argue that the literature on learning organisations is disparate. So, complementary aspects concerning organisational learning are presented.

The perspective of socio-culture is a supplement in the presentation. The last decade's development acknowledges to include more tools, artefacts, as well as the point of view of humans as never stopping to learn, alongside that individuals also learn together in collectives (Säljö, 2000, pp.279). It is argued that this perspective partly is beyond the concepts of learning in behavioural science and cognitive psychology of the development of the intellect, as argued in the guidelines.

Collectives, often groups and formal organisations, are recognised as such: as organisational structures, and the work organisation, alongside the type of parties such as employees and managers and consultants, etc. These parties
are seen as agents of learning in some theories. The field of literature in organisational learning also recognise what is called knowledge creation and processes of knowledge as well as inter-organisational learning. Triggers or hindners for organisational learning and changes are also the context outside the organisation (Berthoin Antal, Dierkes, Child, Nonaka, 2001, Introduction. Finding Paths through the Handbook. Page 1-7).

Two of the founding fathers of organisational learning is Argyris and Schön. At least Argyris is argued to see individual learning as the basis for organisational learning (Maier and Prange and Rosenstiel, 2001, p. 15). The theory includes individuals, groups, and organisations. “Learning is defined as the detection and correction of errors, and errors as any feature of knowledge or of knowing that makes action ineffective.” (Argyris, 1976, p.367). Learning is both single-loop learnings defined as that “participants in organizations are encourage to learn to perform as long as the learning does not question the fundamental design”. Organisations learning is argued to most often be single-loop learning. "Effective learning is though (...) double-loop learning, a participant, would be able to ask questions about changing fundamental aspects of the organisation” (ibid.). The theory concerning organisational learning includes tools of how to transform from single- to double-loop learning, often despite inhabitants of transformation (Argyris, 1976 pp. 363-375). Research concerning the Swedish business sector refer to the same perspective: Transformation of knowledge into double-loop learning includes new work practices, as argued by Forslin and Thulestedt (1993).

Senge, also a leading researcher in the field, declare his general definition of learning organisations in The Fifth Discipline: The Art and Practice of the Learning Organisation (1993). It is “organisations where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning to see the whole together” (Fojt, 1995, 26-33).
So, numerous of disciplines is argued to have shaped thinking about organisational learning. Also, theories of management are claimed to be in the centre, which also is due to the fact that organisation in the private sector is in focus in these studies. Because firms have been in focus one would think it would have created a strong cross-fertilisation between economics and social science, but this is argued not the case, no real dialogue is established (Berthoin Antal, Dierkes, Child, Nonaka, 2001, Introduction. Finding Paths through the Handbook. Page 1-7). The firm, described as an organisation, has become a mutual object of study for almost all social sciences already in the 1960s (Danielsson, 1965). Other research fields of importance are behavioural and cognitive psychology, sociology, anthropology, economics, political science, and history. (Berthoin Antal, Dierkes, Child, Nonaka, 2001, Introduction. Finding Paths through the Handbook. Page 1-7).

According to knowledge processes in firms, it is argued that a majority of articles on the topic of a system, especially production systems such as lean production, still focus on one single aspect at the time, in the relationship between implementation and performance (Shah and Ward, 2003 tot. 21 pp.). There are some examples of studies of effects of more than one key factor in a production system at the time including contextual factors (plant size and age and unionisation status). There are examples of studies of indicators of the importance of “bundles” of interrelated and internally consistent practices, especially including lean production system (ibid.).

A perspective in parallel is that there have been only a few measures that focus on different hypotheses and used multiple practices and their impact on turnover and productivity at the same time. There are examples, exploring personal perspectives alongside strategic human resource management perspectives (Huselid and Jackson and Schuler, 1997 pp. 171-188). The future in management research is argued to be about organisational performance rather than individual performance; and the changes from HR management practices to the role of HR management systems, as solutions to business
problems, and the firm performance and overall business strategy (Becker and Huselid, 2006 tot. 28 pp.).

A further argument for not looking at one dominant logic at the time is that such an approach reveal and limit the perspective on management as such. Dominant logic embedded in an organisation is argued to act as a "blinder" to peripheral vision and new opportunities and knowledge about rethinking the logic of the business. Research about management and managers need to look more beyond the borders of the organisation (Prahalad, 2004).

More contemporary challenges in HRM are argued to bring the two perspectives of humans and structures closer (Huselid and Becker, 2011, tot. 8 pp.).

*Theories of boundaries of competence*

Organisational boundaries are seen as central in theories of organisations since they separate the organisations from the environment. They are the structures and demarcations that constitute organisations. The perspective on the boundaries of the organisations has broadened from a focus on cost efficiency into boundaries also depending on competence, identity, and power (Santos and Eisenhardt, 2005 Introduction pp. 491-492). The main hypothesis is that the organisation is conceptualised as a unique bundle of resources, and therefore determined by the environment. The firm can maximise its values by its boundary. (Santos and Eisenhardt, 2005, Boundaries of Competence pp. 497-500).

In less dynamic environments, organisations are often larger and using tightly entwined methods like “lean manufacturing” (ibid.). Boundaries are in these cases assumed to be set, so they strengthen focal activities and current resources, i.e., they are internalised, while activities based on very different resources and knowledge are outsourced. The boundaries are set, so they leverage the current resource configuration. If the firm expands, it is assumed to be restricted to nearby products and markets (ibid.). Further, it is
argued that industry structures impediments competencies, for example by entry barriers (Teece, Pisano, Shuen, 1997 pp. 509-533).

Dynamic markets are assumed characterised by smaller firms and by this having a more loosely intertwined variety of resources. These environments are described as partnering, product development, building new resources inside and accessing resources from outside the firm. In dynamic and competitive environments different boundaries are assumed to be synergistic, such as long-term efficiency and strategic competence (Santos and Eisenhardt, 2005).

Four-box-schema for intended competence development

An analytical schema that is developed for analysis of intended strategic competence development (KKR, 2003) are included in the thesis to support the inclusion of the diverse phenomena and activities of management and learning practices at work. The schema is a tool for concrete gap analyses that support actions plans for intended strategic competence development. In the analyses, in the thesis, there will be no gap analyses on the firm level. Still, the schema is used as a tool for what type of information about learning and management are to be included in the overall analyses and how should it be sorted into the four boxes. How the included practices are organised according to the four-box-schema is presented in Chapter 5. Findings and Conclusions.

The schema is included as an additional perspective to the theoretical basic measurement framework presented in the MEADOW Guidelines; that mainly describe three dimensions (structure, work organisation, employees' practices). The schema goes beyond the theory of organisational boundaries, which argue that the organisation and its competence assets are determined by the environment (Santos and Eisenhardt, 2005).

Here, in the thesis, the schema is elaborated according to business firms. The analytical four-box-schema describes the firm's competence in- and outside
the firm. The model aims to provide a counterpart on how to sort the included management and learning phenomena and activities. And also a counterpart of the approach of how to look at several aspects of learning at work in parallel. See also the above discussions concerning bundles of practices (Huselid, 1995; Huselid, Jackson, and Schuler, 1997) and (Huselid, 2011) and layers of practices (Shah and Ward, 2003 tot. 21 pp.).

Further, the dynamic processes of partnering, product development, building resources outside the firm, etc. are seen as organisational processes aiming to develop new value-creating strategies (Teece, Pisano, Shuen, 1997). Building competence and using strategies (Prahala, 2004) are an argument that also supports aspects in the schema. The hypothesis about managing out of bounds (Prahala, 2004 pp. 171-179) is an intriguing perspective on firm boundaries. These perspectives also often include the shift from physical to intellectual capital (Hamel and Prahalad, 1996 pp. 237-242).

It is of interest to relate the arguments, above, towards the theories of organisational boundaries, and the hypothesis that competence in the firm is determined by the context (Santos and Eisenhardt, 2005). It is also of interest to relate the discussion towards the statements in the MEADOW Guidelines (Meadow Consortium, 2010b) that the learning at work is encapsulated via policies of steering the management practices. However, the discussion is novel and need to be further developed in forthcoming analyses. However, the presentation is taken a bit further compared to the Paper II, mostly concerning these complementary hypotheses.

The four-box model is organised in two dimensions; both dimensions, in turn, are divided into two perspectives each. The first dimension is the two categories of competencies; human and structural competence capital. The second dimension is about the boundaries of the firm; competence assets that can be used by the firm regardless if they are within- or outside the firm.
The two dimensions, each being divided into two perspectives comprise a four-box-analytic schema, see figure 2.1.

*Figure 2.1. Principles behind the firm competence four-box schema*

<table>
<thead>
<tr>
<th>Inside firm</th>
<th>Human competence, concerns people</th>
<th>Structural competence, concerns competence structural assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employees competence and management and learning practices at work</td>
<td>The firm’s systems supporting humans learning and building of competences</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outside Firm</th>
<th>Individuals outside the firm and their competence</th>
<th>External structural resources; what resources exist and how can they be accessed and used?</th>
</tr>
</thead>
</table>

*Note: The schema is inspired by the paper about intended competence development strategies in public organisations (Statens kvalitets- och kompetensråd, KKR, 2003), see also Figure 1 in the referred PM. The schema is also presented in Paper II in the thesis but simplified. The result of the use and allocation of measured practices according to the schema is presented in Chapter 5. Findings and Conclusions.*

The first of the two categories of competence include people, individuals, here called human competencies. The first vertical line of boxes covers humans within the firm and humans outside of the firm, also including the bottom box concerning people working for the firm even though they are not employed directly by the firm. The top left box, human competence within the firm, is perhaps the most obvious competence asset within the firm. Among these, the most obvious is probably the formal education among the employees and the employees learning practices that take place at work, for instance, an experience that is a result of activities and when solving problems at work. Included are also phenomena and activities aiming to build competence, therefore also including learning. These competencies are also called human capital in economics since they are seen as resources or assets.

The second category of competence is called structural competence, the second vertical line of boxes covers structural competencies within the firm and outside of the firm, also including the bottom box concerning assets outside of the firm but assessable to the firm. These are competence assets defined as competence beyond humans. The second category of competencies, structur-
al competence, includes organisational structure and work organisation and information technology, IT, as well as databases and documents/reports. The assets outside the firm are often of the same kind as the assets inside the firm.

The discussion about competence has earlier often been focusing on who owns or controls the competencies. And in turn, ownership on competence have often been focusing on humans and that these individuals are movable in a way that the firm cannot control, at least not in the same way as it is possible to control structural competence, often owned by the firm. Humans can leave, and when they do, they take their competence with them. Still, this perspective on competence is argued to belong to an earlier focus on competence and on how to transform individuals' competence into the firm's property.

The contemporary focus on competence is more analytical and goes in the other direction, from control to support with the help of structures; it focuses on how to encourage and support learning (Child and Heavens, 2001, Part III. Factors and conditions shaping organizational learning. Ch. 13. The Social Constitution of Organisations and its Implications for Organizational Learning. p. 308). For instance, in specialised work, the qualifications and the initiative of learning at work are often derived to the employees, the individuals, them self.

Additional, this perspective include structural competence and as such management systems and leadership supporting the human competence to prosper. This contemporary perspective has followed the changes and transformation in the economy from managing physical assets to managing processes of intangible assets. It also argues a power shift from hierarchies created to control assets to organisational learning with new roles, interests, and powers both within a firm and in the context outside the firm (Pawlowsky,
Further, there are different ways of defining ownership; here it can be seen as rules or institutions (Aghion and Howitt, 2009 p. 237). Different sets of these rules are argued to support learning and competence building better than other. See also the landmark contribution to institutions and economic growth, where institutions are defined as the rules and restrictions in a society that humans create to define their interplay (North, 1993 p. 16).

Moreover, structural competency is often the foundation for the definition of intellectual capital that also are decomposed into infrastructural assets, including for example ICT; and intellectual property assets, including patent; and market capital, including customer assets. Further, the definition of intellectual capital is argued to diverge after the perspective in interest. For example, if performance is focal, the measurement is often including information about financial assets. If the focus is contemporary, the measures are often on customer or processes. If the future is emphasised, the measures are often on changes and changeability (Luthy19, 1998 tot. 18 pp).

The second dimension – inside and outside the firm – might be argued to address aspects concerning boundaries of the firm. This dimension is illuminated by the horizontal line, in figure 2.1. Traditionally the boxes on the top of the line are the firm, and the boxes under the line are outside of the firm. The left bottom box represents human competencies that firms have access to by hiring humans as consultants and by using private employment agencies. Consultants and individuals from private employment agencies are not employees in the hiring firm; their competencies are seen as a resource outside the firm but used by the hiring firm. A third and fourth category are employees within the firm that are defined as having temporary contracts and part-time employees directly within the firm. Though, in

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measures, all types of temporary contractors are often categorised together, i.e., in this case with employment agencies and consultants. One reason is the use of the practice as a way to quickly and smoothly change the number of humans working for the firm. Another reason for this is that when it comes to investment in competencies the hiring firm assumes to a limited interest in investing in learning for short time contractors, as for employees in employment agencies that are employed by another firm, employment agencies. Part-time workers are also often categorised with contractors because the practice is used as a way to smoothly change the number of working hours for the firm. Other arguments for including all types of short time contracts together in measures is that they aim to meet fluctuations in the market.

Further, the argument for dividing between permanent employees and others is that in general, at least in the past, there have been differences in work tasks between them. The consultants often differ from the other two categories since they are often not only selling extra ‘pair of hands’, they are often also selling knowledge and competence in the form of solutions to specific problems, and they are often bringing in new work practices and processes. The differences between consultants and employment agencies are not equally clear today as a decade ago, at least in Sweden. For instance, employment agencies are also in the market as consultants today, and they sell advanced services. There has also been greater differences in rewarding and payment systems for employees with permanent contracts and others. Earlier, humans belonging to an employment agency have been paid by the agency when they were hired, by a third party, today they can be monthly paid. Permanent employees in Sweden have in general been paid monthly, today, some are paid after their performance, for example, according to how much they have sold. Salary conditions for both permanent employees and those belonging to an employment agency have changed. There is even a study arguing that humans in employment agencies can be higher paid than hu-
mans with permanent contracts (Andersson, Björklund, Christiansson, 2003 pp. 51).

The humans in employment agencies are growing in Sweden (Statistics Sweden, 2015; Swedish Staffing Agencies, 2015) and a larger proportion of them are highly educated people compared to earlier (Tjänstemannaförbundet HTF, 2007).

The second dimension also concerns structural competence capital outside the firm, which is highly relevant according to the argument of boundaries of organisations. It goes beyond traditional boundaries, and it includes access to (strategic) competence assets regardless of whether the firm owns it or not and regardless of what is in- and outside the firm. See the paragraphs above.

**Feasible Research Questions**

The theoretical framework, the presented collection of theories and hypotheses and models, aims to support the design of the feasible research questions and the analyses in the thesis. Still, it includes several hypotheses from more than one research discipline, and it is based on more than one model. The reason for the complexity of the analyses is the complexity of the real life. Therefore, to achieve the purpose of the thesis more than one research question is developed and each question is answered by more than one analysis, using more than one analytical technique.

The analyses in the thesis have in common that they aim to contribute to measures on management and learning at work in business firms that can be used to predict productivity, and that can be embraced in models of productivity. Ultimately the knowledge aim to better understand economic growth. Further, all the analyses are using micro-level-data on the firm level, complemented with information about the human capital on an individual level, but still included and used in the analysis on the firm level. Deeper investigations are advisable and desirable but are outside the scope of the thesis. Still, some analyses are planned in a forthcoming doctoral thesis. More
about the forthcoming ambition in the final chapter, Chapter 6. Final Reflections.

The research questions guiding the analyses are the following:

1. How can management and learning practices at work be described and measured?

2. Is the environment of the firm defining the management and learning practices at work?

3. Can management and learning practices at work predict productivity, and is one model better than the other?

The analyses are mainly performed in three different papers, also presented in summary in the thesis, see Chapter 4. Each paper specifically aims to answer at least one of the three research questions, and the papers complement each other by using different analytical techniques and approaches in the analyses. The papers are also partly overlapping each other in answering the research questions. The Paper 1 aims to be used in the Paper 3. The analyses in the Paper 2, about the firm's environment, specifically complements the analyses in the first paper with additional analytical techniques, and useful in the designing of the analyses in the Paper 3. The result and knowledge in the different papers are assumed cumulative and aiming to provide feasible answers to the research questions.

The comprehensive summary of the analyses in the thesis is using all information in parallel when concluding the answers to the three research questions, regardless of the organisation of the analyses in the three papers.

*How can learning at work be described and measured?*

The first research question is targeting the focal research problem concerning the lack of measures of management and learning at work. This is the case, despite the many different theoretical perspectives on knowledge, and competence development, and learning phenomena and activities. The many
different perspectives might have contributed to the problem. In general, the
data in the matter in focus are argued to be scattered and poor, and the gap
in data is argued to constitute an intertwined problem between theory and
data development (Vickery and Wurzburg, 1998). For a long time, the lack of
knowledge concerning these matters in economic growth is described as a
“black box” (Rosenberg, 1982). Anyhow, some rather recent initiatives have
been taken. Still, most of them have mainly included measures concerning
innovations in products and processes and markets. Only a few are about
management and learning practices at work (OECD, 2010; 2011a; b).

Answering the first question is part of the operationalisation of the
measures. These measures are based on the primary data from the Swedish
MEADOW Employer Questionnaire 2009/2010, which in turn is based on
the MEADOW Guidelines (Meadow Consortium, 2010b) that are specially
developed for the matter for the European Union countries. The use of these
data will restrict the analyses to include those aspects that are identified as
the measures of the management techniques and practices included in the
MEADOW basic measurement framework, see also the description of the
themes in the Swedish MEADOW Survey in Table 3.1. in the thesis.

The data based on the MEADOW Guidelines aim to provide information
about diverse learning phenomena and activities at work which will explore
the area of management and learning practices at work, with the help of var-
ious complementary analytical techniques. Here, both an explorative ap-
proach and theoretical models will be used in the operationalisation of the
measures.

The comprehensive aspects and complementary perspectives and techniques
also aim to provide stable and useful measures to cover different types of
firms. This is often a used technique in the development of measures called
composite indicators, which aim to embrace the measures in productivity
models in a robust way (OECD, 2008). See also further in Chapter 3. Meth-
The fine-tuning of the measures are performed in the analyses of the third research question.

The diverse and multiple aspects, as well as the many observations of firms, represent a risk of a rather long list of measures of different learning phenomena and activities. Therefore the analytical techniques also aim to handle so-called big data are used. The result of the analyses will not end up in a list that describes every one of the different measures in detail or rank the so-called best practices. On the contrary, the various measures will be used to create composite indicators covering and balancing different aspects of learning at work. With the result of the analyses, especially the final analysis studying the learning at work, proof of the usefulness as predictors for productivity will become clear. See the second and third research questions.

*Is the environment of the firm defining the management and learning practices at work?*

The second question is targeting the hypothesis concerning the firm's environment and its potential impact on the management and learning practices at work. Thesis and antithesis are tested. The main hypothesis according to the firm's environment that the analysis lean on is that the firm's assets, including management and learning practices, are heterogeneous according to its environment (Acemoglu, 2009 Part 1. Neoclassical Growth. Ch.2. The Solow Growth Model, 2.1. The Economic Environment of the Basic Solow Model). The alternative hypotheses are based on the theory about the firm's boundary, and specifically, the hypothesis that the firm's competence boundary is determined by the environment (Santos and Eisenhardt, 2005. pp. 497-500). Further, another alternative hypothesis is that it has become more important to gain access to competence outside the firm, assets that go beyond the traditional borders of the firm, as discussed by Prahalad (2004).

Knowledge about the potential relations between the environment on the one side and management and learning at work at the other side as such is of
interest for the understanding of the use of the practices across firms in the business sector. Besides, these potential relations must also be revealed and handled before the creation of the analysis of analyses of prediction on productivity, see the third research question. Such collinearity or multicollinearity can seriously distort the interpretation of analyses of applied models (Se for example Tu, Kellett, Clerehugh and Gilthorpe, 2005). This argument is an additional reason for analyses about the firm’s environment.

Can learning at work predict productivity, and are one model better than the other?

The third question ties together the result from all the analyses in the thesis. It includes the result of the first research question; the measures of management and learning at work. The studies answering the third research question include fine-tuning of the measures in the model of productivity. This way the answering of the third research question becomes part of the operationalisation of the measures. The analyses hope to contribute to the discussion about the use of different measures of indicators in studies of productivity (Huselid, 1995; Huselid, Jackson, and Schuler, 1997; Huselid, 2011). The analyses also aim to include the information from the second question; about the relationship between the different environmental characteristics of the firm and the measures of management and learning practices at work. The answer to the third question widens the perspective from the earlier traditional production function towards including predictors in the model such as management and learning practices at work, also supported by Acemoglu, 2009; Vickery and Wurzburg, 1998; Romer, 1994. This way the analyses can reach the ambition to provide to the knowledge of measures on management and learning practices at work that can be embraced in models of productivity, and ultimately used to understand economic growth better.
Chapter 3. Methodology

The third chapter mainly describes the primary data that is used in the analyses, from the Swedish MEADOW Employer Questionnaire 2009/2010, alongside, the used secondary data. The analytical technics are introduced, they are mostly based on statistical methods. Some aspects concerning the quality of data and how the indicators are constructed are also included. The presentation is further developed compared to the performance in the three papers.

Research Paradigm

The philosophical framework of the thesis, known as the research paradigm, aims to contribute to classifying the level of sophistication of the research, or at least this is often argued to be the reason behind this kind of discussion in business research. Still, here follows some argument concerning the paradigm.

The perspective on the research in the thesis is argued as originated from the positivistic research paradigm, defining research as seeking knowledge and truth in general phenomena and activities in social science. It is assuming that knowledge can be derived from empirical data and that phenomena and activities can be described and explained, and that relations between them can be deducted and predicted (Collis and Hussey, 2009 p.55-70). Others describe the paradigm as research of existing phenomena and activities (Alvesson and Sköldberg, 1994 p. 24). The latter might be interpreted as to imply that analysis based on the positivistic paradigm only study that what is seen or easily seen.
Further, the analysis in the thesis can be described as applied research that deals with the economy analysed with the help of studying the business firms. The analyses aim not be categorised and narrowed for example as merely about descriptive analyses, or only exploratory, or merely with the analytical predictive analyses. It will be all three.

Therefore, hypotheses concerning management and learning practices at work will be tested as such, and about the relation between the firms learning assets and its environment regarding business and workforce characteristics, as well as the impact on the firm's outcome. Consequently, the research can be defined as deductive; testing hypotheses and looking for answers. The use of the data from Statistics Sweden will probably fall into the category of so-called "big data". Thus, some of the used analytical techniques are explorative, looking for hidden patterns and structures in the data. Some of the methods might also define the research as inductive; that the data as such will provide the questions that should be answered by the data. Since the latter perspective also is the case, though the research in the thesis is not specifically looking for new questions but to find answers to existing questions about how to describe and measure management and learning practices at work and growth drivers and use of the measures as predictors of the outcome of the firm.

Because of the dual perspectives, the research approach has the potency of being labeled abductive; and described as a combination of inductive and deductive methods (Alvesson and Sköldberg, 1994 Ch.2.5 p. 41-47). For instance, the data is collected with the help of the MEADOW Guidelines, which is the result of a systematic overview of the essential information that is considered to be needed for creating statistics and indicators of management practices with a focus on learning at work. The result is emphasising on collecting data on firm micro-level and using it for analyses where the result aims to be generalised to the business sector level, with the
help of analytical techniques that both allow predictive approaches, as regression models, and explorative, as specific techniques of factor analysis. Finally, it should be said that the overall methods that will be used in the analyses in the thesis are quantitative statistical analysis. I have learned that some researchers strong in management argue that a quantitative approach to management research is not possible since every organisation is unique. Others researchers in management say that evidence-based analyses concerning firms must be built on a large number of cases and time-series analysis for explanation-building and also that these quantitative techniques also should be used in conjunction with logic thinking (Yin, 1990).

Data – Swedish MEADOW Survey 2009/2010
The use of The Swedish MEADOW Survey 2009/2010 is the core of the design of the data in the thesis. The survey includes several themes based on complementary data sources. Here follows a presentation of the data alongside some principles behind the data. The presentation in this summary is further evolved to more fully describe the range of themes in the Swedish MEADOW Survey compared to the performance in the Paper I in the thesis.

The MEADOW Guidelines includes two Questionnaires, the MEADOW Employer Questionnaire, and Employee Questionnaire. The Swedish MEADOW Survey consists of the Employer Questionnaire.

Four Sources Covers the Themes
The Swedish MEADOW Survey 2009/2010 includes the themes in the MEADOW Guidelines Survey (Meadow Consortium, 2010b). The four following sources are used. The primary data is the Swedish MEADOW Employer Questionnaire 2009/2010 (Statistics Sweden, 2010a; 2011, see chapter 2 and 3 and 11). The secondary data is from the Swedish Innovation Survey, CIS (Statistics Sweden, 2009a) and the Swedish ICT-Survey (Statistics Sweden, 2010b) and firm and workforce characteristics from the Lisa-
database, a Longitudinal Integration Database for Health Insurance and Labour Market Studies (Statistics Sweden, 2009b). In the presentation, short names or acronyms of the data sources are used when it is assumed not to be indistinct; otherwise, full names will be used. The data in the Swedish MEADOW Employer Questionnaire 2009/2010 are matched together with the secondary data with the help of id number of the firms and of the employees. The datasets are made anonymous.

**Primary and Secondary Data**

The primary data in the Swedish MEADOW Employer Questionnaire 2009/2010 is based on an employer questionnaire, focusing on management practices, learning at work and some measures according to cooperation with others. The data are collected according to the MEADOW Guidelines. In the Swedish Survey firm in the business-sector is included. Mainly the CEO or corresponding person is providing the information for the firm, in some cases, an appointed person is providing the answers.

The Swedish MEADOW Survey also include secondary data. The purpose of the secondary data is initially another survey or register. Still, these data are essential for the fulfilling of the scope of the MEADOW Guidelines. The secondary data concerns innovation from the Swedish CIS-Survey covering years 2006-2008; and data concerning ICT from the Swedish ICT-Survey 2008. Data about the firm and workforce characteristics are from register data from the Statistics Sweden's Lisa-database. The firm features include size, business industry, ownership, a group of firms, capital, and value added. Workforce features include education, sex, and gender. The Lisa-database consists of a large number of sources of register data on an annual base of individuals and firms. At the time, the latest available register data was from the year 2008, due to the two-year delay in work-force registry data. The differences between years in register data are usually small, and the year 2008 was used as an approximation for the year 2009/2010.
Themes in the Swedish MEADOW Survey

The themes in the Swedish MEADOW Survey are presented in Table 3.1. The upper part of the table is indexed with capital letters A-E, it is showing the overall themes in the MEADOW Guidelines, measuring the center of the management techniques and practices (Meadow Consortium, 2010b, Ch. I. Organisational theory and measurement framework. Part III. Theories of organisations and organisational change III.2 Management practices and techniques, pp. 25-27), described in Chapter 2. Theoretical Frame, here covered by theme A and B and C. Indicators of these and changes of these are suggested.

The level below capital letters shows sub-themes named after some main aspects. Each theme can depend on more than one source. Therefore, the examples of practices are marked with annotations described beneath the table.

Further, in turn, the themes in the Swedish survey are based on the MEADOW Guidelines framework for see also Chapter 2. Theoretical Frame.

The themes in the Swedish MEADOW Survey are presented in Table 3.1. The upper part of the table is indexed with capital letters A-E and showing the overall themes in the MEADOW Guidelines. The level below shows sub-themes named after some main aspects. Each theme can depend on more than one source. Therefore, the examples of practices are marked with annotations described beneath the table.

The center of the MEADOW framework is the management techniques and practices, here covered by theme A and B and C. Indicators of these and changes of these are suggested. Theme D and E aim to comprise indicators of competitive pressure and other institutional dimensions. See also the presentation of my participation in the Meadow-project in Chapter 1. The Introduction; and History of Research Events.
Theme D and E aim to comprise indicators of competitive pressure and other institutional dimensions, see below.

Theme A is comprised by two sub-themes: workforce characteristics and work contracts. In the Swedish MEADOW Survey, practices about work contracts are covered by primary data from the Swedish MEADOW Employer Questionnaire. Workforce characteristics are covered by secondary data from official registers included in Statistics Sweden's Lisa database.

Theme B comprises four sub-themes; Work practices and management and cooperation are covered by primary data from the Swedish MEADOW Employer Questionnaire. Co-operation is complemented with secondary data from the ICT-survey, about ICT-use in firms.

Theme C is named human resources in the guide; it is covered by primary data from the Swedish MEADOW Employer Questionnaire.

Theme D is firm characteristics; it is covered by secondary data from official registers included in Statistics Sweden’s Lisa database.

Theme E consists of two sub-themes, both are taken as output data, value-added is covered by secondary data from official registers included in Statistics Sweden's Lisa database. R&D is mainly covered by secondary data from the CIS-survey, and complimented with some few questions about cooperation and R&D in primary data from the Swedish MEADOW Employer Questionnaire.

The Swedish MEADOW Employer Questionnaire includes questions about changes per see in the themes. The information about changes is not used in the thesis, according to the argument to focus on the current state of practices. Studies of changes preferably need data from more than one year.

The division of tasks between management and employees is argued to be of importance, some aspects of the matter might be studied with the help of questions in the Swedish MEADOW Employer Questionnaire. Though, the
division of different management's levels as such or knowledge transformation between parties and according to types of knowledge is only partly possible to study with the help of the Swedish Survey. They can be better analysed if the information is collected from different management levels. These perspectives are of interest in larger firms or in loosely organised or in geographically separated firms. However, no such collection is performed in the Swedish MEADOW Survey.

In table 3.1, the MEADOW measurement framework is the management techniques and practices are captured in theme A to C.

Table 3.1. Themes in the Swedish MEADOW Survey 2009/2010

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D and E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristics</td>
<td>Organisational Structure</td>
<td>Human Resources</td>
<td>Context and Firm Output</td>
</tr>
<tr>
<td>Work Contract</td>
<td>Workforce</td>
<td>Work Practices 59</td>
<td>Management</td>
</tr>
<tr>
<td>Work contracts</td>
<td>Employees, Sex, Age, Education 2a</td>
<td>Decentralisation, Team, Flextime 1</td>
<td>Orga. inno-vat., Follow-up 1</td>
</tr>
<tr>
<td>Workforce</td>
<td>Activity, with customers, Suppliers 1 and 3</td>
<td>Education, On the job-training, Organised training 1</td>
<td>Value Added</td>
</tr>
<tr>
<td>Workforce data from The Swedish MEADOW Employer Questionnaire, including 874 firms in Swedish business sector. The Employer Questionnaire is appended in full. 2a. Workforce data from The Lisa database, including all employees in the 874 firms in Swedish business sector. 2b. Firm data from The Lisa database, including 874 firms in Swedish business sector. 3. Data from The ICT-Survey in Sweden, including 874 firms in Swedish business sector. 4. Data from CIS, Swedish Community Innovation Survey, including 740 firms in Swedish business sector.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Classification of variables

The MEADOW Guidelines has provided a tested schema of questions, but there are also significant steps above in how to prepare the information, after the collection but before the analyses. These steps are in-between the original information from the firms and the created measures, here indicators. It
can be described as preparing and processing the dataset. The answers to the questions in the schema must be classified and standardised.

Examples will help to describe the decisions behind the classification of data. An example is a classification of the size of a firm. The necessary information is the specific number of employees in each firm, but this amount of information can be unpractical in the analyses. The information is often classified and simplified, for example into intervals; divided after numbers or percent of employees. These are numerical variables that allow all kind of arithmetic calculations and most kind of statistical analysis. Another example is that it can be classified as a dichotomy binary variable and divided into a group of larger or smaller firms. Another classification is a group of small, medium or large firms. In both cases, the information is transformed from a numerical variable to ordinal variables. These can be ranked, but the values between them are not distinct. Still, the latter information can be easier to use in the analyses. In other words, classifications and types of variables can help to simplify the analyses but also to narrow down the possible choice of arithmetical and statistical methods. Therefore, the decisions of analytic techniques must be taken into account in parallel with the preparing of the datasets and the including of different type of variables.

The questions in the Swedish MEADOW Employer Questionnaire don't permit the same possible number of alternative answers. Some of the responses to the questionnaire can only be arranged as a dichotomy binary variable while others can be divided into several sub-answers. For example, a question with two possible answers, compared to three or four possible answers, should not be given a lower total value because of the number of possible answers. The value given to each question should not be random, in this sense. The ambition is that all the questions have the same weight in the dataset, and if needed it is possible to give a particular question a higher weight than the other in a controlled way.
The indicators called composite indicators, in the thesis, have been investigated concerning their robustness and sensitivity, in parallel analyses to this thesis. A test of random weight is compared to equal weights. The result from these analyses showed no significant differences according to their use in five industry groups (Omanovic and Aksberg, 2010; and 2011, Chapter 2. Theoretical Frame Figure 2.1a-d. p. 33-34).

**The firm as the observation unit**

Economic growth models, in general, have traditionally been concentrated to measures of the quantifying of inputs and output on aggregated levels; often based on aggregated data. The principle idea behind aggregated models is that all activities of an economy count, still it is useful to study the business sector as such since it provides information about the main economic activities in the society. The public sector is indirectly included in some information in the analysis, for example with the help of the data of the percentages of university educated within the workforce. Studies of economic growth on disaggregated levels that do not take account of vital parts of the economy, for example, analyses based on limited parts of industries or very few firms, can give the wrong impression due to the allocation of resources and output between them. These arguments are highly valid. The analyses have to be on a highly aggregated level. Data, on the other hand, are argued to be best studied with the help of collected micro-level data since it contains more detailed information about what is taking place within the firm than meso- or macro-level data (Xavier, 2002). Still, there are studies performed based macro-level or meso-level data. The use of micro-level data is part of the new developed endogenous theory of how the economy functions. The level of data is seen as a theoretical matter as such. Therefore, this way the development of data and theory goes hand in hand.

The MEADOW Guidelines recommends that the collection of information from the employer should be performed randomised, also the advantages
and disadvantages of using other surveys as hosts for the questions, for example, the Community Innovation Survey, CIS, are discussed. One of the benefits, quite crucial, is that such “piggy-backing” can make the collection of data affordably. A disadvantage can be how the piggy-backed survey steers the collection of the “new” survey. The CIS-survey that is piggy-backed use the enterprise (firm) as the observation unit and not the workplace, this can both be to the advantages and disadvantages for the new study, see the discussion below. Further, the CIS-survey only covers about half of the service sector (Meadow Consortium, 2010b, see Chapter V Methodologies for surveys of employers and employees p. 247-325). The latter is probably only a disadvantage for this particular study that is piggy-backing this Swedish CIS-survey. Later CIS-surveys in Sweden aim to cover the business sector.

Most of the firms in Swedish business sector are smaller or medium-sized. The larger firms are not that many and not that large, and they can be (and are often) organised as “smaller” in-depended firms that are part of a ‘group of firms’, also called complex business unit. It is possible to identify these “groups” with the help of specific id-numbers\(^\text{20}\). Larger firms can also consist of workplaces that are the unit that is sorted beneath the organisation (firm) level, these units, workplaces, also have id-numbers. Further, the larger firms often consist of more than one legal unit, which is usually the same as the organisation (firm) unit. The majority of all these firms in the business sector are that they are sole legal units and they are the smallest economic entity with employees that produce goods or services\(^\text{21}\). Since the mid-1990s, economic activities in both manufacturing and services in the Swedish business sector, are measured and presented in business statistics\(^\text{22}\), and on the equivalent level using the definition of the firm (organisational-level). The

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\(^{20}\) Firms belonging to a group of firms have an id-number related to each specific group.

\(^{21}\) The European Parliament and the Council regulate the definition of business and legal units that are used in common statistics, analyses and publications. Regulation of business and legal units (EG) Nr 696/93 and Regulation of Nace rev. 2 (Nace 2007) (EG) nr 1893/2006.

definition of a firm is based on standard European regulations\textsuperscript{23}. If needed, it is theoretically possible to combine data from group level, or with firm level, or at the workplace level.

The Swedish MEADOW Employer Questionnaire is collecting primary data with the firm as the observation unit in the Swedish business-sector. Also, the secondary data about the firm is using the firm as the observation unit. Measurements about the workforce are on an individual level but aggregated to the firm level. An important argument for measuring management and learning practices at work at the firm level is that investments in management practices will include matters directly related to other decisions about innovation activities and investments and the use of information technology as well as measures of productivity. The assumption is that all decisions about all these matters are often held together, according to the guidelines and manuals of innovation; the Oslo Manual (OECD and Eurostat, 2005). Therefore, it is argued that studies of management and learning practices at work in firms in the Swedish business sector shall be measured at the firm level, in general. Which often is the level where decisions concerning these activities and decisions regarding economic activities are held, as argued. The legal unit is usually also the same as the economic entity. The choice of observation unit is assumed to provide high-quality data concerning each organisation economic outcome.

The firm level is argued to be the best level to perform surveys concerning activities about management and learning practices at work in firms in this case. The used sample frame are randomly selected firms in the Swedish Business Register (Statistics Sweden, 2010c).

\textsuperscript{23} According to the registers’ administrators at Statistics Sweden, Swedish Business Register: Berit Westerholm telephone interview 2010.
All the data are on the micro level, here the firm level or the individual level. However, the analysis in the thesis is made on an aggregated level, here the business sector level.

**Sample and response rate**

The selection frame of the Swedish MEADOW Employer Questionnaire consisted of 1374 firms that are market producers in the Swedish business sector, excluding 21 as over coverage. For a firm to be included in the Swedish MEADOW Employer Questionnaire it had to be included in the selection frame of the Swedish Innovation Survey 2006-2008, as well as it had to have at least 15 employees in the year 2008. The data of the Swedish MEADOW Employer Questionnaire was collected in late autumn 2009 and early spring 2010. Managers, mainly the CEO or corresponding person, was interviewed and provided the information for the firm. A minority, are appointed persons providing the information.

The response rate of the Swedish MEADOW Employer Questionnaire Survey is 65 percent, 881 firms, which is high for a non-mandatory survey. The numbers of firms that fully completed the questionnaire were 874 (Statistics Sweden, 2010d). Further, a non-response analysis has been conducted with the help of data from CIS and ICT and economic register data. The result shows no significant difference between the responding and non-responding firms (Omanovic and Aksberg, 2010; and 2011, *Chapter 2. Theoretical Frame* Table 2.2 to 2.3. pp. 26-28).

The industries included represents about 55 percent of all employees working in the business sector, and specifically high-technology industries according to the selected industries in the Swedish Innovation Survey.

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24 Collection took place in November 30th in 2009 to 11th of February 19th 2010.
The reason for including a relatively large number of firms in the Swedish MEADOW Employer Questionnaire is incident to the aim of generalising the result to the Swedish business sector.

The original samples of CIS and the ICT surveys are selected from register data in the year 2008, as a stratified random sample according to industries and five size classes in the Swedish business sector. Firms with fewer employees than 250+ was selected according to an optimal allocation of firms. This means that if it is assumed that the result of critical indicators is less spread among the firms, then fewer observations are included, and if the spread is higher than in general, more observations are included. The allocation is due to the assumed variances in the results of important indicators in different size classes of firms. All firms with 250+ employees are included in the selection frame. The industries in the business sector are defined by the National Accounts, GDP, and Swedish Business Register FDB (Statistics Sweden, 2010c). Some industries are not included in the CIS Survey 2006-20082006-200825, and therefore not covered in the Swedish MEADOW Employer Questionnaire. For more information about the response rate in the CIS and ICT-surveys and the Swedish MEADOW Employer Questionnaire, see Paper I, Table 2.

**Limitation and Strength in Data**

The quality of the data is a fundament for the analysis in the thesis since it is aiming to provide with measures in an area that are criticised for lacking relevant measures. The primary data in the analysis is the Swedish MEADOW Employer Questionnaire. This is a survey that is collected once, following the MEADOW Guidelines. The analyses are including complementary secondary data from the year previous to the primary data. The secondary data is mainly covering the year 2008. The different secondary data is collected separate-

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25 Agriculture, and mining, and construction, and accommodation, and industries part of the trade industries, as well as industries dominated by the public service.
ly, as different register data or in stratified and randomised surveys; in all cases with mandatory status. The analyses in the thesis are using primary and secondary data that are assumed having both high validity and reliability.

Often the quality discussion concerning bigger datasets, especially if they also are based on samples, is that it focuses on reliability, for example comparing sub-samples in the dataset and if possible corresponding data from different years.

**Validity**

Here, much of the quality aspect is about the validity. It means that the data is covering what it is intended to cover; both regarding what aspects it should include and regarding how well it is covered. If it is valid, it is often said to be highly valid; to have a high validity. In this case, the design of the survey, and mostly the design of the questionnaires and the questions as such, comprises an essential base for validity.

Therefore, one aspect of the validity is the use of primary data from the Swedish MEAD-OW Employer Questionnaire that is collected according to the MEADOW Guidelines (Meadow Consortium, 2010b). The usage of data based on the guideline is an argument about what aspects that should be covered is covered. The Guidelines are argued to represent in-depth knowledge concerning the included management and learning practices, based on some of the most important surveys in the field in Europe, complemented with expertise from OECD and US. Not only is the information in the guideline from different surveys previously used in Europe it is tested among various European countries by the Meadow-project based on translated questionnaires, audited by the Meadow-project (Meadow Consortium, 2010a).

Further, the questionnaires are used in full collections of data in at least a handful of European countries. The Swedish MEADOW Survey is based on
the guideline. Above the quality tests by the Meadow-project, it is also tested before the full collection in Sweden, by Statistics Sweden.

A fundamental step for high quality is the use of microdata, on firm-level, here represented by the CEO. The information in the Swedish survey is mainly collected by telephone interviews with the firm's CEO, which is argued to strengthen the quality of the data. The use of this kind of microdata increase the quality of the data as such, and therefore the validity of the data, compared to the data based on the middle (meso-) level and compared to data based on even further aggregated levels. The reason is that firm-level data provides information about management and learning from the same level in the organisation as other important decisions about the firm's economy, for instance about the production and the development. Both primary and secondary data are at the firm level. Further, the secondary data are from register data or stratified randomised surveys, all mandatory with high quality. The relatively large number of firms included can help to reduce any occurrences of smaller problems in the data; with for example the cognitive perception of a specific question by a particular respondent.

Further, the analytical steps in the construction of measures include that they are based on results from multi-factor analysis aiming to investigate internal relationships between aspects of the primary data as well as links with other highly relevant external factors; such as the firm's business preconditions and workforce quality as well as productivity. Additional, the final step in the analysis in the thesis mainly include measures that are constructed so that several aspects are covered; in composite indicators. This is argued to increase the validity in the measures. The steps in the analysis are used to improve the validity (and also the reliability), these steps are highly recommended by OECD in making indicators (OECD, 2008). See also further details in Chapter 3. Methodology.
The Swedish design of the collection of the data has been used by Statistics Norway in the collection of a Norwegian survey conducted in 2011. This survey was almost in detail a similar survey to the Swedish survey, which is a quality marking as such. Den-mark performed both the MEADOW Employer and Employee Questionnaires 2010, and Finland 2012 completed both the MEADOW Employer and Employee Questionnaires (The Swedish Work Environment Authority, 2014a and Meadow Consortium, 2010a). The knowledge from the Norwegian survey and the other Nordic countries surveys can be further used to understand the validity and reliability.

**Reliability**

The design of the Swedish MEADOW Survey including both primary and secondary data also aims to provide consistent conditions for the collection of data, to increase the reliability of the data. As mentioned, the secondary data is collected separately, as different register data or in stratified and randomised surveys; in all cases with mandatory status.

An important aspect of reliability is the selection of observations, here the firms. In the Swedish MEADOW Employer Questionnaire, the firms are selected so that they will represent the Swedish business sector according to different industries and sizes. The stratified and randomised sample makes it easier to cover different types of firms correctly. The reliability is strengthened because almost all possible and relevant background data is available. The permissions as such to make advanced statistical analysis is assumed to contribute to balance in the analysis and the results. The representative number of firms included aiming to make it possible to draw general objective conclusions about the business sector in Sweden. This is an important aspect of reliability. Accounted weights according to size, industry, and productivity is available and used when it is needed.

Further, the construction of the analyses also aims to increase reliability, see also the above discussion about validity. The performance of analyses inves-
tigating the data as such is a way to understand the reliability of the data (Statistics Sweden, 2011). Further, the performed multi-factor analysis, for instance, both the initial step in the creation of the measures as well as the final use of composite measures in the analysis, aims to provide information about reliability.

**Analyses Parallel to the Thesis**

Analyses parallel to the thesis also provide information about the validity and the reliability. This information is useful for evaluating the quality of the analyses in the thesis and also for evaluating the quality of the result of the analyses in the thesis.

The parallel analyses are based on data from the Statistics Swedish Survey 2009/2010 (Statistics Sweden, 2011) and on analyses based on data from two new surveys, called NU2012 and NU2015. These two surveys are financed and organised by the Swedish Work Environment Authority, the latter of the two surveys in close collaboration with Statistics Sweden. The selected sample in each of the two survey is stratified according to industry and size (Stelacon AB, 2013; Statistics Sweden, 2016). NU2015 is using the CIS survey as the selection frame for the business sector, and the ICT survey for micro firms (5-9 employees), in the same way as the Swedish MEADOW Employer Questionnaire. Both new surveys include register data and the latter also include innovation data from the CIS-survey and ICT-data from the ICT-survey. They two new surveys are including the same information as the Statistics Swedish Survey 2009/2010, complemented with the help of the result of the analyses based on the data (Statistics Sweden, 2011) and based on the result of the analyses in the present thesis. The two new surveys also include a theme concerning the management of work environment, and they are developed to include all industries in the working life, as well as workplaces in the public sectors.
Several different analyses have been performed in parallel to the thesis. For example, analyses comparing the Swedish MEADOW 2009/2010 and the Swedish Work Environment Authority’s survey, called NU2012, both cross-sectional analyses and analyses based on a cohort of firms participating in both surveys. There are also several other analyses based on NU2012 as well as analyses based on NU2012 and NU2015 comparing measures the two years (Swedish Work Environment Authority, 2014a; Swedish Work Environment Authority, 2017a; b; w.y.). Some of the analyses also include several years of complementary register data, which aim to include the quality of the analyses. For instance, these analyses show consistency in the representativeness of the organisations included in each of the three included surveys concerning the firm's business precondition and workforce composition as well as productivity. Some of the analyses also investigate the employee's labour market position. The results from the different analyses show high consistency in the measurements. The consistency of the result of the different analyses “indicate” high validity and also high reliability.

**Analytical Techniques**

The used analytical techniques in the thesis are mainly statistical analysis used in two ways, in describing phenomena, as in inductive explorative approaches (Collis and Hussey, 2009). It can be explained as that it is describing what is measured, and every time a phenomenon can be measured its probability if existence increases. These techniques are also often used, in general, in testing hypothesis towards empirical observations, which is the basic concept in deductive research (ibid.). Some hypotheses are tested in the thesis to verify or reject the relationship between management and learning practices at work, and the firm's environment and output, the latter regarding productivity.
Statistics

From the beginning statistics exclusively included official data concerning information about states (Hofsten, 1979). Now all kind of information is called statistics. Today, the statistics often involves both the creation of data and the collection of data and the organisation and presentation of data. The definition of statistics has also changed due to the development of computerisation of information and analysis. If statistical analysis and interpretations are included or not in the concept is depending on its purpose.

The data is based on information directly related to each firm, often all 881 firms, the number varies a little according to if there are partial missing data concerning a specific question or register data. Some fewer number of observations when innovation and ICT in the analysis. The relatively large amount of data is processed with the help of SAS software programs. SAS Advanced Analytics for big data (SAS, 2016) is used, alongside some minor calculations in Excel. The latter programme is mainly used for tables and diagrams.

Descriptive statistics

In general, descriptive statistics summarises data without derivation of any kind, often straightforward, and defined as statistics not including inductive statistics. Descriptive statistics are often using numbers or percentages.

The descriptive statistics in the thesis is mainly about the number of firms in the sample and the response rate. Descriptive statistics are performed as tests of different kinds in all statistical analyses using SAS, but only some few of them are presented due to their many numbers. Just the most necessary results are shown, for example, when describing the quality of a model.

Measures of weighted mean values of incidences of the management practices are presented. The weights in the measures are based on the proportion of the firm's value added in the business sector, according to size and industry.
Correlation analysis

The Pearson correlation analysis of estimated coefficient based on two variables, so-called bivariate analysis are performed. This is one of the most commonly used statistical analysis of the strength of linear dependence between two variables.

The result of a correlation analysis is between -1 and 0 and +1. If it is -1 it is interpreted as that the variables are negatively correlated and that they are excluding each other. If the result is +1 it is interpreted as that they are positively correlated and that they provide the same kind of information. If the result is 0, there is no correlation.

For the result to be meaningful to interpret or not is due to the degree of probability of the random of the result. Three degrees of significance are often recognised in social science. The highest level of degree is that the probability is not higher than one percent, 0,01. The medium degree is a probability between one and five percent, 0,05, often the commonly used level. The third level is between five and ten percent, 0,10.

Correlation analysis and matrixes are performed and examined in all included statistical analyses using SAS. Only some of these results are presented due to the many results. It is a traditional way to start the progress and procedure of analysis.

Factor analysis

Two models of factor analysis are used, both are multivariate statistical methods. The model Principle Factor Analysis (PFA) is recommended and often used in psychology research, often aiming to reveal hidden structures. It uses the common variances of variables, excluding unique variances in extracting factors. Still, the most common model is Principal Component Analysis (PCA), it is constructed by statisticians and aims to reduce the complexity of data by decreasing the information into fewer factors, called compo-
nents. It accounts the maximum variation in the dataset for one factor at the
time (Darlington, 1997). PCA reflect both common and unique variance of
the variables (Garson, 2007). Both models combine variables into fewer fac-
tors. Both methods are tested in the main analysis, and the result is showing
almost identical results. Therefore, it is argued as reasonable to limit the fur-
ther analysis to one of the models, and PCA is chosen.

Each independent variable gains a value per factor in the analysis. A value
close to zero means that the independent variable has no value in explaining
the underlying factor and a value close to one means that the independent
variable has a value in explaining the underlying factor.

The models are assumed to be defined according to factors retained. The ei-
genvalue of each factor is suggested to be equal to or higher than one for to
be included in the model, since lower values are assumed not to be contrib-
uting to the explanation significantly, according to the mineigen criterion.
Further, it is commonly argued that a rotated solution is more interpretable
since it seeks to facilitate and simplify the interpretation of the factors. The
rotation alters the distribution of eigenvalue and percent of variance ex-
plained between factors and therefore the factor loadings, i.e., the presented
values. The distribution of variances concentrates on the main factor and not
on the surrounding values. Different rotation methods are tested, and Vari-
max rotation is used. (Darlington, 1997; Garson, 2007)

There are only a few rules about which variables and how many that can be
included. Generally speaking, it is argued that the more variables, the better,
so long as the variables remain relevant to the underlying factors (Darling-
ton, 1997).

Each analysis in the thesis is limited to include relevant variables for the spe-
cific investigation per see. For example, the investigation of hidden patterns
of used management and learning practices at work only includes these vari-
ables, and no other variables, i.e., no background variables. If the analysis
aims to study relations with the background, then these variables are also included, for example, the firm's general business preconditions.

Another principle is about the percentage of the variance explained by the included factors and the adequacy of the model measured with The Kaiser's Measure of Sampling Adequacy, MSA. A criterion is that the overall MSA shall be at least $= 0.5$. Together these measures provide with information about the quality of the model (SAS, 2010).

**Linear regression analysis**

Linear regression analysis is used to study if independent x-variables can predict the value of a depended y-variable. The used regression model aims to study the strength of dependence between these independent variables the depended y-variable, i.e., the coefficient value. The model control for all independent variables by holding the value of the constant at the same time as it studies the strength of dependence of one independent variable at the time. A linear model can be used since the y-value is numerical, between 0-1.

A regression model is used to study if the management practices, learning at work, can be predicted by the firm's environmental precondition. In these analyses, management practices are dependent variables and the precondition is the independent variables.

A regression method is also used to investigate if labour productivity, measured per employee, in business firms can be predicted by the management practices, in these analyses the management practices are included as independent variables.

Each independent variable gains value. A value close to zero means that the independent variable has no value in explaining the independent variable and a value close to one means that the independent variable has no value in explaining the independent variable.
The regression model also provides information about the quality of the model, per see. Here, how much of the variance in the dependent variable that can be explained by the independent variables. This test is commonly called R-Square (R2); it can be between 0 and 1. If the test shows =1 then the independent variables answer for all variances of the dependent variable; if the test shows =0 the independent variables have no value in explaining the independent variable. If the test is low, it can be interpreted as that the construction of the independent variables can be altered and then better suited to predict the dependent variable. It can also mean that the dependent variable is non-linear and that another model is better suited than the used. A very high or low value is not so interesting because then it is either overlapping or not at all overlapping. Still, a rather low value is not unusual in social science since explanations are assumed to be complex.

For the result, the value, to be meaningful to interpret or not is due to the degree of probability of the random of the result. Three degrees of significance are often recognised in social science. The highest level of degree is that the probability is not higher than one percent, 0,01. Medium level is a probability between one and five percent, 0,05, often the commonly used level. The third level is between five and ten percent, 0,10.

Information concerning if the included variables are related with high or low significance are included in the model. The high significance is defined as if the significance is at 0,01 level, which means that it is under 1 percent chance that the result is a coincidence. The Rather high level is 0,05 which means rather high, and 0,10 means that it is under 10 percent chance that the result is a coincidence, here a too low level for interpretations (SAS, 2016).

Construction of the two management models for prediction of productivity

Two management models (approaches) are tested. Both include information about the firm business and workforce characteristics as well as some other important variables that are presented in the Paper III table 6. In the ap-
proach called the bundles of practices, the calculation includes all the information presented in table 5.1. In the TQM-model the calculation includes information about the sex principles, for details see Paper III (page 50-64). In each of the two model, the information is summed up as the product, so that each of the two management models is constructed as a multicomposite index, before they are included in the regression analyses, respectively. This way the construction of each of the two multi-indexes is following the principles on applied technics for composite indicators presented by OECD (2008).

Each of the two multi-composite indexes is created in steps. The first step is the standardising of each question to take account of the different number of possible answers to the question included in the specific management model. Each answer of a question is then included in one of the seven bundles of practices or one of the six TQM-principles. The TQM-practices contains the same information as the bundles of practices about management and learning except for the information about numerical flexibility. To be clear, TQM doesn't include information about numerical flexibility, but TQM includes other additional information about customers and suppliers and the organisation of the management.

The next step in the construction of the two indexes is the standardising of the number of possible sub-indexes, here the number of sub-indexes is the number of bundles or the number of principles, respectively. The last step of in the construction of the indexes is to make a total product of the sub-indexes. One total product for the bundles and one total product for the principles, respectively.

Each firm has now its final value on each of the two indexes depending on their use of the practices included in each of the management models.
Logic thinking

The analyses presented in the comprehensive summary are further interpretations and comparisons of the results of the papers in the thesis. The analytical technique can be described as logical thinking. It is supported by arguments such as that empirical research is to its advances when it is accompanied by logical thinking (Yin, 1990).

The comparing of results using different analytic techniques is also argued to provide with a deeper understanding of the results and will also provide complementary information about the phenomena or activity or its context.
Chapter 4. The Content of the Papers

The chapter gives an overview of how the analyses are organised in each paper in the thesis, which is not the same as the division of the research problem to the three research questions. The summary of each paper includes a list of the main analyses in the paper, together with information about in which original table the results can be found and used analytical techniques. The three papers in the thesis are appended in full at the end of the thesis.

Paper I. Work Organisation and Competence Development in Swedish Firms

The paper is targeting the research problem concerning the lack of management and learning practices at work by describing and scrutinising four composite indicators of management and learning practices at work.

The paper includes an extensive introduction of data and the hypothesis behind the MEADOW Guidelines. However, the presentation of the methodology is further elaborated and presented in the comprehensive summary, see Chapter 3. Methodology.

The indicators include answers from nineteen questions based on primary data from the Swedish MEADOW Employer Questionnaire 2009/2010 (Statistics Sweden, 2011, chapter 11), from Statistics Sweden. The collection of the data is following the MEADOW Guidelines (Meadow Consortium, 2010b) that are developed to provide information on the matter and for to be applied in the countries in the European Union.

It is argued that the four composite indicators aim to measure more than one dimension and more than one perspectives of management and learning practices at work supporting learning, according to the basic measurement
framework in the MEADOW Guidelines. They are the structure; the work organisation, including the division of tasks; and the employees' practices, including training and type of contracts. The hypothesis is that there are synergy effects on performance when these dimensions are adopted together (Meadow Consortium, 2010b, Ch. I. pp.25-27).

The indicators are also aiming to measure practices regarding both long-time development and short-run changes in the economy, often related to new opportunities or repeatedly fluctuations in the economy. Here, it includes the latest economic crises in 2008. Three of the indicators aims to capture learning and one indicator aim to meet changes in the number of employees, called numerical flexibility. The indicators are further described in the Paper I and discussed in Chapter 5. Findings and Conclusions.

Table 4.1. Paper I, List of analyses, tables and analytical techniques

<table>
<thead>
<tr>
<th>Main Analyses</th>
<th>Main Tables</th>
<th>Analytical Techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extensive introduction of method and data</td>
<td>Paper I, Table 1 to 3, pp. 148 to 178</td>
<td>-</td>
</tr>
<tr>
<td>Four composite indicators</td>
<td>Paper I, Table 4 to 7, pp. 178 to</td>
<td>Descriptive</td>
</tr>
<tr>
<td>Incidences of the four composite indicators across firms in the Swedish business sector</td>
<td>Paper I, Table 14, 15, 17, pp. 200 to 204</td>
<td>Comparing statistics</td>
</tr>
<tr>
<td>Relations between firm business and work-force characteristics and the four composite indicators</td>
<td>Paper I, Table 18, p. 206</td>
<td>Correlation analysis</td>
</tr>
<tr>
<td>Firm business characteristics and workforce characteristics as predictors for the four composite indicators</td>
<td>Paper I, Table 19, p. 210</td>
<td>Regression analysis</td>
</tr>
</tbody>
</table>
  - Individual learning                                    |
  - Structural learning                                    |
  - Decentralisation                                       |
| Scrutinising of the four composite indicators            |                                         |                       |
  - Relations between the four composite indicator         | Paper I, Table 8, p. 191                | Correlation analyses  |
  - Relations within each composite indicator              | Paper I, Table 9 to 12, pp. 193 to 197  | Correlation analyses  |

Note: The result marked in blue is highlighted in Chapter 5. The Findings and Conclusions, as one of the main findings.

Further, three of four indicators are the result of earlier analyses (Swedish National Board for Industrial and Technical Development, NUTEK, 2000)
and the fourth composite indicator – structural learning - is defined according to a suggestion in Paper I, which divide learning at work into individual and structural learning. The content of the Paper I is presented in Table 4.1.

The four composite indicators are essential in several of the analyses. For example, the analyses of the incidence of the four composite indicators across business industries in Sweden by combining them with firm register data (Statistics Sweden, 2009b). The use of the indicators has not excluded them from being scrutinised. The result from the correlation analysis reveals that the indicators can be divided into more than four indicators. The result is also the starting point for the further investigation of the data in the composite indicators, see Paper II and III.

The analyses in the paper provide some of the answers about how to describe management and learning practices at work as four composite indicators. Further, the paper also delivers information about the relationship between these measures and the firm's environment that proved to be useful in the understanding of the measures as such and valuable in the forthcoming analyses concerning productivity. The composite indicators are not, in general, depending on the type of production, the industries, or by the size, indicating the complexity of the production and the market influence. The result is highlighted in Chapter 5. Findings and Conclusions, as a key finding.

Further, the four composite indicators are essential in the analyses of the incidence of the practices across business industries in Sweden. The result shows that they are fairly equally used across the business industries, with some minor exceptions concerning higher incidences in larger firms and firms with higher frequencies of the high-educated workforce.

Comparing statistics, weighted mean values; and regression analysis is used in the studies of incidences of learning practices across business industries. The latter is preferred since it provides more robust measures since the first.
Paper II. Firm Environment and Competence Portfolio
The paper aims to further investigate the relationship between the firm's business environment preconditions as such, and its management and learning practices at work. In these analyses, there is also some novel examination concerning the collaboration in innovation and research in business firms in Sweden with other parties. The paper is complemented with an analytical schema that is describing the firm's competence portfolio, specially developed for analysis of intended competence development (KKR, 2003). The four-box-schema are further elaborated, in the presentation of the learning measures in Chapter 5. Findings and Conclusions, and therefore not further discussed here. The content of the Paper II is presented in Table 4.2.

Table 4.2. Paper II, List of analyses, tables and analytical techniques

<table>
<thead>
<tr>
<th>Main Analyses</th>
<th>Main Tables</th>
<th>Analytical Techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td>Four-box-schema: human and structural competence in- and outside the firm</td>
<td>Paper II, Figure 9.1, p. 286</td>
<td>Qualitative analysis</td>
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<tr>
<td>Firm business environment preconditions, extended with six business characteristics</td>
<td>Paper II, Table 9.1, p. 290</td>
<td>Factor analysis</td>
</tr>
<tr>
<td><strong>Innovation, actor and country</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analyses of pattern between learning practices and firm environment</td>
<td>Paper II, Table 9.2 and 9.3, pp. 292 to 294</td>
<td>Factor analysis</td>
</tr>
<tr>
<td>Background test of model of predictors for productivity</td>
<td>Paper II, Table 9.4, p. 299</td>
<td>Factor analysis</td>
</tr>
<tr>
<td></td>
<td>Paper II, Table 9.6, p. 301</td>
<td>Regression analysis</td>
</tr>
</tbody>
</table>

Note: The result marked in blue is highlighted in Chapter 5. Findings and Conclusions, as a key finding.

Analyses of the firm's environment about different business characteristic as such are performed. The result doesn't confirm that the environmental conditions as such are intertwined as argued in the theory of competence boundaries (Santos and Eisenhardt, 2005, Boundaries of Competence pp. 497-500), including hypotheses about the market and large firms, are tested. One of the main results indicates that less dynamic markets don't always correlate with larger firms, as argued in theory. The analyses of the environment are mainly based on secondary register data (Statistics Sweden, 2009b).
They include measures of size, industry, ownership alongside secondary data about innovation (Statistics Sweden, 2009a) and ICT-data (Statistics Sweden, 2010b) and some primary data from the Swedish MEADOW Questionnaire (Statistics Sweden, 2011, chapter 11) about the type of production and cooperation. Factor analysis is used to extract factors and to reveal hidden patterns within the firm's precondition. The result is highlighted in Chapter 5. Findings and Conclusions in the thesis.

Analyses of innovation concerning the cooperation with other parties are performed. The result shows that firms in Swedish business sector collaborate with all types of organisations in Sweden, and outside Sweden with the firm in the US and universities in China (Asia).

The analyses include investigation of the relationship between the management and learning practices at work, and the firm's environmental preconditions, complementary to the analyses in Paper I. Factor analysis is used. The result is that firms use the management practices regardless of their precondition environment, the latter including both firm business and workforce characteristics. Still, the same exceptions, as in Paper I, are indicated: Large foreign-owned firms are using numerical flexibility to a higher degree than smaller Swedish-owned firms. There is also an indication that the work practice called flex-time is more common in firms with a high degree of university educated women. These analyses indicate that there is some common underlying information, but there is no further investigation performed in the specific matter. The investigation of the relations between the firm business characteristics and learning practices cannot be confirmed; the business characteristics do not denote the competence boundaries of the firm.

An additional qualitative analysis is performed resulting in an analytical four-box-schema developed explicitly for strategic analysis of intended competence actions. Here, it is used in the sorting of the practices according to
human and structural competence, and in- and outside of the firm. The schema is highlighted in *Chapter 5. Findings and Conclusions* in the thesis.

Factor analysis has been a useful technique in the extraction of factors and revealing of potential patterns. Additional, in the paper a regression model is prepared and tested, and finally used in the analysis of predictors, and finally elaborated in the Paper III.

**Paper III. Bundles of Practices versus TQM Principles and their Prediction for Productivity**

The Paper III address the overall purpose of the thesis; it investigates if management and learning practices at work can be used to predict productivity. The analyses aim to elaborate and to widen the perspective from the earlier traditionally production function to-wards predictors in the model as such management practices, according to Rosenberg, 1982; Romer, 1994. Further, the analyses tie together the result from all the analyses in the thesis. It includes the result of the measures of management and learning practices at work and its relationships with the firm environment, from the analyses of the first and second research question. The content of the Paper III is listed in Table 4.3.

**Table 4.3. Paper III, List of analyses, tables and analytical techniques**

<table>
<thead>
<tr>
<th>Main analyses</th>
<th>Main Tables</th>
<th>Analytical Techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of two management approaches</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- <strong>Bundles of practices</strong></td>
<td>Paper III, Table 1, p. 47</td>
<td>Factor analysis</td>
</tr>
<tr>
<td>- <strong>TQM-principles</strong></td>
<td>Paper III, Table 2. p. 55, and Table 3. p. 57, and iii. p. 58-59, Table 4. p. 61, and Table 5. p. 63, and vi. p. 64.</td>
<td>Factor and correlation analysis</td>
</tr>
<tr>
<td><strong>Basic model</strong> of predictors for productivity without management</td>
<td>Paper III, table 6, p. 66</td>
<td>Regression analysis</td>
</tr>
<tr>
<td><strong>Two management approaches as predictors for productivity?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- <strong>Bundles of practices</strong></td>
<td>Paper III, table 7, p. 68</td>
<td>Regression analysis</td>
</tr>
<tr>
<td>- <strong>TQM-principles</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: The result marked in blue is highlighted in Chapter 5, The Findings and Conclusions, as a key finding.*
The analyses of predictors for productivity compare two different management approaches; both assumed to predict productivity. One explorative approach and Total Quality Management, TQM. Both include management and learning practices at work measured in firms in Sweden business sector. The models also address the discussion about the measures of practices and management approaches as such (Shah and Ward, 2003).

Two management approaches:

The first explorative approach, bundles of practices, on how to measure management and learning practices at work is the result of a factor analysis, which extracts underlying factors, hidden patterns, or practices. The result is discussed according to the theory of sediments of layers of old and new practices, which in turn can be the result of the continuous rethinking of management. The bundles of practices include one information about work contracts (numerical flexibility) that is not included in the TQM-principles. The bundles or principles is not significant as a predictor for productivity numerical flexibility. The approach is restricted according to data from the Swedish MEADOW Questionnaire 2009/2010 (Statistics Sweden, 2011, chapter 11) but otherwise, it doesn't include any specific standards concerning management models.

The second model, TQM, is analysed by six principles: team, learning, customer focus, supplier relations, benchmarking, top-down implementations (Hackman and Wageman, 1995, pp. 309-342). The TQM-model still does not explain the labour productivity better than the approach called a bundle of practices. The measures of these principles in Swedish firms is based on primary data from the Swedish MEADOW Questionnaire, and secondary data on firm business characteristics, based on register data and data from the CIS-survey (Statistics Sweden, 2009a) and ICT-survey (Statistics Sweden, 2010b).
The consistency of each TQM-principle is analysed, as a way to learn more about TQM. Four of six principles are studied by factor analysis showing that they are not homogenous they are divided into two or three bundles of practices, each, in the same way as the result of the analyses of bundles of practices. Alongside, numerical flexibility is also tested as a sole indicator. The result shows that a sole indicator is not as important as when it is included together with other practices in.

The results of the analyses verify that both approaches predict productivity in the cross-section analysis in the year 2008. The findings indicate synergy effects on performance when more than one management and learning practice is applied. However, there is a difference in how much they each explain. The results are highlighted in Chapter 5. Findings and Conclusions as a main finding in the thesis.

The factor analysis has proven to be a good analytical technique when it comes to revealing potentially hidden patterns. Analysis aiming to predict effects better use regression analysis, due to the quality of the regression models as such and also due to the complexity in the interpretation of the result in factor analysis.
Chapter 5. Findings and Conclusions

The chapter presents the main answer to the three research questions. Key findings are presented according to each research question. This way, the analyses are rendered more in full. The main results are highlighted with tables and figures.

Conclusions and Key Findings

A conclusion worthy to mention is that all analyses from all three papers provide to the main findings and the three research questions. All provide meaningful answers; some spot-on answers and answers indicate interesting results. Additionally, the different analyses are supporting each other.

Measures of management and learning at work

Concluding

The first research question is targeting the focal research problem concerning the lack of measures of management and learning practices at work. The research question: How management and learning at work can be described and measured is answered in more than one way. There are various ways to describe and measure the practices. The following ways are more eloquently discussed: the four composite indicators, the bundles of practices and the TQM-principles. The bundles of practices are presented as a key finding, and the latter, TQM, is used as its mirror in the analyses to the third research question.

The main finding is based on the data that comprises the four composite indicators. These four are following the recommended applied technics of composite indicators (OECD, 2008) based on the MEADOW Guidelines
(Meadow Consortium, 2010b), see also the previous Chapter 2. **Theoretical Frame** and Chapter 3. **Methodology.** The four composite indicators are primarily used in the analyses of the second research question in the thesis and used in paralleled performed analyses in the Productivity Project at Statistics Sweden (Statistics Sweden, 2010; 2011). As described in Chapter 5. **Findings and Conclusions,** the composite indicator of structural learning is a suggestion from work in the thesis; the other three indicators are the result of earlier performed analyses in the matter (NUTEK, 1996; 2000; ITPS 2001).

The initial analyses in the thesis investigated the correlation between and within each of the four composite indicators. The reason for this was to understand the measures better. This investigation concluded that further information could be provided if the indicators are rearranged. The initial analysis is presented in Paper I. The initial investigation was, therefore, the starting point for further analyses using complementary analytical techniques. As argued above, the complementary analyses in the thesis have provided intriguing results that deepen the understanding of these measures. The analyses, performed in in Paper II and III, using factor analysis to reveal hidden structures in the data. The result provided the key finding that the management and learning practices at work are used in seven bundles of practices. The result is indicating the contemporary use of these practices at work. One of the main differences between the result of seven bundles and the four composite indicators is the understanding of the use of structural learning. The findings will hopefully contribute to the knowledge and understanding of management and learning practices at work. See also the result in Chapter 5. **Findings and Conclusions;** table 5.1.

The analyses of the measurements are performed in all three papers in the thesis, mainly due to the step-wise approach in the design of the analysis of the thesis and to the use of the different complementing analytical techniques.
Key results

Here, the three ways to describe and measure the practices are discussed, and key results are presented.

The bundles of practices is a key finding in the matter; it is the result of a factor analysis based on nineteen questions. These questions include management and learning practices at work, both within the firm and outside the firm but accessible for the firm to use without being the owner of the asset. This approach to study management is an explorative approach designed to comprise the actual use of the practices, regardless of the use of specific management models.

The measures of the practices are can also be theoretically designed; according to a specific management model, here based on the six TQM-principles, representing a theoretical model based on a preunderstanding of the best way to perform the practices. TQM is suggested in the MEADOW Guidelines as an indicator of a management model that support development. The use of TQM in the analysis in the thesis might provide some information about the linkages between the data and the hypotheses behind the data in the MEADOW Guidelines. This analysis is an additional contribution of the thesis that goes beyond what was originally planned. The measures of the TQM is a little further described in the presentation in main findings of the third question about the productivity, in the chapter, and more fully described and commented on in the Paper III. The two management approaches, TQM and the bundles, are used in the analysis of predictors for productivity, respectively.

The measures are also designed in the analyses according to the four composite indicators, in line with the applied technics for composite indicators presented by OECD (2008). The four composite indicators are specifically used in the describing of the incidences of the use of the practices and the rela-
tionship between the practices and firms the environment relation, see the main finding of the second question, forthcoming in the chapter.

Though, the analysis in the thesis started with defining the four composite indicators with the help of nineteen questions from the Swedish MEADOW Survey 2009/2010. One of these four indicators – structural learning - is the result of the suggestion from work with the analysis in the thesis; the other three are the result of earlier performed analyses in the matter (NUTEK, 1996; 2000; ITPS 2001). The initial work with the analysis was performed in the Productivity Project at Statistics Sweden (Statistics Sweden, 2010; 2011) and parallel with other analyses in the project at Statistics Sweden. Therefore, the initial analysis of the management and learning practices at work is defined according to the four composite indicators presented in the analyses in the Paper I. As described, in Chapter 4. The Content of the Papers. The composite indicators are following the MEADOW Guidelines (Meadow Consortium, 2010b), see also the previous Chapter 2. Theoretical Frame.

These initial analyses of describing and measuring also included the scrutinising of the four composite indicators, with the help of correlation analysis. The result of these analyses indicated that the information that comprises the four composite indicators could be divided into more than four indicators. This result is followed up by the analysis providing the result of the seven bundles. The result of the correlations is stated here and not further described, for more detailed information see Paper I.

The complementing analyses that describe the contemporary use of the management practices with a focus on management and learning practices at work are performed with factor analysis. The result of the factor analysis is presented here, called the bundles of practices.

The difference between the two used methods, correlation and factor analysis, can be described as that they more or less are answering different questions. The correlation analysis is about the relationship between two practic-
es (variables) at the time regardless of other influences on them from other practices. The factor analysis is the relationship between several practices simultaneously, which indicates that the analysis is considering several variables or factors at the time, see also Chapter 3. Methodology, and the description of analytical techniques. The first method, correlation analysis, tend to overvalue the relations, the result of the factor analysis is therefore appreciated higher in the answer of how to describe and measure learning.

A third and qualitative analysis is performed. The additional analysis complement with an analytical four-box-schema specifically developed for strategic analysis of intended competence actions. It helps in the sorting of the practices according to human and structural competence, and in- and outside of the firm. It is further described below. The two following analyses that are therefore further highlighted:

The bundles of practices – comprised of factor analysis

The firm competence portfolio – a four-box-schema

**Bundles of management and learning practices**

The analysis is based on factor analysis, and nineteen practices are included. The approach is explorative; it leaves a large portion of explaining to the outcome of the model. The result is indicating the contemporary use of these practices at work, and it shows that the practices are used as seven bundles of practices. The results also show that the bundles, in general, do not exclude each other; they are more or less equally used together or on its own. All seven factors are significant, and therefore relevant. The result of the seven bundles of practices is a key finding in the thesis, see Table 5.1 Bundles of combinations of use of management practices.

This approach in the analysis on how to study management is based on that single practices, one at the time is not in focus at the firms. The assumption is that management theories and their use are constantly evolving. Old prac-
tices are mixed with new; some are substituted, and others are survivors. The approach is in line with the discussion of production systems that concerns more than one key factor at the time (Shah and Ward, 2003). It is described as sediments of management practices in an organisation. The meaning of bundles of practices contra sole indicators is argued to be of great interest according to HRM-theory (Huselid, 1995; Huselid, Jackson, and Schuler, 1997; Huselid, 2011). The approach is addressed in the MEADOW Guidelines (Meadow Consortium, 2010b, Ch. III. pp. 116-117). The importance of using practices in “bundles” and the internally consistent practices are discussed (Meadow Consortium, 2010b, Ch. III. pp. 116-117). The approach also finds support in the MEADOW Guidelines by the statement that there is “no universal best way of organising...” (Meadow Consortium, 2010b, Ch. I. pp. 22-24).

Further, the approach and result are also in line with one of the major hypotheses in economic theory about the importance of learning that takes place at work (Arrow, 1962). Additional, the diversity of measures also indicate the firm’s willingness to invest in training (Becker, 1964). The measures are scaled according to the firm’s performance of few or several of the practices, the use of several of the practices is indicating a greater willingness to invest in the matter. The complexity of the investments made by the firm can be recognised by the multiple measures included in the analysis, see the hypothesis about the innovation concerning the combination of different goals and methods (Meadow Consortium, 2010d) simultaneously. It is also argued that it provides some information about high-performance and knowledge management (OECD, 2003). Aspects of individuals versus structures and collectives, and alongside parties such as employees and managers and consultants, etc. are tangled by the results (Berthoin Antal, Dierkes, Child, Nonaka, 2001), since the result include both individuals learning practices and structural learning practices. Accordingly, it tangles new roles, interests,
and powers (Pawlowsky, 2001). See also below about the Firm Competence Model.

Further, as mentioned the nineteen practices are not used in groups according to the measures called the four composite indicators. The main difference between the bundles of practices and the composite indicators is that structural learning is divided into three-factors and not one common bundle, see column 1, 2, 6; they are marked with violet colour, indicating theoretical relations. Factor 1 is about teamwork, and factor 2 is about monitoring customers, and factor 6 is about business intelligence. Factor 1 can provide information about both human-related structural competence but also related to building tools. Factor 2 is argued to indicate building structural capital with the help of tools in the organisation and by monitoring and following up systems, with the help of customers. Factor 6, is argued to indicate the building of structural capital with the help of monitoring knowledge outside the organisation.

The result in the analysis is in line with the hypothesis in the MEADOW Guideline about performance when various dimensions are adopted together. Here, three dimensions are in focus the structure; the work organisation, such as division of tasks; and the employees’ practices, including training and type of contracts (Meadow Consortium, 2010b, Ch. I. pp.25-27).

Furthermore, the result of the factor analysis might contribute to the further understanding of the linkages between the hypotheses behind the Swedish MEADOW Survey, based on the MEADOW Guidelines, and the data. The reason is that it is explorative, and it reveals patterns, and it aims not to add any specific constraint on the analysis, besides the included answers to the nineteen questions. Alternative analyses to table 5.1 indicate robustness, see also Chapter 3. Methodology.

The result of the factor-analysis is used as the first step in the operationalising of the measures that are included to answer the third research question.
Table 5.1. Bundles of learning and management practices

<table>
<thead>
<tr>
<th>Variables; all included learning at work</th>
<th>1 Team &amp; Documenting work practices</th>
<th>2 Customer &amp; Quality focus</th>
<th>3 Flexible work contracts</th>
<th>4 Individual learning</th>
<th>5 Decentralisation &amp; Flex-time</th>
<th>6 Business intelligence</th>
<th>7 ROT Multi task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage employees in improvements groups (TIS 44 M) STRU</td>
<td>0,71</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Documenting work practices (DU 57 M) STRU</td>
<td>0,51</td>
<td>0,33</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage employees in team with jointly decisions (DWT 40 M) DEC</td>
<td>0,50</td>
<td></td>
<td></td>
<td></td>
<td>0,34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency of team briefing meetings (FTM 104 M) STRU</td>
<td>0,48</td>
<td>0,30</td>
<td></td>
<td></td>
<td>0,42</td>
<td>-0,37</td>
<td>0,34</td>
</tr>
<tr>
<td>Percentage flex-time (FW 48 M) DEC</td>
<td>0,47</td>
<td>0,30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measure customer satisfaction (CS 61 M) STRU</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0,73</td>
</tr>
<tr>
<td>Percentage of the employees with part-time? (PT 12) NUM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0,39</td>
<td></td>
</tr>
<tr>
<td>Follow up the quality in production (EPS 53 M) STRU</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0,40</td>
<td></td>
</tr>
<tr>
<td>Performance evaluation interviews (ET 94 M) STRU</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0,52</td>
</tr>
<tr>
<td>Percentage of all employees from an employment agency? (RC 14) NUM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage employees with a temporary contract? (TW 11) NUM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0,67</td>
</tr>
<tr>
<td>Percentage employees in training with salary (UPE100 M) IND</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage employees on-the-job training (FB 102 M) IND</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0,73</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organised competence development, in normal every-day (DL 96 M) IND</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0,59</td>
</tr>
<tr>
<td>Percentage employees with paid training (PE 99 M) IND</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0,28</td>
</tr>
<tr>
<td>Decentralised quality control (QDE 34 M) DEC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decentralised planning (TD 32 M) DEC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0,77</td>
</tr>
<tr>
<td>Monitoring ideas outside the firm (FEI 59 M) DEC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0,77</td>
</tr>
<tr>
<td>Training for rotating tasks (ROT 51 M) NUM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0,79</td>
</tr>
<tr>
<td>Variance Explained by Each Factor</td>
<td>1,86</td>
<td>1,72</td>
<td>1,52</td>
<td>1,48</td>
<td>1,38</td>
<td>1,16</td>
<td>1,16</td>
</tr>
</tbody>
</table>

Source: Paper III. Bundles of practices versus TQM principles and their prediction for productivity. Table 1. P 47.

Note: Generated by SAS System Model: Principal_Component_Analysis_PCA.

Note: Kaiser's Measure of Sampling Adequacy MSA = 0.71 and 54 percent of all variances are explained by the seven factors. Generated by SAS. Rotation Method: Varimax. Variable label: The questions are numbered according to the Swedish questionnaire.
Some further fine-tuning of these measures are performed and presented in the presentation of the answer to the third research question. Additionally, more about the effect of the bundles on performance in answer to the third research question about productivity.

**Firm's competence portfolio**

The MEADOW theoretical frame is complemented with the dimensions included in the analytical four-box-schema, specifically developed for strategic analysis of intended competence actions. It helps in the sorting of the practices according to human and structural competence, and in- and outside of the firm. The hypothesis behind the model is described in *Chapter 2. Theoretical Frame; Principles behind firm competence*. The schema is in its way a support and a presentation of the main hypothesis according to that the firm’s assets, including management and learning practices, are heterogeneous according to its environment (Acemoglu, 2009 Part 1. Neoclassical Growth. Ch.2. The Solow Growth Model, 2.1. The Economic Environment of the Basic Solow Model).

Four-box-schema

The schema organises the practices in four boxes. The dimensions represented in the schema about individuals versus structures is supported by the discussions in the grand Handbook of Organizational Learning & Knowledge, see for instance Berthoin Antal, Dierkes, Child, Nonaka (2001, Introduction. Finding Paths through the Handbook. Page 1-7). Matters concerning the context outside the organisation is seen as triggers for organisational learning and changes. Further, hypotheses about double-loop learning are targeting the discussion concerning individuals that are participants in learning and their ability to act on needed fundamental changes, also described as “Effective learning” (Argyris, 1976, p.367). The individual perspective is complemented with structural perspectives on the measures, which in turn support the double-loop perspective on learning at work. This is one of the two vital dimensions in the four-box-schema.
The second dimension concerning in- and outside the organisation are also supported by the general hypothesis of the boundaries of the organisation, traditionally defined by legal-ownership to resources (Santos and Eisenhardt, 2005 Introduction pp. 491-492). Further, it is argued that it has become more important to gain access to competence outside the firm, assets that go beyond the traditional borders of the organisation, as discussed by Prahalad (2004). This argument is not further analysed in the thesis, see also Chapter 6. Final Reflections. The schema is supported in the discussion of new roles, interests, and powers both within an organisation and outside the organisation (Pawlowsky, 2001, pp. 61-88).

The specific concept of flexible firms including the dividing of the workforce, into the core and the peripheral workforce, the latter organised with short time, and temporary work contracts (Atkinson, 1984a; b) are supporting the dimension of in- and outside the organisation in the four-box-schema.

Measures in the schema

The measures of the bundles of practices (marked with the number of the factor, see also table 5.1) and the measures of the TQM-principles (marked with blue text and in Roman figures) are both sorted according to the four-box schema, see figure 5.1. Each measure is followed by information of its source, for example, MEADOW is used as an abbreviation for the Swedish MEADOW Questionnaire. The measures are only included once, even if it occurs in both approaches. All measures in the bundles except for numerical flexibility is also included in TQM. Therefore, all measures marked TQM is unique for the management model. Further, measures based on register data are restricted to formal education. All abbreviations are explained in notes under the figure. All used measures in the bundles and TQM are organised according to the four boxes.

The top-left-box (red) are directly related to people, such as formal education, that is often measured as part of the stock of assets, formal as well as informal competence and practices that build competence. Management and learning
practices at work are included, both individual learning practices (factor 4) and work practice that supports competence building (factor 5) that take place as a result of decentralised activities at work, for example when solving problems.

As argued in the principles behind the firm competence model, see the explanation of Figure 2.1 in Chapter 2. Theoretical Frame; in specialised work also the qualifications in work and the system of learning at work is often derived to what the employees them self's achieved. Therefore it gains from being decentralised to the employees or otherwise it might not occur. It should be included in the top-left-box (red).

On the other side, structural competence includes management systems supporting the human capital to perform and develop its capability. Measures organised in the top-right-box (blue) are the organisation of the teamwork (factor 1) and the organisation of the monitoring and follow-up (factor 2), here complemented with information from TQM about reporting to top management (TQM-principle iii.).

The bottom-right-box (violet) represents structural competence that the organisations have access to but do not own. Included are monitoring of others ideas and technology (factor 6) and systems that go outside the organisation for communication and cooperation with others outside the firm, here suppliers (TQM-principle iv.) and customers (TQM-principle v.).

Training for rotation involves people. The indicator is a single measure, and here it is used to indicate the variation of work for people, this can, still, the system as such for the training and rotation is part of the structural competence. These systems can be restricted to within the firm or include more than one firm. The indicator can therefore also be argued to indicate resources not only within the firm but possibly also numerical flexibility.

Here, numerical flexibility includes organising rotating tasks between people, more often needed to be organised as such in larger organisations, while it is more common that the employees are more familiar with all tasks in smaller organisations. The practice is often measured together with practices creating
flexibility using resources outside the organisation (factor 3). Numerical flexibility includes using temporary contractors directly within the organisation (Atkinson, 1985) and part-time employees, the bottom-left-box (green).

**Figure 5.1. Measurements of practices in the model; in- and outside the firm**

<table>
<thead>
<tr>
<th>Inside firm</th>
<th>Structural Competence, concerns structural competence assets</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Human Competence, concerns people</strong></td>
<td><strong>Systems supporting humans learning and building of competence. For examples: work organisation, decision and support systems, databases, the intranet, reports, etc.</strong></td>
</tr>
<tr>
<td><strong>Employees learning at work</strong></td>
<td><strong>Team and Improvements groups &amp; Documenting work practices; Factor 1 (Meadow)</strong></td>
</tr>
<tr>
<td><strong>Formal education (Lisa data)</strong></td>
<td><strong>Monitor Customer &amp; Quality focus; Factor 2 (Meadow)</strong></td>
</tr>
<tr>
<td><strong>Individual learning; Factor 4 (Meadow)</strong></td>
<td><strong>Top Management Responsibilities; TQM-theory focus on responsibility for systems and implementations; the Swedish measures is restricted to information about direct reporting to the head of the firm; iii (Meadow)</strong></td>
</tr>
<tr>
<td><strong>Decentralisation &amp; Flex-time; Factor 5 (Meadow)</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outside Firm</th>
<th><strong>External structural resources. For example databases, the internet, libraries, etc.</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Humans outside the organisation</strong></td>
<td><strong>Business intelligence, monitor ideas and technology development outside the firm; Factor 6 (Meadow)</strong></td>
</tr>
<tr>
<td><strong>Flexible work contracts</strong></td>
<td><strong>Supplier Relation, including systems for sharing information; and cooperation with others; and acquisition of innovation; iv. (CIS, ICT, Meadow)</strong></td>
</tr>
<tr>
<td><strong>Consultants, Employment Agencies</strong></td>
<td><strong>Customer Preferences, including systems for sharing information; v. (CIS, ICT, Meadow)</strong></td>
</tr>
<tr>
<td><strong>Short time contractors</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Part-time work, see argument below Factor 3 (Meadow)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Training for rotation; Factor 7 (Meadow)</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** The schema is first presented in Paper II and further developed with the Figure 2 in Chapter 2. Theoretical framework. The aim here is to organise the different practices according to the principle in the four-box model. The schema is inspired by (KKR) 2003) concerning intended competence development strategies in public organisations. The following abbreviations are used: Meadow = Swedish MEADOW Employer Questionnaire, CIS = Innovation Survey, ICT-survey.

The analytical four-box-schema ties together the first and the second research question by the specific interest in the sorting of human and structural competence and practices to the perspectives of in- and outside of the firm.
The Firm Environment

Concluding

Is the environment of the firm defining the management and learning practices at work? The answer to the second research question in the thesis is that the use of the practices is not defined by the environment of the firm. The analyses answering the question are testing the hypotheses about relationships between the firm's environment and the management and learning practices at work. The two opposite hypotheses have been tested in the analysis, both thesis and antithesis according to the firm's environment. The result of the analyses is in line with the main hypothesis in economic theory; that the firm's assets are heterogeneous according to its environment (Acemoglu, 2009 Part 1. Neoclassical Growth. Ch.2. The Solow Growth Model, 2.1. The Economic Environment of the Basic Solow Model). And the hypothesis that the environment determines the firm's competence boundary (Santos and Eisenhardt, 2005. pp. 497-500).

The analyses of the environment are performed in two of the papers in the thesis, mainly due to the use of the different complementing analytical techniques. The analyses in the third paper support these analyses in the first and second paper.

Key results

The main result is from the four regression analyses, one for each of the four composite indicators, in Paper I. The findings indicates that in general the practices are used equally across the Swedish business sector, here split according to six business and workforce characteristics. They do not differ between industries, which is one of the major characteristics. It is a common measure for indicating the type of production and partly the firm's position in the value chain. But, the result indicates a relationship between the composite indicators and the size - a minor dependence. The results predict some differences between large and small firms, in these analyses. Size is a measure of the complexity of the production; the larger the firm, the more complex
production. It is also used to partly indicate the firm's position in the value chain and also its possibility to influence the market. The education level of the workforce is included indicating the quality of the workforce and the technology level. The result is that higher education predicts decentralisation and greater structural learning.

Investigations into the relationships between higher education and learning at work such, for instance, on-the-job-training, are argued to be of greater importance than earlier understood because it is assumed to be undervalued. Therefore, further investigations are argued to be essential, by Acemoglu 2009 (Part 3. Neoclassical Growth. Ch.10. Human Capital and Economic Growth, pp 463-505). See the Future Research - the Logic Next Step in Chapter 6. Final Reflection.

The strength of the relationships between size and education level and the indicators for management and learning practices at work is low, and therefore of low interest.

Further, the stepwise regression analyses used in the third research question about productivity, in paper II and III, confirm the concluding from analyses in Paper I that there is no relationship between the size and the education on the one hand and the practices at work on the other hand.

The further analyses in Paper II contributed to the understanding of the absence of relationships between the different business characteristics as such. These analyses investigate the hypotheses concerning that competence boundary are assumed denoted by the firm's environment; and especially that the business characteristics are related and intertwined are presented (Santos and Eisenhardt, 2005. pp. 497-500). Alongside, the argument that it has become more important to gain access to competence outside the firm; assets beyond the traditional borders of the organisation, are discussed (Prahalad, 2004). The latter assumption needs further investigation.

The main results of the analyses in the thesis are in line with the main theory behind the analyses is economic growth theories that assume that the firm's
assets are heterogeneous according to its environment (Acemoglu, 2009 Part 1. Neoclassical Growth. Ch.2. The Solow Growth Model, 2.1. The Economic Environment of the Basic Solow Model).

Alongside, complementary analytical techniques are used. The analyses are performed with the help of weighted mean values of incidences and by factor and regression analysis. The two latter analytical techniques are ranked as more advanced since they here include more factors simultaneously compared to the used measure of weighted mean value, that is only standardised for two factor at the time. The reflection of the results according to methods is an analogy with the answering of the first research question; the simpler the methods, the more the relations are overvalued. Two of the analyses are highlighted:

Management practices and the firm environment – comprised of regression analysis

About intertwined firm business preconditions – comprised of factor analysis

The management practices are not denoted by the firm's environment

The hypotheses of the relationship between the firm's management and learning practices and the firm business environment are tested. The main analyses are the four regression analyses, one per composite indicator that is performed. In each analyse, one of the four indicators is the depended variable, in other words, the studied indicator. The independent variables, business preconditions that are tested towards the depended variable are the size, industry, ownership, alongside information about the quality of the workforce in the firm; age, sex, education. Altogether six variables.

Two of the six variables are indicating some relationship with management and learning practices; these are the size: indicating the complexity of the production as well as the possibility to influence the market and its place in the value chain. The results for size predicts differences between large and small firms, in these analyses. This is the case for three composite indicators, but not for decentralisation.
The other variable indicating some relationship is the *education level*; indicating the quality of the workforce as well as the technology level. The results for higher level of education predict higher values of decentralisation and structural learning in the firms, in the calculation of the four regression analyses. Some correlation between the percentage of higher educated workers and the structural learning and decentralisation are revealed.

The two factors that are showing significant results in the referred analyses also show that the strength in the relation (coefficient value) is low or rather low. Therefore, the practical meaning of the relationship is low. Further information about the relationship is from the basic analysis concerning the impact on productivity; they provide some information about the importance of size and education level; it is significantly related in one of the final analysis, but only when a measure of management is included, otherwise not. This can be an indication of the true value of size when it comes to productivity, that it is better revealed when it doesn't have to also provide information about other measures such as management and learning.

Still, the correlation in the final productivity analysis does not reveal any relationship concerning education level. The result is the same whether or not a measure of management is included or not. Further aspects and investigations about the relationships between higher education and learning at work such as on-the-job-training are argued to be of importance because it is assumed to be undervalued. Therefore, further investigations are argued to be essential, by Acemoglu 2009 (Part 3. Neoclassical Growth. Ch.10. Human Capital and Economic Growth, pp 463-505). Additional investigations about investments on-the-job training and the relation with higher education are suggested.

In other words, the environment: the background variables, age and gender, concerning the quality of the workforce show no relations with the composite indicators in general; they do not matter according to the analyses. It is the same about the business preconditions, two of three, show no relations with the composite indicators in general. One of these is the *industries*, indicating the type of production and also the market position in the value chain. Another
is foreign ownership, an indicator of the international market and indirectly the foreign competition. Neither industry nor foreign ownership matter. The results are presented in a matrix table 5.2.

**Table 5.2. Firm environment don’t denote the management practices**

<table>
<thead>
<tr>
<th></th>
<th>IND</th>
<th>STRC</th>
<th>DEC</th>
<th>NUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreign</td>
<td>0.04</td>
<td>-0.01</td>
<td>0.0003</td>
<td>-0.01</td>
</tr>
<tr>
<td>Smallfirms</td>
<td>-0.12***</td>
<td>-0.05***</td>
<td>0.01</td>
<td>-0.06***</td>
</tr>
<tr>
<td>Largefirms</td>
<td>0.09**</td>
<td>0.05**</td>
<td>0.01</td>
<td>0.05***</td>
</tr>
<tr>
<td>18 Industries</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Young_ &lt; 35</td>
<td>-0.08</td>
<td>-0.13**</td>
<td>-0.09</td>
<td>0.05</td>
</tr>
<tr>
<td>Old_ &gt; 50</td>
<td>-0.18</td>
<td>-0.1</td>
<td>-0.24**</td>
<td>-0.02</td>
</tr>
<tr>
<td>HighEdc university¹</td>
<td>0.05</td>
<td>0.15***</td>
<td>0.19***</td>
<td>0.01</td>
</tr>
<tr>
<td>LowEd compulsory²</td>
<td>-0.08</td>
<td>-0.06</td>
<td>-0.12</td>
<td>0.02</td>
</tr>
<tr>
<td>Women³</td>
<td>0.09</td>
<td>0.06*</td>
<td>0.15**</td>
<td>0.09***</td>
</tr>
</tbody>
</table>


**Note:** Generated by SAS System Model: Linear_Regression_Model

**Note:**
1) University = ≥3 year or longer; 2) Compulsory school = 9 years schooling; 3) Woman, is a numerical variable. Note: *** High significance, the correlation is significant at the 0.01 level, i.e., it is under 1 percent chance that the result is a coincidence.

**Relations among different business environmental preconditions**

The hypotheses of the relationship between the different firm business preconditions as such are studied. In theory about the firm boundaries is assumed that some of the firm’s environmental conditions are intertwined. Specifically, that larger firms are acting on less dynamic markets (Santos and Eisenhardt, 2005, Boundaries of Competence). Still, in general, these arguments are not supported by the result of the analyses in the thesis. The results are more in line with the hypothesis in economic growth theory that the firm's assets are heterogeneous according to its environment (Acemoglu, 2009 Part 1. Neoclassical Growth. Ch.2. The Solow Growth Model, 2.1. The Economic Environment of the Basic Solow Model).

The indicator for the firm's business environment preconditions are the firm's size, as an indicator of the complexity of the firm's production and also an indicator of the possibility to influence its market. It might also provide some information about the place in the value chain, the larger, the more powerful in
the market as well as, the more complex and higher up in the value chain. Further indicators are; *industry*, as an indicator of the type of production, and therefore the type of market. And; *foreign ownership* is used as an indicator of an international market and foreign competition. Extended information, compared to the analyses above concerning the relationship between the firm environment and the management and learning practices at work, are: *standardised or customised production*, as an indicator of if the firm is dynamic or not. *Cooperation* with other parties and *innovation* as such are also included and used to indicate the dynamics of the organisation and production. The latter indicates the investment of the firm into the future. Detailed descriptions of all measures can be found in the papers; Paper I, and Paper II, and Paper III.

The main result, presented in table 5.3, is that the different firm business preconditions are not correlated, not making any specific patterns with each other. The environmental preconditions are not intertwined, according to these results. The result indicates that less dynamic market (see factor 2) don’t always define large firms (see factor 4 and 5). These different conditions are not by a common factor. Further, both firms with standard production and customer oriented production are involved in innovation and cooperate with others.

The only relation, pattern, is between *foreign ownership* and the firm’s *size*; the larger the firm the higher is the probability that it is foreign owned (see factor 4). The relationship is, therefore, indicating a relationship between foreign competition and international markets on the one side and the firm’s complexity, market power and place in the value chain on the other side. This is not a surprise; it is well known that there is a greater international interest in ownership of a firm in Sweden if it is large, and presumably, the firm is often already is on the international market and therefore more available for foreign ownership.

Further, none of the industries is significantly correlated with any of the other indicators. Alternative analyses have been performed, with and without the
industries. These results are not included in the table, but the results are also strong evidence of non-correlation.

Table 5.3. Different firm environment condition are not intertwined

<table>
<thead>
<tr>
<th>Factor1</th>
<th>Factor2</th>
<th>Factor3</th>
<th>Factor4</th>
<th>Factor5</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.11c. Tangible R&amp;D</td>
<td>0,92</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E.11a. In-house R&amp;D</td>
<td>0,89</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E.11b. External R&amp;D</td>
<td>0,81</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E.11d. HC-R&amp;D</td>
<td>0,61</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Custom_prod</td>
<td>0,99</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stand_prod</td>
<td>-0,99</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q71,73,75,77,79 Coop</td>
<td>0,87</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q81,83,85,87,89 OutSour</td>
<td>0,84</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q66-70 Prod_infirm</td>
<td>0,52</td>
<td>0,20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Largefirms</td>
<td>0,20</td>
<td>0,88</td>
<td>-0,19</td>
<td></td>
</tr>
<tr>
<td>For_own</td>
<td>0,66</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mediumfirms</td>
<td></td>
<td>-0,16</td>
<td>0,98</td>
<td></td>
</tr>
<tr>
<td>Smallfirms</td>
<td>-0,19</td>
<td>-0,66</td>
<td>-0,67</td>
<td></td>
</tr>
<tr>
<td>Variance Explained by Each Factor</td>
<td>2,68</td>
<td>1,99</td>
<td>1,81</td>
<td>1,74</td>
</tr>
</tbody>
</table>


Note: Generated by SAS System Model: Principal_Component_Analysis_PCA

Prediction of Productivity

Concluding

The third research questions address the overall purpose of the thesis regarding in providing suggestions for measures on management and learning practices at work that can be embraced in models of productivity, as a way to better understand economic growth. Answering the research question is the final step in the analysis of the thesis, and its aims to contribute with measures of management and learning practices at work that can be embraced in models of productivity. Can management and learning practices at work predict productivity, and is one model better than the other? The answer to the question is a simple Yes!

The research question is answered with the help of two parallel regression analyses based on different management approaches. One is the contemporary use of the practices in bundles, also presented as a key finding in answer to the first research question. The other is the TQM-principles, used as a mirror to
the bundles of practices. The latter model is based on theories and a preunderstanding of best practices. The purpose includes testing if one approach is better than the other as a predictor of productivity. There are no distinct results in the analysis in this thesis concerning if one is better than the other, both predict productivity. Still, the comparing of the two management approaches provide some information that strengthens the conclusion concerning the result of the bundles of practices as the contemporary use of the practices. Further, the analyses provide some information on the importance of the practices of numerical flexibility, during the deep financial crises 2008/2009.

The analyses provide a fine-tuning of the measures used in the production function. The result indicates synergy effects on the performance when more than one practice is adopted together. This is a key result in the thesis. It is argued that the findings are supported by the discussion of the meaning of bundles of practices contra sole indicators argued within HRM-theory (Huselid, 1995; Huselid, Jackson, and Schuler, 1997; Huselid, 2011). This discussion is also argued in the basic measurement framework in the MEAD-OW Guidelines concerning the approach of bundles (Meadow Consortium, 2010b, Ch. I. pp.25-27). In other words, besides that the analyses provide answers to the third research question about productivity, the fine-tuning of the measurements also provide information to the first research question, i.e., besides bundles of practices, the measures summarised into an overall index provide further information about the practices.

Part of the analyses answering the third research question about productivity has been performed during the analyses concerning the second research question about the impact of the environment. However, the analyses were divided into Paper II and III, due to the large scope of the analyses concerning the environment. Some of the productivity analyses are presented in the Paper II, but the main result and the analyses of TQM were performed in the Paper III, alongside the further elaborated analyses concerning numerical flexibility. TQM was added due to the interest in comparing the explorative approach of the bundles of practices with a theoretical management model.
Key results

The analyses answering the third research question in the thesis ties together the result from the analyses in the thesis, both from the first and the second research questions. Further, the research question is the actual starting point for the analyses in the thesis. The analyses follow the analogy perspective; the knowledge of economic growth is a recipient of knowledge of management and learning practices at work, discussed, in Chapter 2. Theoretical Frame; and in Inter-disciplinary fields of theory.

The first step in the analysis is to create a basic regression model that is without any information about the management and learning practices at work; this is part of a standard procedure in how to make regression analysis model. The reason is to see if the basic information about the firm and its environment precondition will change when the information of the management and learning practices at work are included. The result shows that this is not the case; the firm's basic information does not change when the new information is included in the analysis. The first step of the analysis is according to the expected result and the general hypothesis concerning productivity analysis. Therefore, these results about the basics are only commented on in this overall way and not presented as part of the main finding in this chapter. For further information see Paper III.

Still, the statement also referred to in the answer of the second research question is the relationship between the education level of the workforce and learning practices at work as such. Education is included in the basic analysis but outside of the index of the two management models. In other words, formal schooling is not included within any of the management models, but the information is included in the model of productivity. Therefore, there is some further information in the analyses about their relationship; the result does not support any relationship between formal education and learning practices at work. Still, according to research in economic growth further and deeper knowledge as such about the relation between formal schooling and on-the-job investments is of interest. See the hypothesis about the combination of the two

The second step in the analysis is to include the information about the management and learning practices. The two models, bundles of practices and TQM-principles are included in the analyses, in each model respectively. The two separate regression models including management, one for the bundles of practices and one for the TQM-principles are created and performed. The principles are: team, learning, customer focus, supplier relations, benchmarking, top-down implementations (Hackman and Wageman, 1995, pp. 309-342).

The two management approaches, calculated as two multi-composite-indexes, are included in the model of productivity, in separate models, one for each approach. In the analysis higher values on the index are compared to lower values, in each of the two regression models. The result from the regression analyses, after the management models are included, are presented in a matrix table 5.5. The first column represents the result from the regression model with the bundles of practices. The second column is the result of the model of six TQM-principles, and the third column is the TQM-model plus an extra indicator of practices of numerical flexibility that are included in the calculation but in parallel with the other practices, which means that it is not included in the actual TQM-index. More about this extended analysis further on in the presentation of the results. The quality of the indicator in the model is defined by its significance of being random; here marked by stars, see also the note under the table.

The results in table 5.4 are indicating that both management approaches, the bundles of practices as well as the TQM, shows that they are both significantly predicting productivity, measured as a positive effect on the firm's value added per employee. The higher use of the management practices, the higher productivity. Still, they were both assumed to predict productivity. The interpretation of the result is that there is only a five percent chance of that the result of the two analyses is random. Another quality measure is the total degree of explanation (R2). The result for the included models differs between the
models. If this measures can be argued to indicate the contemporaneous of the models, the seven bundle can be argued to be a more contemporary approach in firms in the Swedish business sector, compared to TQM. The latter management approach is comprised of more practices and should, therefore, be a richer model, but it seems it is not, according to how much of the variances it explains. The management approaches measuring the contemporary use of the practices have a better fitness.

*Table 5.4. Management practices can predict productivity*

<table>
<thead>
<tr>
<th>Dependent variable: Value added per all employee at the firm-year 2008</th>
<th>Bundles</th>
<th>TQM</th>
<th>TQM plus Numerical flexibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-Square ($R^2$) = 0,30</td>
<td>R-Square ($R^2$) = 0,12</td>
<td>R-Square ($R^2$) = 0,14</td>
<td></td>
</tr>
<tr>
<td>Independent variables:</td>
<td>**</td>
<td>**</td>
<td>*</td>
</tr>
<tr>
<td>Management concept high compared to low values 2009/2010; percentage</td>
<td>In the index</td>
<td>Not included</td>
<td>*</td>
</tr>
<tr>
<td>Numerical flex 2008; percentage</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Paper III. Bundles of practices versus TQM principles and their prediction for productivity. Table 7, p. 68.

Note: Generated by SAS. System Model: Linear_Regression_Model. Value added per employee; Gross fixed capital formation; University educated percentage; Women percentage; Age of the employees; Firm size; Foreign or Swedish owned firms they are all based on the LISA-database 2008. Specialised vs. standardised are from the Swedish MEADOW Questionnaire. Industries are based on Swedish Business Register FDB. Part of a group of firms is based on the ICT-survey.

Note: If it is one percent chance it is marked with three stars (***) and five percent is marked with two stars (**) and ten percent with one star (*).

Further, the results contributes with some information concerning the essential hypotheses in economic theory about the importance of learning that takes place at work as a result of work experience or specific activities when solving problems (Arrow, 1962). Further, the results. The results also indicate that it is in line with the hypothesis about synergy effects on performance when the three dimensions in the firm are adopted together. In the basic measurement framework in the MEADOW Guidelines, they are described as: the structure; the work organisation, such as division of tasks; and the employees’ practices, including training and type of contracts are supporting the approach of bundles (Meadow Consortium, 2010b, Ch. I. pp.25-27).

Further, the result for the explorative model of bundles of practices depends on the advantages of the model. It is constituted by actual use of the practices in so-called contemporary bundles, and another is that it includes an indicator of
practices of numerical flexibility, the third is that this indicator of numerical flexibility is included in the actual index of the management practices, as one of the bundles of practices.

There are several alternative analyses behind the presented results. One of them is a test that includes practices of numerical flexibility as a sole indicator in parallel to the other practices, here complementing the TQM-model. In this alternative calculation numerical flexibility is not included in the index of six principles, but parallel as a sole indicator. The result based on this alternative analysis of TQM with the extra variable of flexibility is that the analysis not to the same degree as the first TQM-model, without this extra indicator, predicts productivity, but still not to the same degree of how much it explains the seven bundle approach. The result is interpreted as that the use of temporary contractor is not equally valuable for the firm as a parallel strategy as if it is included in the main management model, as in the seven bundle of practices. When temporary contractor are included in the main management strategy, it provides a higher value to the management model, in the year of 2008.

The comparing of the three results are indicating that numerical flexibility, the use of flexible work contracts, is of importance in the year of 2008. The result reveals that practices of numerical flexibility as a sole indicator are valuable but not equally valuable to the firm as if it is included in a strategy with other practices, such as in the index of the bundles of practices. The result of the third analysis indicates a little higher percent of explanation compared with the TQM-model in the second analysis. In fact, as mentioned above, further alternative analysis of the seven bundle approach has been performed, but they are not presented. Still, they show that all the bundles of practices together are essential for the result of the model. This is the main conclusion for firms in the year 2008 of the analyses. The difference between the two management models when it comes to practices of numerical flexibility is one of the main conclusion in the analyses.

A plausible explanation for the result concerning practices of numerical flexibility is the economic, financial crises that resulted in a dramatic drop in
production levels in firms in Swedish business sector during the last part of the year 2008. Firms using a high degree of practices of numerical flexibility, specifically temporary contractors, could faster adjust the number of employees than other firms. Statistics concerning temporary workers support this conclusion (Statistics Sweden, 2015).

The analysis in the thesis includes data for productivity in the year 2008. Therefore it is of interest to compare the results concerning the years previous to the crisis. One of the parallel analyses presented in the same book as the Paper II can bring some light to the matter (Statistics Sweden, 2011). Results measured as the average productivity for firms in the Swedish business sector during the year 1998 to 2008 according to different composite indicators are presented (Wallen, 2010, p334; 2011, p253).

In the calculation of productivity within the firms are divided into six classes of numerical flexibility practices26, the result is showing that firms with the lowest use of numerical flexibility (level 0 and 0.5 and 1) had the highest average productivity level during these eleven years, as expected. The result also shows that something happened the last year when the economy started to turn down because of the financial crises. The firms with the highest-use of numerical flexibility (level 2 and 2.5) did not decrease their productivity level to the same extent as the other firms, from 2007 to 2008. The result is valid during years 2007 to 2008. Firms with the second-highest-use did not change its productivity level at all; it was the same in 2008 as the previous year. All the other classes had a little lower or much lower productivity level in 2008 than they had the year before. Therefore, during the year of the crisis year 2008, the high-productivity firms almost had the same productivity level as the groups of firms that usually are included in the low-productivity firms, at least half of all classes did end up at about the same level. (Wallen, 2010, p334; 2011, p253).

Further estimations concerning productivity during the year 1998 to 2008 is using regression analysis. The analysis includes all years for the whole period

26 Six classes of numerical flexibility (0; 0.5; 1; 1.5; 2; 2.5).
in the same model. The result shows that firms with a low level of numerical flexibility during the whole period have higher productivity levels, the result is significant. Still, since the analyses include all years in the same calculation (Wallen, 2010, p342; 2011, p261). Further, the probability of surviving during the period was lower for a firm with a higher use of numerical flexibility (ibid. p346; p265). In this latter analysis, all years are also included in the same calculation. These regression models are in general preferred since they show the general result taking a longer period into account. Still, if the interest is the specific condition for one year, here the year of the crisis, it will not be revealed in models including several years.

The use of other additional practices than those in the bundles of practices, such as those that also are included in TQM-model is a higher degree of top management involvement, and a high degree of cooperation with others, such as suppliers, customers and in matters concerning innovation. These practices predict productivity, and they might be argued to compensate for a high degree of flexible working contracts practices, but not in the year 2008. This is what the result between the two models can be interpreted to indicate. An additional explanation is that a high degree of contracts with suppliers and others, as in TQM, could have been a problem during the crisis since it might prohibit fast necessary downsizing. Further, it might also have been an issue according to payment and other financial aspects, since the crisis to a large extent origin in lack of in trust in financial matters. On the other side, longer contracts with other firms might also provide trust, which could have been useful in the crises. Still, the result of the analysis is indicating that these other practices did not compensate for numerical flexibility in the year 2008.
Chapter 6. Final Reflections

Choice of Data

The analysis in the thesis is based on the Swedish MEADOW Survey 2009/2010 from Statistics Sweden (Statistics Sweden, 2011) which in turn it is based on the MEADOW Guidelines (Meadow Consortium, 2010b). The purpose of the guide is to harmonise statistics concerning organisations and organisational changes and to produce indicators for work and learning in business firms in the European Union.

The advantage of using the Swedish MEADOW Survey 2009/2010 is that it is based on guidelines made by leading researchers in Europe in management and learning at work. It is based on already performed surveys in Europe, and it is aiming to be used in all countries in the European Union. An important complementary quality is that the MEADOW guidelines also provides access to the community of researchers in Europe involved in the work with the Guidelines.

There was a possible choice between the used dataset, the Swedish MEADOW Survey, and the dataset called NUTEK Survey 1998 (NUTEK, 2000).

The NUTEK Survey 1998 was at first the only dataset that was available. Therefore it was used in the planning of the analyses in the thesis. It has some advantages, for example, it is influenced by the work performed by the Institute Statistics Canada, including measures about work organisation and learning at work. The NUTEK Survey is partly based on the first draft of the Canadian Survey (The completed schema by Statistics Canada, 2015a; b). The initiative was at the time the OECD Jobs Strategy (OECD, 1996). The NUTEK Survey is still proven useful, for example in the analyses parallel to this thesis, measuring the average productivity level between 1998 and 2008 according to
the use of some of the management practices included in three of the four composite indicators (Wallen, 2010, 313-356pp.; 2011, 233-275). The possibility to make long-term analysis is the second advantages for the NUTEK Survey data. The aim of the OECD initiative is overlapping the aim of the thesis, and the scope of the NUTEK Survey is very much in line with the overall purpose of the thesis. However, the purpose of the thesis seems not to be in line with the scope of the completed Canadian guide 2015, see *The Research Problem*, in *Chapter 1. The Introduction*.

However, both surveys have advantages, and both provide significant information about management practices. The two datasets have been available since the time they were collected, respectively. Still, the data are more contemporary in the Swedish MEADOW Survey 2009/2010 compared to the NUTEK Survey 1998, and the MEADOW Guidelines include several more aspects, than the NUTEK Survey. Further, the scope of the MEADOW Guideline is very much in line with the overall purpose of the thesis.

There have been follow-ups of the Swedish MEADOW Survey 2009/2010. The first follow-up survey is the NU2012, partly covering the MEADOW Guidelines (The Swedish Work Environment Authority, 2014a; b; Stelacon AB, 2013). The second survey the NU2015 covers all teams in the MEADOW Guidelines (Statistics Sweden, 2016; Swedish Work Environment Authority, 2017a; b; w.y.).

The conclusion concerning the data is that it has been crucial for the thesis to have had access to data from Swedish MEADOW Survey 2009/2010. The results of the analysis of the thesis are due to the use of the data from the Swedish MEADOW Survey. Hopefully, the choice to use the Swedish MEADOW Survey has strengthened the results of the analyses in the thesis, and therefore its further use in policy decision making.

**Future Research - the Logic Next Step**
The main argument for the forthcoming research in the PhD doctoral thesis is the same as in the licentiate thesis; the ongoing struggle for better understanding of driving forces for economic growth. The aim is additional contributions
to indicators useful as predictors for economic growth, in line with theories that include endogenous hypotheses concerning management and learning practices at work (Acemoglu, 2009, Part 3. Neoclassical Growth, pp. 371-534; and Part 4 Endogenous Technological Change pp.535-704; Romer, 1994).

The additional analyses can be organised to confirm the analyses in the licentiate thesis but with contemporary data from the follow-up surveys NU2012 and NU2015, see also the discussion about validity and reliability in Chapter 3. Methodology. This will provide some more information about the indicators validity and reliability. On the other hand, the analyses can also deepen the systematic understanding of the management and learning practices at work and their use as predictors of productivity. These aspects are described in Chapter 2. Theoretical Frame.

For instance, the forthcoming analyses can deepen the knowledge about the hypothesis concerning the challenges in HRM to bring the two perspectives of humans and structures closer (Huselid and Becker, 2011). Further, the focus can include deepening the knowledge on the bundles of practices compared to sole indicators, according to HRM-theory (Huselid, 1995; Huselid, Jackson, and Schuler, 1997; Huselid, 2011). This analyses might also better illustrate the perspective on the matter described as layers of old and new practices that are of interest (Shah and Ward, 2003) and they may also include some further aspects concerning the use of practices beyond the borders of the organisation, as argued by Prahalad (2004). There is also a special interest in indicators of on-the-job investments in combination with formal higher education, according to Acemoglu 2009 (Part 3. Neoclassical Growth. Ch.10. Human Capital and Economic Growth, pp 463-505).

Finally, organisational innovation and knowledge management and creation, are examples of appointed prioritised measures (OECD 2015b). Therefore, further aspects concerning innovation and communication technology, ICT, are suggested to be more visible in the future models.
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Appendix

The Swedish Meadow Employer Questionnaire 2009/2010

Published in Book: Learning Organisations Matter, page 319-330.

All three papers appended in full

Paper I. Work organisation and competence development in Swedish firms.

Published in Yearbook on Productivity 2010, page 143-217.

Paper II. Firms' environment and competence portfolio.

Published in Book: Learning Organisations Matter, page 279-308.

Paper III. Bundle of practices versus TQM principles and their prediction for productivity.

Published in Yearbook on Productivity 2011, page 35-77.
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Paper I. Work organisation and competence development in Swedish firms.
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Paper I