MANAGEMENT PRACTICES IN FINNISH MANUFACTURING ESTABLISHMENTS: EVIDENCE FROM FMOP

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JYVÄSKYLÄN YLIOPISTO

ABSTRACT

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Abstract

Due to advances in data gathering, management practices have started to emerge as another piece in the empirical productivity puzzle. After the development of a quantitative survey tool named the Management and Organizational Practices Survey (MOPS), studies have found cumulating evidence for the significance of management practices in explaining productivity dispersion.

Data collected with the recently conducted Finnish Management and Organizational Practices Survey (FMOP) is used to examine management practices in Finnish manufacturing establishments. Helsinki-Uusimaa is compared to the other large areas of Finland to determine whether there are significant cross-regional differences in the quality of management practices. An Olley-Pakes decomposition is used for a cross-regional comparison of the components of the aggregate (employment weighted) management score. Furthermore, a moment-based estimation procedure is utilized to allow for statistical inference about the components of the decomposition.

No statistically significant cross-regional differences in the quality of management practices are found in Finnish manufacturing establishments.

Key Words:
management practices, management survey, FMOP, MOPS, Olley-Pakes decomposition, allocation term, allocation effect

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Tiivistelmä – Abstract

Edistysaskeleet aineiston keräämisessä ovat nostaneet johtamiskäytännöt esiin osana vastausta kysymykseen tuottavuuseroista. Kvantitatiiviseen kyselytyökaluun perustuvat tutkimukset ovat löytäneet kumulatiivista näyttöä johtamiskäytäntöjen kyvystä selittää tuottavuuseroja. Kyseisen työkalun nimi on Management and Organizational Practices Survey.

Tässä tutkielmassa tarkastellaan Suomen johtamis- ja organisaatiokäytäntöjen kyselyllä eli FMOP-kyselyllä kerätyn aineiston avulla Suomen tehdasteollisuuden toimipaikkojen johtamiskäytäntöjä. Tarkoituksena on selvittää, onko Suomessa tilastollisesti merkitseviä alueellisia eroja johtamiskäytäntöjen laadussa. Helsinki-Uusimaata verrataan muihin Suomen suuralueisiin. Työvoimapainotettu keskiarvo eli kokonaisjohtamispistemäärä jaetaan osatekijöihin käyttäen Olleyn ja Pakesin (1996) staattista hajotelmaa. Nämä osatekijät ovat painottamaton johtamispistemäärän keskiarvo sekä niin kutsuttu allokaatiovaikutus. Hajotelma tehdään hyödyntäen momentteihin perustuvaa estimointimenetelmää, joka mahdollistaa tarkan tilastollisen päättelyn koskien hajotelman osia.

Suomen tehdasteollisuuden toimipaikka-aineistosta ei löydetä tilastollisesti merkitseviä alueellisia eroja johtamiskäytäntöjen laadussa.

Asiasanat:
johtamiskäytännöt, johtamiskysely, Suomen johtamis- ja organisaatiokäytäntöjen kysely, FMOP, MOPS, Olley-Pakes-hajotelma, allokaatiotermi

Säilytyspaikka
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1 INTRODUCTION

The drivers of productivity are a constant and essential focus of economic research. Yet, there exists a large unexplained part of productivity that empirical literature has not unravelled. Due to recent advances in gathering quantitative data concerning management practices, a new component of said unexplained part has started to become uncovered. Management practices as a cause of productivity differences is certainly not a new idea. Nevertheless, it has only been studied extensively for about a decade with qualitative data, and with quantitative data, the research is still at an early stage.

In his survey of empirical research on productivity differences, Syverson (2011, 336) states that "perhaps no potential driver of productivity differences has seen a higher ratio of speculation to actual empirical study", referring to the aptitudes of managers and the quality of management practices. At the forefront of amending this shortcoming is the Management and Organizational Practices Survey (MOPS), a quantitative survey tool developed by Nick Bloom, John Van Reenen and Erik Brynjolfsson together with the United States Census Bureau and the National Science Foundation. After the development of the MOPS, studies have found cumulating evidence for the significance of management practices in explaining productivity dispersion. This tool has now been translated and adapted to collect data on the quality of management practices in Finnish manufacturing establishments.

The goal of this thesis is to present an overview of previous findings and to use the Finnish Management and Organizational Practices Survey (FMOP) data to examine the quality of management practices in the Finnish manufacturing sector. The empirical section focuses specifically on the differences in the quality of management practices between the large areas of Finland, comparing Helsinki-Uusimaa to the rest of the country. An Olley-Pakes decomposition is used to determine the components of the aggregate (employment weighted) average management score. These components are the unweighted average score and a covariance-like allocation term. To allow for statistical inference and hypothesis testing about possible cross-regional differences in the components of

management practices, a moment-based estimation method, developed by Hyytinen, Ilmakunnas and Maliranta (2016), is used.

Focusing on cross-regional differences may provide useful information for regional policy-making. If, for example, establishments in Helsinki-Uusimaa had higher average management scores, the result could imply that the large area had a competitive advantage over the rest of the country. Reallocation of resources to that area might benefit the economy in the aggregate. This could further justify support for centralization of businesses and services towards the metropolitan area and evoke research on the causes of these differences. The differences in the adoption of management practices might be connected to the amount of competition in the area, or it could be due to learning spill-overs from other establishments, for example. Contrarily, if there are no statistically significant differences, there is probably no need for any geographical focus in improving management practices.

At the core of the cross-regional comparison, in terms of competitiveness, is the Olley-Pakes covariance term. In productivity studies, the reallocation of resources has been shown to account for a large part of cross-country productivity differences[1]. The covariance term also seems to be a good measure of said resource allocation, as argued by Bartelsman, Haltiwanger and Scarpetta (2013), for example. They empirically show that differences in the Olley-Pakes covariance term accounts for a significant part of the cross-country productivity dispersion (Bartelsman et al. 2013).

The main result of the empirical section is that there seem to be no statistically significant cross-regional differences in the quality of management practices in Finland, at least when comparing Helsinki-Uusimaa to the rest of the country. The same result holds when Helsinki-Uusimaa is replaced with West Finland. Furthermore, no significant differences were found in either of the components of the aggregate management score between the large areas.

The structure of the thesis is organized as follows: section 2 presents an overview of how management practices are and have been measured, focusing especially on the World Management Survey (WMS) and the MOPS. Section 2 also introduces some simple theoretical approaches to economic modelling of management practices. Existing empirical literature concerning management practices is presented in section 3, with an emphasis on MOPS and MOPS-based studies. Section 4 provides an overview of the FMOP survey instrument and data, as well as a short description of the decomposition methods used in the empirical analysis. Section 5 presents the results from the moment-based estimation and hypothesis testing.

[1] See for example Foster, Haltiwanger & Krizan (2001) for an overview.

2 THEORETICAL BACKGROUND

2.1 Theoretical models of management practices

The following chapters will introduce two alternative views for dispersion in management practices, and in the next chapter the theoretical approach will be extended by two models that link managerial quality to firm performance through a management function embedded in a production function framework. The first model concerning the variation of management practices across firms is based on optimization and the second one on inefficiency of management (Bloom & Van Reenen 2007). The connection between management and performance is first described with a model in which the level of managerial quality is considered a technology and always improves firm performance (Bloom, Sadun & Van Reenen 2016). The second approach considers the quality of management practices as relative to a firm's business environment, which means that the level of managerial quality does not always have a positive effect on output (Bloom, Sadun & Van Reenen 2016).

2.1.1 Optimization and inefficiency

Optimization is an essential notion in economics and the root of many theoretical models. Management, too, can be described as a firm's optimization problem where the improvement of the quality of management or the adoption of more structured practices is simply a choice in which a firm weighs the benefits against the opportunity costs of said actions. Bloom and Van Reenen (2007) describe a simple management practices optimization model that is based on an aggregate management variable (M), which is composed of two broad types[2] of management practices, $M = h(M_1,M_2)$. M is defined as a monotonically increasing function of the two measures M_1 and M_2 (Bloom & Van Reenen 2007).

Bloom and Van Reenen (2007) then define a production function with constant elasticity of substitution of the form:

$$Y = \left[(B_1 M_1)^{\frac{\sigma-1}{\sigma}} + (B_2 M_2)^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}, \quad (1)$$

where the technological parameters B_1 and B_2 are both greater than zero and the elasticity of substitution σ is greater than one. B_1 and B_2 represent the benefits attained from each type of management practice. The profit function in the model

[2] In this model, the dimensions M_1 and M_2 denote what Bloom and Van Reenen (2007) call "human capital management" and "fixed capital management", which encompass every aspect of management that the MOPS, for example, is designed to measure.

includes output Y, its price P, a non-specific vector of inputs X and the two dimensions of management practices and their unit costs:

$$\Pi = PY - W'X - \rho_1 M_1 - \rho_2 M_2. \quad (2)$$

W' denotes the unit cost of the inputs. It can be seen from the profit function that if the choice of management practices is purely an optimization problem for each firm, then profits are not assumed to be a monotonically increasing function of management. Solving the first order conditions (FOC) for the management practices, one gets the following relation for each type of management practice j = [1, 2]:

$$lnM_j = (\sigma - 1)ln(\varphi(X)) + ln(Y) - \sigma ln\left(\frac{\rho_j}{P}\right) + (\sigma - 1)lnB_j \quad (3)$$

This equation shows that as the unit cost ρ_j of a management practice M_j goes up, the measure of said management practice decreases, and as the parameter B_j goes up, so does the practice. To see how the demand of the management practices behaves in relation to their costs and benefits, the demand is expressed in terms of relative costs and relative benefits. The relative demand for each dimension of management practices can be derived by merging the FOCs for both individual types of practice, resulting in the following equation:

$$ln\left(\frac{M_1}{M_2}\right) = -\sigma ln\left(\frac{\rho_1}{\rho_2}\right) + (\sigma - 1)ln\left(\frac{B_1}{B_2}\right) \quad (4)$$

As might be expected, the relative demand increases when the relative benefits increase, and the relative costs have an inverse effect. (Bloom & Van Reenen 2007.)

Conversely, the inefficiency of management approach assumes that at least a part of the cross-firm dispersion of quality in management practices is exogenous and that the variation of practices between firms is an indicator of efficiency or lack thereof. Bloom and Van Reenen (2007) use the production function

$$Y = A(M)F(X) \quad (5)$$

as a premise for the model. Total factor productivity is denoted A and is an increasing function of management M. $F(X)$ is a function increasing in X, a vector of non-specific inputs, such as labour, capital and raw materials. Therefore, the production function implies that when managerial quality increases, so does productivity. The profit function in this model is of the form:

$$\Pi = PA(M)F(X) - W'X, \quad (6)$$

where W' is again the unit cost of inputs. Thus, because TFP or "efficiency" (A) is increasing in managerial quality, profitability always increases with the quality of management practices, unlike in the optimization model. The following intangible capital stock (technology) model is an example of the inefficiency approach.

2.1.2 Management as intangible capital stock and design

Even though economists have clearly shown that advances in technologies such as R&D and information technology are a very important factor of TFP (e.g. Griliches 1998), a significant part of productivity differences remains unexplained. Motivated by this residual productivity, as well as existing hypotheses and the considerable amount of empirical evidence[3] on the significance of management practices in explaining firm performance, Bloom, Sadun and Van Reenen (2016) present two classes of models that focus on management as the driver of productivity growth. They call the two approaches "Management as a Technology", which has the characteristics of an inefficiency model, and "Management as Design", of which the optimization model is an example (Bloom, Sadun & Van Reenen 2016).

In the technology approach, there are management practices that can be ranked in quality regardless of the business environment in which they are applied. The design approach, where the quality of management practices is always relative to the conditions and environment in which the firm is operating, allows the adoption of "better" or more structured management practices to either increase or decrease output. Mathematically this means that in the basic production function framework of

$$Y = F(\tilde{A}, L, K, M)\ , \tag{7}$$

where L and K are labour and capital without management, Ã is efficiency and M is management capital, some firms in some environments can have $F'(M) \leq 0$ for some M. For these firms, a positive exogenous shock in M would decrease output even if management capital had a unit cost of zero. (Bloom, Sadun & Van Reenen 2016.)

Both set of models are based on the same underlying formalization starting with the industry-level production function of the form:

$$Y_i = \tilde{A}_i K_i^{\sigma} L_i^{\beta} \tilde{G}(M_i)\ , \tag{8}$$

where $\tilde{G}(M_i)$ is a management function for all firms i. Bloom, Sadun and Van Reenen (2016) define M as intangible capital and the factor inputs and outputs as firm specific. They specify the following constant elasticity of substitution demand function:

[3] See section 3.

$$Y = N^{\frac{1}{1-\rho}} \left(\sum_{i=1}^{N} Y_i^{\frac{\rho-1}{\rho}} \right)^{\frac{\rho}{\rho-1}}, \tag{9}$$

where N is the number of firms, $N^{\frac{1}{1-\rho}}$ is a degree of substitution adjustment factor and the elasticity of substitution ρ is greater than one. They normalize the industry price to $P = 1$ and (using the FOCs) find an inverse demand curve of the form:

$$P_i = \left(\frac{Y}{N}\right)^{\frac{1}{\rho}} Y_i^{-\frac{1}{\rho}} = B Y_i^{-\frac{1}{\rho}}, \tag{10}$$

where $B = \left(\frac{Y}{N}\right)^{\frac{1}{\rho}}$ is the demand shifter. The above equations result in the revenue function[4] and profit function of a firm:

$$P_i Y_i = A_i K_i^a L_i^b G(M_i) \tag{11}$$

$$\Pi = A_i K_i^a L_i^b G(M_i) - c_K(K_i) - c_L(L_i) - c_M(M_i) - F, \tag{12}$$

where profits are determined as revenue minus capital, labour, management and fixed costs. (Bloom, Sadun & Van Reenen 2016.)

In the intangible capital stock approach, the management function $G(M_i)$ is always increasing in M, and therefore the revenue function in equation (11) can be presented in a simpler form:

$$P_i Y_i = A_i K_i^a L_i^b M_i^c, \tag{13}$$

where $G(M_i) = M_i^c$ (Bloom, Sadun & Van Reenen 2016). To add endogenous improvement and the depreciation of management (because management is considered an intangible capital stock), Bloom, Sadun and Van Reenen (2016) present a generalized model for the accumulation of management and physical capital:

$$M_{it} = (1 - \delta_M) M_{it-1} + I_{it}^M. \tag{14}$$

Here I_{it}^M depicts investments in management and, because the model does not allow the selling or trading of the intangible capital stock of adopted

[4] $A_i \equiv \tilde{A}_i^{1-1/\rho} (Y/N)^{1/\rho}$, $a \equiv \alpha(1 - 1/\rho\ )$, $b \equiv \beta(1 - 1/\rho)$ and $G(M_i) \equiv \tilde{G}(M_i)^{(1-1/\rho)}$.

management practices, $I_{it}^{M} \geq 0$ holds for all i, t and M. However, both physical and management capital can be purchased as investment goods at a market price. Physical capital can also be sold and that results in the following equation for physical capital accumulation:

$$K_{it} = (1 - \delta_K)K_{it-1} + I_{it}^{M} - \phi_K D[I_{it}^{K} < 0] \,, \tag{15}$$

where D[.] is the function for selling owned capital stock (negative investment) and ϕ_K is the resale loss. (Bloom, Sadun & Van Reenen 2016.)

According to Bloom, Sadun and Van Reenen (2016), design models assume that the quality of management practices and their effects on firm performance are always relative to the firms adopting them. The effect of a management practice can depend on the industry or geographical location in which the firm is operating, or even on firm-level variables such as the number of plants or employees, growth rate or age (Bloom, Sadun & Van Reenen 2016). It is intuitively reasonable to think that for example in some fields of work, a direct incentive pay system can improve worker productivity, whereas it could have adverse effects in a different field. The same reasoning applies for different types of management practices across different countries, cultures and firms with diverse characteristics.

The ways in which a formal description for the so called "Management as Design" approach can be constructed are numerous, but Bloom, Sadun and Van Reenen (2016) present an example to demonstrate how one can apply the management function to obtain an optimal level of management by maximizing the function. They define the optimal level of M as $\bar{M}$ and the equation for the management function as

$$\tilde{G}(M_i) = \frac{1}{(1 + \theta|M_i - \bar{M}|)} \,, \tag{14}$$

where $\theta \geq 0$ and $\tilde{G}(M_i) \in]0,1]$ decreases as M diverges from $\bar{M}$. This model implies that the dispersion of management practices between firms is due to profit maximizing firms choosing the level and type of practices that suit their environment. Another example of a model of this type is the previously described management practices optimization model.

2.2 Measuring management practices

A researcher attempting to reliably measure management practices faces many challenges, the least of which are not separating "better" practices from "worse" ones and the data acquisition itself. These challenges have been confronted with the introduction of the World Management Survey (WMS) and the Management

and Organizational Practices Survey (MOPS). The following chapters describe how these surveys have been constructed and used to quantify and measure management practices. Other methods have been used in the literature, such as the WMS based Management, Organisation and Innovation survey (MOI) conducted by the European Bank for Reconstruction and Development together with the World Bank (Buffington, Foster, Jarmin & Ohlmacher 2016), but here the focus will be on the WMS and the MOPS.

2.2.1 The World Management Survey

Since its introduction by Bloom and Van Reenen (2007), the WMS has been an important and widely cited empirical method of studying management practices. The survey methodology[5] uses 18 different management practices and scores the answers concerning each practice from 1 to 5, 1 being the lowest quality score and 5 being the highest. The scoring system is based on a management practice assessment tool developed by a market leader in management consultancy (Bloom & Van Reenen 2007). The 18 management practices are divided into 4 groups: operations, monitoring, targets and incentives. A firm receives a high score if it tracks performance and uses the collected data to continually improve its processes, sets goals and acts to achieve them, bases promotions and other rewards on performance and ability and intervenes if employees are performing badly (Bloom & Van Reenen 2007). The survey has also been expanded with separate question sets for healthcare, education and retail, in addition to the original manufacturing survey (Buffington et al. 2016).

The telephone interviews are conducted so that the interviewer has no information concerning the firm's performance and the mid-level manager being interviewed is not told that the answers are being scored. This double-blind technique is used to minimize survey bias. The interviewers (MBA-type students) only know the company name and industry, always speak the native language of the interviewee and the average interview lasts for 50 minutes. The questions are open-ended and designed to reveal information about actual practices used in the firm through examples. Every practice starts with a broader question and follow-up questions are used to achieve a more accurate evaluation for the scoring. (Bloom, Lemos, Sadun, Scur & Van Reenen 2014.)

The WMS is a long-running project and has been conducted in five major waves since it was first developed: 2004, 2006, 2010, 2013 and 2014. The original survey included randomly selected firms from France, Germany, the UK and the US, whereas the second wave added 8 new countries and re-surveyed all the firms from the first wave to create a data panel with a time dimension. The 2010 survey included the same firms again, but in 2013 and 2014 more countries were added to the dataset, in addition to re-surveying the existing firms from before

[5] The individual survey questions can be found in Bloom and Van Reenen (2007) and from the WMS web page www.worldmanagementsurvey.org.

2013 in the latter wave. Overall, a dataset of 11 383 firms and 15 489 interviews from 34 countries was accrued. (Bloom, Sadun & Van Reenen 2016.)

As a test of measurement consistency, 222 firms or 5% of the sample were surveyed again using different interviewers and managers from different plants of the same firms as interviewees. A statistically significant correlation of 0.51 was found between the re-sample and the original responses. The measurement error of the survey is represented by the remaining non-correlated variation that is not due to actual within-firm between-plant variation in management practices. This means that the WMS as a measure of management suffers from survey noise, but it does still capture significant amounts of information about cross-firm differences in management. (Bloom et al. 2014.)

2.2.2 The Management and Organizational Practices Survey

The original 2010 MOPS was developed as a collaboration between the United States Census Bureau, the National Science Foundation and researchers Nick Bloom, Erik Brynjolfsson and John Van Reenen. It is a survey tool with closed-ended questions that consists of 16 questions on management practices, 13 questions on organizational practices and 7 background questions. The management questions can be divided into three different areas, which are monitoring (5 questions), targets (3 questions) and incentives (8 questions). The survey design is meant to measure primarily the same aspects of management as the WMS and was modelled in part from a World Bank survey tool and developed through extensive testing and refinement by the US Census Bureau, whereas the division into three sections is based on Bloom and Van Reenen (2007). The MOPS has since been expanded with additional question sets concerning data and decision making and uncertainty. (Bloom, Brynjolfsson, Foster, Jarmin, Patnaik, Saporta-Eksten & Van Reenen 2017.)

The MOPS tool was designed for establishment-level use in manufacturing industries and was first implemented in the US in 2010. A second MOPS survey was conducted for the year 2015, with the addition of the new sections and some slight modifications to the original ones. The response rate for the original 2010 US MOPS was 78% and the distribution of respondents was slightly skewed towards larger establishments, as measured by the number of employees. (Bloom et al. 2017.)

The responses of the surveyed establishments are first normalized to a scale of 0 – 1 and then aggregated into an establishment-level structured management score. This is done by calculating the unweighted average of the establishments' responses to each management question. The more structured the practices regarding monitoring, targets and incentives are, the closer the establishment-level structured management score is to 1. Bloom et al. (2017, 28) define more structured management practices as "those that are more specific, formal, frequent or explicit". (Bloom et al. 2017.)

2.2.3 Comparison between closed-ended and open-ended surveys

The World Management Survey is an example of a survey method that uses open-ended questions, whereas the Management and Organizational Practices Survey is a closed interview method, which means that it gathers data with closed-ended questions. Both methods are valuable tools in gathering data, but they have some meaningful differences regarding for example accuracy, cost and speed. Analysing those differences can be useful when evaluating the reliability of a study or when deciding which research method to use in a particular setting.

Based on Bloom, Lemos, Sadun, Scur and Van Reenen (2016), the comparison focuses on 6 distinct attributes: accuracy of responses, international comparability, response rates, replicability, cost per survey and speed of delivery. Open interviews such as the WMS have the advantage of high accuracy and international comparability. An interview conducted by a trained interviewer together with open-ended questions makes it possible to acquire accurate responses with examples. Furthermore, it enables confirmation for the interpretation of the answers straight from the interviewees themselves. With multilingual interviewers it is also possible to survey multiple countries from one location and see that the questions are understood equivalently in every geographical area. (Bloom, Lemos et al. 2016.)

With the MOPS and other closed-ended surveys, it is more difficult to control for possible biases and preconceptions of the respondents, as well as to ensure that interviewees interpret the questions correctly and answer meticulously and truthfully. Once the responses have been received, it is very difficult to gain additional information about their content and interpretation. The international comparability of closed questionnaires can be at the same level with open ones, but it requires careful translating and consideration of cultural differences. However, after these issues are controlled for, a closed-ended survey can be more straightforward to complete in multiple countries than an open-ended one. (Bloom, Lemos et al. 2016.)

The response rates for a closed-ended mail survey depend heavily on whether the survey is voluntary or mandatory. In the United States, co-operation with the US Census Bureau resulted in a response rate of around 80% for the MOPS, but for example in Finland and Germany (Broszeit, Fritsch, Görg & Laible 2016), where the survey was voluntary, the response rates were much lower: approximately 31% and 6%, respectively. For the WMS, Bloom, Lemos et al. (2016) have had a response rate of approximately 40% on average, which is comparable to the response rate of the Finnish Management and Organizational Practices Survey. However, the interactive nature of the interview format ensures comprehensive responses and a very small item non-response. (Bloom, Lemos et al. 2016.)

Whereas neither survey method has a clear advantage over the other in response rates, closed-ended survey instruments are much more easily replicated, as the questionnaire can be copied with little need for adjustment. The only challenge is translating the questionnaire so that the information is relayed correspondingly in every setting. The interview-based open-ended survey method

requires much more resources and meticulous planning to be replicated analogously. Interviewers must be carefully trained to ensure the comparability of delivery and interpretation. (Bloom, Lemos et al. 2016.)

Closed-ended surveys have a low cost per survey, especially when conducted with large samples. Very large data sets can be acquired with just the fixed costs from planning and designing the survey instrument and the process of data gathering (Bloom, Lemos et al. 2016). However, according to Bloom, Lemos et al. (2016), the speed of delivery suffers from the need of collaboration with national statistical agencies and the planning and coordination involved with such cooperation. Bloom, Lemos et al. (2016) estimate that a typical time span for a closed-ended survey is 4 – 6 months, where the survey itself takes approximately 3 months to complete with an additional 1 – 3 months of data cleansing.

The need for thoroughly trained interviewers, recruitment of willing managers and lengthy personal interviews makes the WMS type survey method much more expensive and more challenging to organize. This raises the cost-per survey, as the interviewers are paid during the entire preparation and data collection process. In contrast to the high cost per survey, an open-ended survey can be completed relatively quickly. The survey wave itself can be carried out in 10 weeks, with planning and recruitment of interviewers taking approximately a month and a half. This means that the data can be ready in 4 months, counting from the very beginning of the process. (Bloom, Lemos et al. 2016.)

3 EXISTING LITERATURE

3.1 Productivity dispersion

Studies have found that differences in productivity across firms are considerable and persistent, be the level of examination within countries, across industries or even within precisely defined industries. When studying productivity dispersion, Chad Syverson (2004) finds that in the United States manufacturing sector, on average, a plant in the 90th percentile produces almost twice as much as a plant in the 10th percentile of the production distribution. This is on average, with the same amount of inputs used, which means that the across-firm differences in productivity are found to be even wider in many other industries. Furthermore, evidence from other countries display even more significant productivity differences. For example, productivity dispersion measurements with within-industry data from China and India show plants in the 90th percentile of the revenue-based productivity distribution producing over five times more than plants in the 10th percentile (Syverson 2011).

Another finding is that the total factor productivity of a firm is highly correlated with its past values, which indicates that productivity, or lack thereof, is a very persistent quality. Productivity is also correlated with the survival of firms within an industry, a result that is again consistent regardless of the level of examination. (Syverson 2011.) From these observations, as well as from the wide range of other literature with similar results, it could therefore be concluded that productivity matters very much for firms striving to survive and succeed. Productivity also matters in terms of the welfare of countries, at least when measured in GDP, as can be seen in the case of the United Kingdom from FIGURE 1. The figure shows the growth of GDP decomposed into the contribution from inputs and the contribution from the growth of total factor productivity.

It seems quite clear that differences in productivity are large, persistent and consequential. Nevertheless, the causes for these differences are only partially understood and there is a significant unexplained part of productivity, some of which might begin to unravel due to the recent advancements in measuring management practices in a quantifiable way. When reviewing the evidence concerning productivity dispersion, Bloom and Van Reenen (2011) conclude that, accounting for different inputs in the production function, characteristic stochastic shocks and differences in plant level prices are not enough to explain the substantial heterogeneity in firm performance.

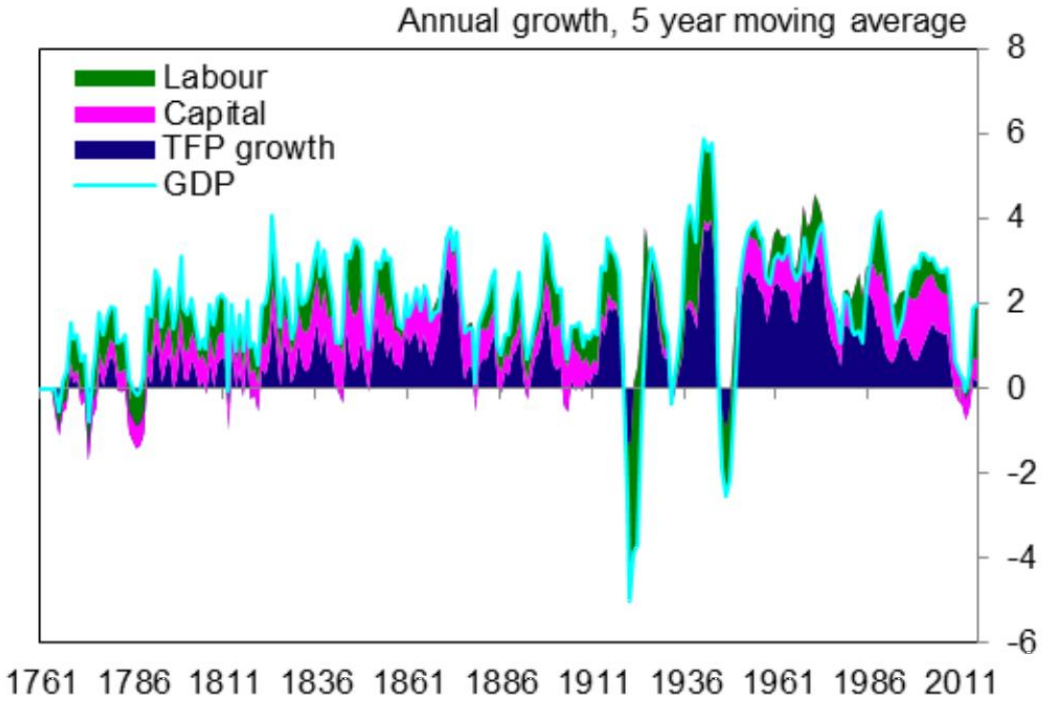

FIGURE 1 Decomposition of long run UK GDP growth. (Hills, Thomas & Dimsdale 2015.)

Bloom et al. (2014) construct a firm-level histogram of the dispersion of management practices, as measured by the World Management Survey (WMS), and find that just like productivity, the distribution of management practices across firms within countries varies considerably in all the countries covered by the WMS data. This variation is found to be lower in countries such as the US, where the markets do not exhibit high frictions, than in countries that do. The management practice scores reveal that the US has the highest average scores, followed by Germany, Japan, Sweden and Canada. (Bloom et al. 2014.)

Changes in economic growth have traditionally been studied using aggregate macro data, but there has been an increasing focus on including micro-level information into the models, which means utilizing plant- and firm-level evidence to measure productivity (Syverson 2011). Perhaps one of the most recent developments in this trend is the utilization of data on management practices to explain differences in productivity. The thought that management could drive differences in productivity is a very old one (i.e. Walker (1887)), but adequate data for empirical testing of this hypothesis has been made available only relatively recently. This section will examine literature concerning this connection and other aspects of management, with evidence from Human Resource Management, the WMS, a random control trial in India and the MOPS.

3.2 Human Resource Management

In their literature review on Human Resource Management (HRM), Bloom and Van Reenen (2011) study how HRM relates to firm and plant level productivity as a first order outcome. They limit their usage of the term HRM to include incentives (pay, positive feedback and advancement in career and in the organization) and features that affect hierarchy, work flexibility, teamwork and distribution of information. They call the listed features work organization. Both direct and indirect measures of incentive pay are examined, the former meaning direct incentive pay data from a variety of sources and the latter a measure constructed by examining correlations between pay and firm performance. The other measures of HRM are based on surveys. (Bloom & Van Reenen 2011.)

By critically examining a vast array of empirical micro-econometric studies, Bloom and Van Reenen (2011) derive five main results:

1. Incentive pay systems for both individuals and groups have a positive causal relationship with productivity.
2. In many cases, incentive pay also causes a significant positive turnover of workers, where more productive workers gravitate towards firms that offer higher incentives.
3. Other complementary factors, such as the previously mentioned work organizational features, seem to boost the productivity effects of new incentive pay systems.
4. Incentives may sometimes negatively affect productivity. Often this is the case when the incentive systems are built in a way that allows workers to manipulate them.
5. Usage of incentive pay systems is linked to more within-firm productivity dispersion, because the incentives have a bigger effect on more productive workers.

Although they make some confident and well justified conclusions about the effects of HRM on productivity, Bloom and Van Reenen (2011) also state that the studies reviewed in the paper are afflicted by a lack of accurate and representative data. This hinders the research, especially with regards to time series analysis, because the data is not adequate to gain a sufficient understanding of the trends and time series processes involved. This means that even though they find clear cross-sectional evidence for the productivity benefits of HRM practices, these findings cannot, for the most part, be reproduced or backed up in the time series dimension.

Moreover, the most robust results concerning the effects on productivity of changes in HRM practices are found mostly from studies utilizing small groups of firms or plants within single firms, which might not be enough to make robust

policy or firm operations model recommendations. Nevertheless, the aggregate evidence clearly points to a relationship between HRM practices and firm level productivity, which gives credence to the idea that management practices could be one answer to the question of unexplained gaps in total factor productivity. (Bloom & Van Reenen 2011.)

3.3 Evidence from the World Management Survey

Bloom, Sadun and Van Reenen (2016) use the World Management Survey (WMS) to empirically study whether the predictions attained from their previously described intangible capital model are supported by the data. According to the model, there should be a strictly non-negative correlation between firm performance and higher management scores. Bloom, Sadun and Van Reenen (2016) use local linear regressions to show that there is a distinct monotonically increasing connection between the management score and the natural logarithm of firm sales. The same result is found when estimating the local linear regression of firm TFP on management score.

To analyse these correlations further, they look at the relationship between a standard-score-normalized aggregate management variable and several different firm performance measures from accounts data. When regressing sales on management and the number of employees, a highly statistically and economically significant relationship is found: according to Bloom, Sadun and Van Reenen (2016), a higher management score of one standard deviation correlates with approximately 43% higher labour productivity. The validity of this result requires that using firm sales and the number of employees is an accurate way of measuring labour productivity. However, the correlation between sales per employee and management, without any additional variables in the regression, is clear.

When Bloom, Sadun and Van Reenen (2016) include firm capital stock and their set of general controls[6], the coefficient of management on sales decreases by a little more than 50%, while remaining statistically significant. They also show that the correlation is somewhat constant by running the same regression using a sub-sample with data for each firm from at least two years. When including firm fixed effects to account for possible variation of the variables over time, the coefficient decreases even more, but retains its statistical significance. It can be questioned whether the magnitude of the correlation is economically significant after adding the firm fixed effects, but the authors state that including fixed effects is a highly strict test for the regression because of the high probability of attenuation bias. (Bloom, Sadun & Van Reenen 2016.)

[6] The general controls include firm age, employees with a college degree and a set of survey noise controls (Bloom, Sadun & Van Reenen 2016).

Bloom, Sadun and Van Reenen (2016) also find that there is a clear positive correlation between higher management scores and firm size. According to their regression results, a higher management score of one standard deviation signals a higher employee number of approximately 49%. They also use Return on Capital Employed, 5-year sales growth and Tobin's average q (total market value of a firm divided by its total asset value) as proxies for firm profitability and find that these measures are positively and statistically significantly related to management scores, as is the probability of not going bankrupt or exiting the market. (Bloom, Sadun & Van Reenen 2016.)

A causal inference cannot be drawn from these correlations, as it is likely that management is endogenous. Moreover, it is probable that even the estimates from longitudinal data are interfered by some unobserved variables which vary in time and correlate with both performance and management, as Bloom et al. (2014) point out in their review of the studies on the subject. Bloom et al. (2014) also acknowledge the likelihood of reverse causation and use the possibility that firms with better productivity might be able to hire better managers or management consultants as an example. However, the existing Randomized Control Trial (RCT) evidence, albeit rather sparse, does give some support to the causality of the findings made with the non-experimental evidence.

To examine how much of cross-country variation in TFP can be explained by management, Bloom, Sadun and Van Reenen (2016) decompose an aggregate country level size-weighted management index into two parts, a within firm and a between firm component. They calculate the management score gap and TFP gap between each country and the US and use the evidence they have presented, together with the results of Bloom, Brynjolfsson, Foster, Jarmin, Saporta-Eksten and Van Reenen (2013), to estimate that a one standard deviation increase in the management score induces an average treatment effect of a 10% increase in TFP.

Bloom, Sadun and Van Reenen (2016) find that management practices can be linked to an average of 30% of the cross country TFP gaps. The fraction of the TFP gap explained by management varies greatly, with the lowest fractions in low income countries ranging from 6.2% in Zambia to 12% in Tanzania and the highest fractions in high income countries ranging from 43.9% in Sweden to up to 55.3% in the UK (Bloom, Sadun & Van Reenen 2016). With the extensive robustness tests conducted, the fraction stays between 20% and 50%, which is, as Bloom, Sadun and Van Reenen (2016) also note, non-trivial indeed. These results, even though only suggestive, give support to the hypothesis that management practices could be a significant variable when studying cross and within-country differences in TFP.

3.3.1 Workforce selection as a channel – evidence from Germany

Another study focusing on the link between a WMS based index of management and productivity is by Bender, Bloom, Card, Van Reenen and Wolter (2018). It utilizes longitudinal employee earning records combined with WMS data from middle-sized German manufacturing plants to answer the research question of

how much management affects productivity and how much of this effect can be accounted for by workforce selection and pay premiums, the latter of which is used as a proxy for incentive systems. To avoid the previously mentioned issues caused by the WMS's emphasis on certain types of management systems, the study focuses on middle-sized companies and does not include firms of under 50 employees. The data on individual workers is from the Integrated Employment Biographies, which is provided by the Institute for Employment Research (IAB). As a basis for the empirical analysis, they apply a simple constant-returns-to-scale production function complemented by parameters for management labour, non-management labour and their levels of productivity. The function is of the form:

$$Y_{jt} = \theta_{jt} f\left(Q_{Njt} N_{jt}, Q_{Mjt} M_{jt}, I_{jt}, K_{jt}\right), \tag{15}$$

where Y_{jt} is the output of firm j in period t, K_{jt} represents capital and I_{jt} intermediate inputs, θ_{jt} is total factor productivity, N_{jt} and M_{tj} are inputs for non-management and management labour and Q_{Mjt} and Q_{Njt} their levels of productivity, respectively. (Bender et al. 2018.)

To analyse the quality of workforce, regarding its productivity outcome, Bender et al. (2018) obtain a structural distribution for the workforce of each firm by deriving a decomposition of worker and firm-level pay from wages. The authors base this on a previous study with empirical evidence from Germany and argue that a reasonably accurate approximation of the structure of wages can be achieved with this framework. Due to the convincing empirical accuracy of the framework, they use the estimations of worker[7] and firm effects from the previous study to derive a sum parameter of worker ability and firm-level incentives. However, they also acknowledge that the summarized parameter for the effects of financial incentives might be a rather inaccurate description of the underlying factor, which is the compensation policy of a firm. (Bender et al. 2018.)

The basic descriptive statistics presented by Bender et al. (2018) imply that daily wages vary slightly less and worker skills slightly more in firms with higher management scores. Furthermore, it is noted that management scores are positively correlated with the average human capital of the workforce, as well as with labour productivity, which is measured as a logarithm of sales per worker (Bender et al. 2018). The distinctly positive (and convex) connection between average worker fixed effects and sales per worker, also revealed by the descriptive analysis, can be considered as evidence for the importance of a part of the research question; how much of the effect of management practices on productivity can be explained by workforce selection (Bender et al. 2018).

Additionally, the authors run some basic regressions with the standardised management scores, average human capital of the workforce and other firm-level control variables and find further validation for the strong correlation between

[7] A proxy for the long run human capital of workforce

management quality and workforce quality. This correlation is especially strong when examining workers who are in the 75th percentile of employee quality, a quantile of workers the authors regard as managers. The coefficient of mean managerial ability on the management z-score is 0.294, whereas the coefficient of mean employee ability is 0.216, when controlling for firm size. When both managerial and average employee ability are included in the regression, only the former remains statistically significant. These preliminary findings imply that the management quality scores are related to the levels of human capital, as measured by worker ability, most notably when considering the abilities of managers. (Bender et al. 2018.)

When analysing productivity with the production function framework, Bender et al. (2018) find a rather distinct, strong and clearly statistically significant partial correlation[8] between the WMS scores and sales. This is before controlling for worker ability and is consistent with the findings of Bloom et al. (2016). When Bender et al. (2018) add controls for average worker and manager ability and the share of workers with a college education, the coefficient decreases by half. The authors therefore conclude that, according to the production function approach, approximately 50% of the relationship between management practices and productivity can be accounted for by firms with higher scores on the WMS employing higher quality workers, especially in the top 75th percentile of the worker skill distribution (Bender et al. 2018).

However, the introduction of capital as an additional control variable causes the coefficients of worker ability, the share of workers with a college education and especially the WMS score on sales to fall significantly in both magnitude and in statistical significance (Bender et al. 2018). They do remain statistically significant, but only at the 10% confidence level, and the coefficient for the management score falls by another 50% (and even more when a firm-level wage premium variable is added). This is a large drop, but the results can still be considered meaningful. All the production function results are based on straightforward averages of standardised WMS scores as the proxy for management practices, but Bender et al. (2018) have included robustness tests where they use different methods, such as principal component analysis, to measure management from the WMS. The robustness tests support the results obtained by using the z-score averages.

To diminish the issues arising from the likelihood of endogeneity problems and observational errors, Bender et al. (2018) turn to a logarithmic reduced form TFP specification, where labour, capital and intermediate inputs are a part of the definition of TFP[9], and therefore on the left-hand side of the equation, unlike in the production function approach. They justify this estimation method with the fact that the factor inputs are endogenous. The method is more parsimonious and, according to Bender et al. (2018), enables more meticulous analysis of the principal variables. The authors also note that the downside to the TFP specification

[8] The coefficient is 0.26 with a standard error of 0.048.
[9] $\log TFP_{jt} \equiv \log(Y_{jt}) - s_L\log(L_{jt}) - s_I\log(I_{jt}) - s_K\log(K_{jt})$, where s_L, s_I and s_K are cost shares.

approach is the rather strict assumption of output elasticities of the factor inputs being equal to the share of total costs that they induce, which is not likely to hold perfectly (Bender et al. 2018).

Now the dependent variable is TFP and the coefficient of management score without any controlling variables is 0.08. The effects of controlling for average worker and manager ability are a 24% and a further 14% decrease in the management coefficient, respectively. Introducing the firm wage premium as another control produces an even further decrease of 16%, with a resulting management score coefficient of a little over half of the original correlation. Repeating the estimations with additional controls does not change the results drastically. (Bender et al. 2018.)

To answer the research question of the paper, Bender et al. (2018) examine the changes in the coefficients, both in the production function and the TFP specification approach. Based on the results, they conclude that the overall effects of management practices on productivity consist at least partly of the intermediary channels of workforce selection and pay (Bender et al. 2018). Even though there are still unexplained parts in the relationship between management practices and productivity, this gives more insight to the mechanisms through which the effects are propagated.

3.4 Randomized Control Trial in India

Bloom, Eifert, Mahajan, McKenzie and Roberts (2013) present such experimental evidence concerning management practices and firm performance in large Indian textile firms. The study involved 17 firms and their 28 plants. The RCT was conducted by randomly selecting plants that received the treatment, five months of free management consulting, and other establishments to form a control group. The authors acknowledged the possible issues raised by the relatively small sample size and addressed them with several robustness checks to assure the credibility of the results. (Bloom, Eifert et al. 2013.)

The plants were consulted to adopt and improve upon management practices very similar to those that the WMS was created to analyse (Bloom, Eifert et al. 2013). The results from the study can therefore be interrelated with those from the non-experimental evidence in Bloom, Sadun and Van Reenen (2016). First the authors show that the intervention did indeed affect the management practices of the establishments receiving the treatment. On average, the use of the management practices they were consulted to adopt increased from 25.6% to 63.4%, with the changes being persistent at least for the next year, whereas the control plants increased their usage of the same management practices by only 12 percentage points (Bloom, Eifert et al. 2013).

The main results from Bloom, Eifert et al. (2013) are that the received management consulting raised plant output by an average of 9.4% at the 5 %

confidence level and TFP[10] by 16.6% with a statistical significance of 10%. The increase in TFP resulted from rising output and the decrease of capital and mending labour, the latter of which was due to a decrease in quality defects (Bloom, Eifert et al. 2013). The study also implies that a one standard deviation increase in management scores similar to the WMS would cause a productivity increase of 10%, which is within the range of results found in the non-experimental estimations of Bloom, Sadun and Van Reenen (2016).

Some other studies based on experimental evidence that have found similar results include Bruhn, Karlan and Schoar (2017) and Giorcelli (2016). These give credence to the positive causal effects of management practices on firm performance, but there is also some literature that finds insignificant, mixed or even negative effects of managerial interventions on firm profits (see, for example: Berge, Bjorvatn & Tungodden 2014; Giné & Mansuri 2014; Drexler, Fisher & Schoar 2014; Karlan, Knight & Udry 2012).

According to Bloom et al. (2014), the latter results are most likely a result of the very small firm size, predominantly one-person firms, used in these studies; the interventions and the WMS focus on management systems that might not be as significant for these kinds of micro-enterprises as they are to larger firms. Furthermore, these studies often use small local firms as consultants for the interventions, and such companies might not be able to reach the same quality of management consultancy as bigger international ones, such as Accenture, who were used in the intervention of Indian textile plants (Bloom et al. 2014).

3.5 Management and Organizational Practices Survey (MOPS)

The MOPS is a relatively new method of measuring management practices and as of May 2017 it has therefore only been used to study the "economics of management" in the United States, Germany (Broszeit et al. 2016) and Pakistan (Lemos, Choudhary, Van Reenen & Bloom 2016). However, other countries, such as Great Britain (Awano, Heffernan & Robinson 2017), Japan, Canada, Mexico and Finland, have initiated corresponding endeavours with surveys equivalent or similar to the US MOPS. Due to the novelty of the survey and the current sparsity of studies utilizing it, this section will mostly focus on evidence from the US by Bloom et al. (2017), with a brief overview of results from Germany and Pakistan.

[10] TFP = log(value added) – 0.42*log(capital) – 0.58*log(labour), where the factor weights are cost shares, capital is physical capital and labour is production hours.

3.5.1 Management practices in the United States

The WMS showed a wide dispersion of management practices between firms, especially in countries with high market frictions (e.g. Bloom, Sadun & Van Reenen 2016). The MOPS-based empirical study of Bloom et al. (2017) supports these findings of large cross-firm variation in management practices and finds that the considerable dispersion exists also within firms and across plants. The overall dispersion across plants can be seen in the histogram of FIGURE 2, which shows that less than one fifth of plants have adopted at least 75% of the structured management practices (an average score higher than 0.75), whereas over a quarter of establishments have adopted under 50% of the more structured management practices. However, the overall cross-plant variation in the histogram can result from both between and within firm components. (Bloom et al. 2017.)

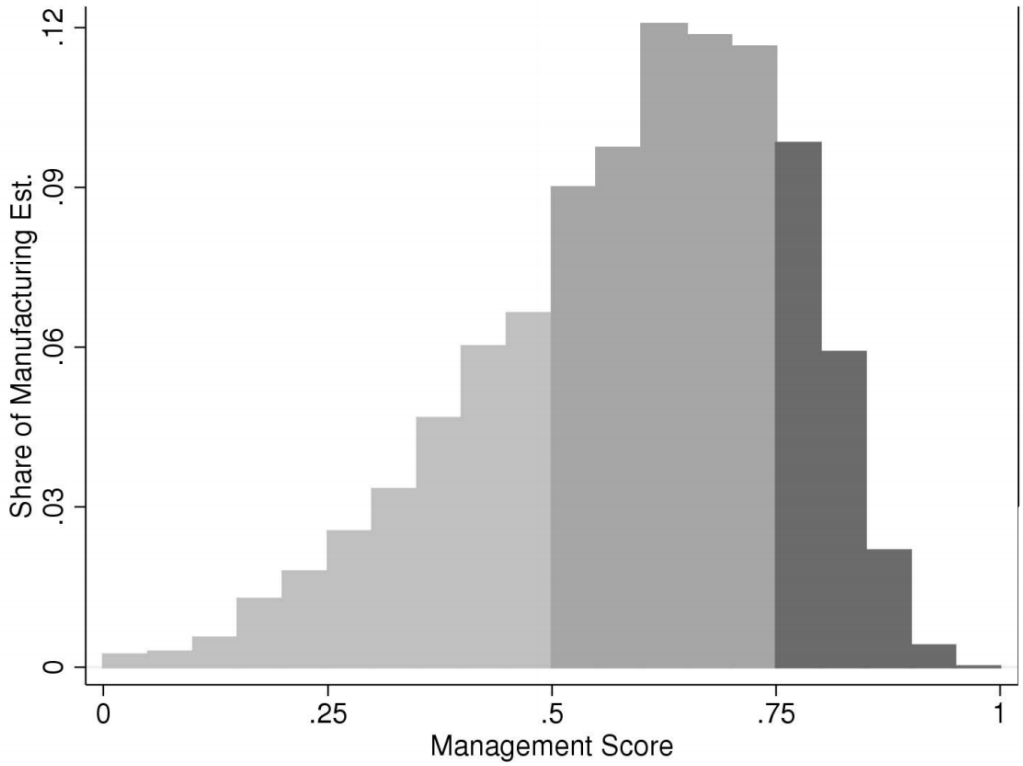

FIGURE 2 Spread of management scores across establishments. (Bloom et al. 2017.)

To find how much of the dispersion occurs within firms, Bloom et al. (2017) use multi-plant firms to plot the management score variation of the establishments against the variation of the whole firm. This enables them to analyse the shares of the total variation explained by the parent firm and the plants within a firm. They find that the share accounted for by the plants within a firm gets bigger as the number of establishments in the firm grows. In addition, by aggregating all the different sized firms, they find that within-firm variation accounts for approximately 42% of the total variation. Overall, the data used in the study include all

manufacturing plants of multi-establishment firms, but only large (over 250 employees) single-establishment firms. (Bloom et al. 2017.)

According to Bloom et al. (2017), measurement error in plant-level scores would cause a bias towards overestimating the plant-level variation, which is why they utilize a 500-plant part of the sample, for which two different plant managers have filled the survey separately and independently. They analyse the correlations between the different within-plant scores to estimate the measurement error of the overall cross-establishment variation in management scores and take the error into account when decomposing the management dispersion. They repeat the analysis with controls for within-firm management variation in geographical location and operating industry, and conclude that larger firms have bigger shares of within-firm variation most likely because of the wider array of industries and regions that they operate in. (Bloom et al. 2017.)

Bloom et al. (2017) also estimate that a third of the variation in management practices is driven by product market competition, state-level business environment (as proxied by "Right to Work" regulations[11]), learning spillovers between firms and education (as proxied by local supply of educated employees). To create an instrument for the local supply of educated employees, they use land-grant universities (LGU), the locations for which were typically selected solely by the availability of vacant land lots in the late 19th century (Bloom et al. 2017). The framework for the instrument, which relies on the quasi-random county-level allocation of the colleges, is based on Moretti (2004).

By comparing the location of the LGUs with the location of the MOPS respondents, Bloom et al. (2017) find that establishments which are located in a county with an LGU are more likely to have a higher management score. The connection is large and statistically significant. This result is supported by the substantial, positive and statistically significant relationship between establishment-level management scores and the county-level share of the 25—60-year-old population with a bachelor's degree (Bloom et al. 2017). The connection between the local supply of educated workforce remains significant after controlling for population density and local unemployment rate (which represent economic development). According to Bloom et al. (2017) this suggests that a more highly educated workforce might lead to more structured management practices in more direct ways than just through economic development in general.

After establishing the extensive management practices dispersion within and across firms, Bloom et al. (2017) use the MOPS data together with other firm-level data to study the connection between management and firm performance. The performance measures are gathered mostly from datasets by the Annual Survey of Manufacturers, Census of Manufactures (ASM) and the United States Patent and Trademark Office (USPTO). Rather than attempting to establish outright causal inferences between structured management practices and firm performance, Bloom et al. (2017) note that their analysis is more about determining the

[11] Laws that prohibit conditioning the hiring of employees on belonging to a trade union (National Right to Work Legal Defence Foundation web page 2016).

capabilities of the MOPS in obtaining useful and substantial information about management practices. Nevertheless, the following empirical results by Bloom et al. (2017) are sure to give some insight into the link between management and performance outcomes, as measured by productivity, profitability, firm growth, innovation and survival.

The premise of the model for management and productivity in Bloom et al. (2017) is a simple modified Cobb-Douglas plant-level production function of the form:

$$Y_{it} = A_{it} K_{it}^{\alpha} L_{it}^{\beta} e^{\gamma X_{it}} e^{\delta M_{it}}, \tag{16}$$

where Y_{it} is the real value added, A_{it} denotes plant-level productivity without the effect of management practices, K_{it} is the capital stock of the plant and L_{it} is labour input. The management score and the vector of controlling variables, M_{it} and X_{it}, are in exponential form so that they would be in levels after the logarithmic transformation. Because the different management practices measured in the survey have a strong correlation with each other, the model uses an average of all the adopted structured management practices as the M_{it} variable. The regression function used in the estimations is derived by taking logs of the above equation and dividing by labour:

$$Log\left(\frac{Y_{it}}{L_{it}}\right) = \alpha log\left(\frac{K_{it}}{L_{it}}\right) + (\beta + \alpha - 1)\, log(L_{it}) + \gamma X_{it} + \delta M_{it} + f_i + e_{it} \tag{17}$$

Here f_i is a set of fixed effects for establishment, firm or industry, replacing the productivity term A_{it}, and e_{it} is a stochastic (randomly determined) residual term. $Log(Y_{it}/L_{it})$ is a measure for labour productivity and the firm-level standard errors are clustered, since the data contains firms with several plants. (Bloom et al. 2017.)

Before adding any controls, the regression with labour productivity as the dependent variable results in a highly statistically significant (1% level) coefficient for management, which implies that with every 10% increase in the management score, one can expect to see labour productivity that is approximately 1.136 times or 13.6% higher (Bloom et al. 2017). Bloom et al. (2017) also present this in the context of standard deviations[12], where an upward change of one standard deviation in the management score implies a 21.3% increase in labour productivity. Adding capital intensity, number of employees, worker education, industry fixed effects and noise controls for survey bias brings the coefficient down to where a 10% increase in the management score implies a 5.1% higher labour productivity, which is still significant both statistically and economically (Bloom et al. 2017). An additional finding is the heterogeneity of the correlation

[12] The management score has a standard deviation of 0.152 and a sample mean of 0.64 (Bloom et al. 2017).

between management and labour productivity across industries, the reasons for which are not addressed in the study (Bloom et al. 2017).

To address possible omitted variable bias, Bloom et al. (2017) use the 2005 recall questions included in the MOPS and couple them with 2005 data from the ASM to form a data panel of the variables. If the presumed omitted variables do not vary in time at plant level, a fixed effects model (with establishment fixed effects) should remove their effects from the panel regression (Bloom et al. 2017). With this regression, the coefficient is 0.298 and still statistically significant at the 1% level, which is an indication that the original ordinary least squares regression does indeed depict the relationship between productivity and management and not just a mutual correlation with some unobserved variables. Statistical biases are still a potential problem, for example if changes in the management practice scores are caused mainly by some omitted time-varying variables, but according to Bloom et al. (2017), this bias is likely to be cancelled out or even exceeded by measurement error.

To examine whether the variation in more structured management practices is correlated with the variation of labour productivity across plants within each firm, Bloom et al. (2017) run the same OLS regression but with firm-level fixed effects in the establishment dimension of the data. Using the sub-sample of multi-plant firms with the firm fixed effects, they find a management coefficient of 0.233, which is statistically significant at the 1% confidence level (Bloom et al. 2017). This implies that the overall productivity of a firm is linked to the dispersion of management practices between its own establishments. Even though these results do not show a causal relationship, firms could, based on these results, potentially improve their productivity by simply bringing the plants with less structured management practices on par with the better managed plants within their own firm.

Moreover, the management-performance relation also seems to be very significant in magnitude, even when comparing to human capital, information technology and R&D, which are traditionally considered to explain the observed variation of productivity to a high degree. Bloom et al. (2017) find that the share of the 90-10 spread of TFP explained by the 90-10 spread of the management score is 18.1%, whereas the same share is 16.9% for R&D and only 7.5% and 11.1% for IT investment per worker and share of employees with a college degree (proxy for human capital), respectively. When these factors are considered together, they explain 32.5% of the 90-10 TFP gap, with management remaining statistically significant at the 1% level (Bloom et al. 2017.)

The authors also note that, considering the existing estimates, according to which approximately half of the measured firm TFP consists of measurement error, it is plausible that the factors analysed here explain as much as 60% of the non-measurement error productivity variation (Bloom et al. 2017). Based on the results presented above, management is an important part of this large and relatively well understood fraction of variation in productivity.

The analysis of the relationship between more structured management practices and other firm performance measures (besides productivity) is based

on the MOPS year and the last year of the data from ASM, which are 2010 and 2013 respectively. Bloom et al. (2017) find that the number of employees grew more rapidly in plants that had adopted more structured management practices, a highly statistically significant result that persists after adding TFP as a regressor[13]. Furthermore, TFP itself seems to explain some of the employment growth, with a statistically significant coefficient of 0.033 (Bloom et al. 2017).

Management has a similar significant correlation with firm survival between the years 2010 and 2013. The average probability of exit without management or TFP is 7%, and a one standard deviation higher management scores implies a 2 percentage point decrease in the exit rate, which could be interpreted as either a 29% lower probability of exit or correspondingly as a 2.2% higher probability of survival. Including TFP does again not change the coefficient for management, but the correlation between TFP and survival is much smaller in comparison than with employment growth; a one standard deviation higher TFP implies only a 0.8 percentage point (11%) drop in the probability of exit. (Bloom et al. 2017.)

Profitability (operating profits/sales) and innovation (R&D spending per employee) are also found to be significantly connected with more structured management practices, even with all the control variables included. The coefficients of management on profitability and R&D per employee are 0.058 and 0.385, respectively. The results concerning profitability, firm growth, innovation and survival are consistent with the productivity analysis, in that management is strongly related to firm performance. Moreover, they find corresponding and compelling evidence for the correlation between management and performance across industries and geographical location. The credibility of the results is supported by an extensive set of robustness test. (Bloom et al. 2017.)

3.5.2 Germany and Pakistan

Whereas the US MOPS data consists of all manufacturing plants of multi-establishment firms and large single-establishment firms, the German MOPS or GMOP only includes manufacturing establishments with at least 25 employees. The results are very similar to those found in the US by Bloom et al. (2017), with similar large dispersion between establishments in all size classes. The management score is again also positively connected with establishment size, which has the highest explanatory power of all the variables on which the management score was regressed. (Broszeit et al. 2016.)

Other variables include foreign ownership, skills of managers (share of managers with a university degree) and exporting, all of which were found to have a statistically significant positive relationship with management. A contrary result, no significant association, was obtained with family ownership, skills of non-managers, level of competition and the presence of works councils as regressors. (Broszeit et al. 2016.)

[13] coefficient of 0.056 without TFP and 0.052 with TFP added to the equation.

The study also uses a standard productivity equation to analyse the link between labour productivity and management. The dependent variable in the estimated OLS regression is the natural logarithm of labour productivity, which is measured by value added per employee. The result is that a 0.1 increase in the management score implies an average increase of 7.1% in productivity. In the context of the German data, this signifies an 11.3% increase in labour productivity when the management score rises by one standard deviation. As a comparison, using US MOPS data, Bloom et al. (2013) find that a one standard deviation change in management implies a 21.3% change in labour productivity. (Broszeit et al. 2016.)

The average establishment in Germany is somewhat smaller than in the US, which could be one explanation for the large difference in the effect on productivity of management practices (Broszeit et al. 2016). It is plausible that smaller establishments have less use for high levels of structured management practices, which might explain why a country with smaller establishments would benefit less from increases in said practices. Broszeit et al. (2016) also suggest this as an explanation. Moreover, they find that the correlation between management and productivity increases with establishment size and use this to argue in favour of the suggested hypothesis (Broszeit et al. 2016).

In Pakistan, the sample is restricted to establishments in the province of Punjab with at least 10 employees. For comparability with the US MOPS, and to match the data with the 2010 Census of Manufacturing Industries (CMI) Survey data, the Management and Organizational Practices Survey in Pakistan (PK-MOPS) is completely based on recall questions, which raises concerns about the reliability of the answers. The face-to-face interviews were conducted between 2014 and 2015, but the questions concerned management practices in 2005 and 2010. To address recall bias, an aided recall technique was used during the interviews. Moreover, a comparison between the PK-MOPS answers and the CMI data was conducted to see if the differences in employment, which was asked in both surveys, changes in time. Some recall bias was found[14], but the responses do still provide useful and sufficiently accurate information. (Lemos et al. 2016.)

The results are very similar to those from the US and Germany: establishment size, age, exports and employee skills are all found to have a positive and significant correlation with more structured management practices. The magnitude of the size–management relationship in Pakistan is also very similar to the US.

Furthermore, the observed association between management scores and labour productivity is almost identical to the correlation presented by Bloom et al. (2013). A one standard deviation increase in the management score is associated with a 21.9% increase in productivity, whereas in the US the corresponding result is 21.3%. Controlling for capital per employee, interview noise and establishment size reduces the PK-MOPS result to 14.1%. When Lemos et al. (2016) use only

[14] The logs of employment from the PK-MOPS and CMI have a highly significant correlation coefficient of 0.85.

establishments with longitudinal data and add fixed effects, the correlation just loses its statistical significance at the 10 % confidence level, albeit the magnitude does not change. (Lemos et al. 2016.)

The most notable differences in the PK-MOPS results compared to the US and Germany are the considerably lower mean management score and even larger dispersion in management practices between establishments (Lemos et al. 2016). Moreover, Lemos et al. (2016) observed that Pakistani establishments in publicly listed firms have significantly lower management scores than those in firms of other ownership types. Thus far, this result is exclusive to Pakistan in MOPS based studies.

4 DATA AND METHODS

4.1 Data

The sample for the 2016 FMOP data collection consisted of 2509 Finnish manufacturing establishments with more than 4 employees. The final number of valid responses was 731, with a response rate of approximately 31% after accounting for over-coverage. Analysis of total non-response conducted by Statistics Finland showed that the distribution of respondents is skewed towards larger establishments, as measured by the number of personnel. Statistics Finland also conducted a post-stratification to provide sample weights that correct for some of the non-response bias in the data. Additional restrictions[15] dropped the final number of establishments used in the analysis down to 609.

The FMOP questionnaire has a total of 35 questions, of which 16 concern management practices. In addition to the 16 management questions, the questionnaire has 13 questions on organizational practices and 6 background questions. The questions concern the year 2016, but most of the questions also have a recall component, where respondents are asked to give an answer regarding the circumstances five years earlier. The complete FMOP questionnaire form is included as appendix C.

The responses for each question are normalized on a scale of 0 – 1 and the establishment-level management score is calculated as the unweighted average of the normalized responses. The answer options corresponding with management practices that are considered the most structured are assigned a value of 1 and the least structured practices are assigned a value of 0. Bloom et al. (2017) define more structured management practices as "those that are more specific, formal, frequent or explicit" (Bloom et al. 2017, 28).

The management questions can be divided into three sections: monitoring, targets and incentives. The monitoring section consists of questions 1 – 5 and they ask about the utilization and gathering of information and data in the monitoring of production. Questions 6 – 8 are about the setting of production targets and questions 9 – 16 ask about practices concerning bonuses and incentives, policies on recruitment and promotion as well as policies concerning the dismissal and reassignment of managers and non-managers.

For parts of the empirical analysis, control variables and regional subdivisions for the establishments in the FMOP data are acquired from the Establishments 2015 data set of the Finnish Business Register by Statistics Finland. Only data concerning establishments that responded to the questionnaire was used. All handling of data has been conducted following disclosure avoidance procedures to ensure the confidentiality of individual survey units.

[15] More closely described in appendix B

4.2 Descriptive statistics

With a standard deviation of 0.13, the dispersion of management practices between establishments is evident. As described by Maliranta and Ohlsbom (2017), approximately 7% of establishments have a management score higher than 0.8, whereas establishments with a score of under 0.4 make up a little over 5% of the data. Furthermore, FIGURE 3 shows that the distribution is skewed slightly to the left, which indicates that the mass of the establishments is concentrated on the right side of the distribution. A rudimentary examination of the data showed that a considerable part of this dispersion relates to differences in establishment size. This aspect of the dispersion is analysed more carefully by Maliranta and Ohlsbom (2017), who find a positive correlation between establishment and firm size and management scores.

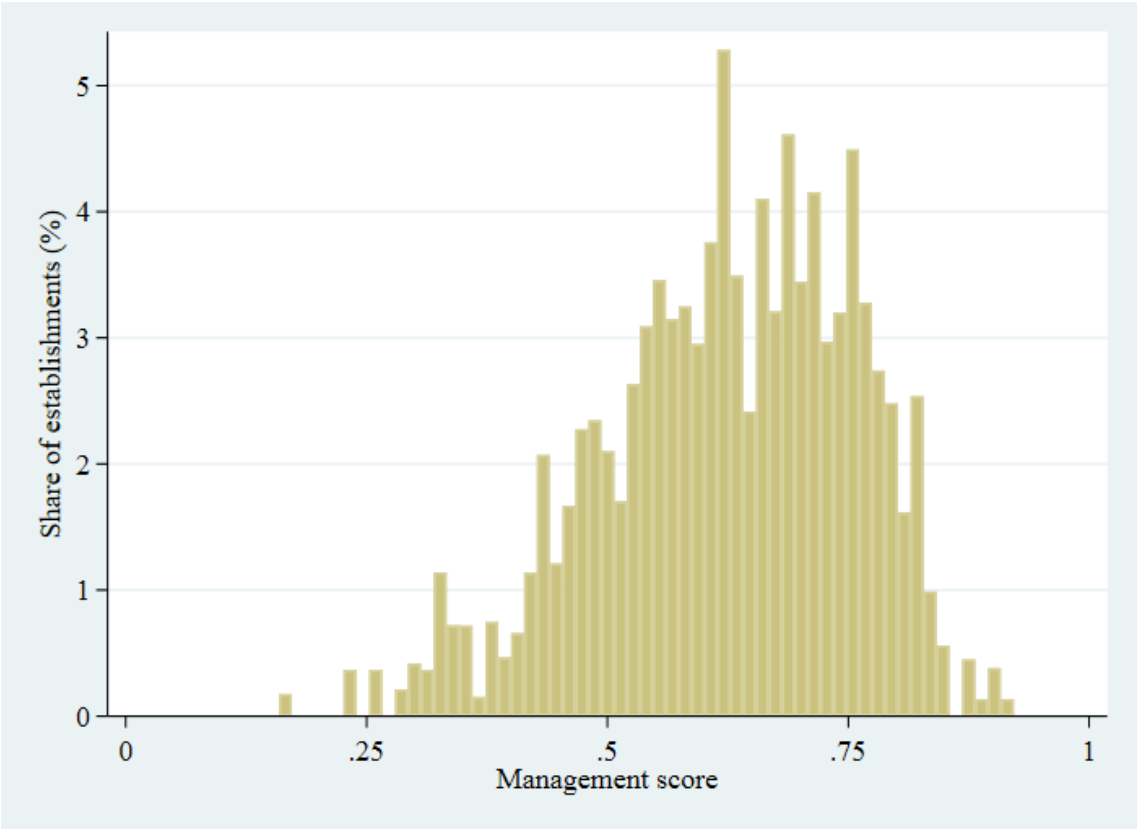

FIGURE 3 Distribution of the unweighted management score.

The empirical analysis in the following section is focused on the possible role of cross-regional differences in the dispersion of management practices. The subdivision of large areas[16] is used to examine whether management scores in Helsinki-Uusimaa differ from those of the rest of the country. This division was

[16] Level 2 of the subdivisions in the Nomenclature of Territorial Units for Statistics (NUTS) codes of Finland.

chosen to ensure that the areas have enough establishments in the data. Åland, with only two establishments included in the data, was omitted for the same reason. The rest of the country is compared to Helsinki-Uusimaa because it has the highest employment weighted (aggregate) and unweighted average management scores (0.71 and 0.64 respectively). TABLE 1 shows descriptive statistics of the data for the division of Finnish large areas used in the analysis. All analysis was conducted also with West Finland replacing Helsinki-Uusimaa as the area of comparison, with no differing results.

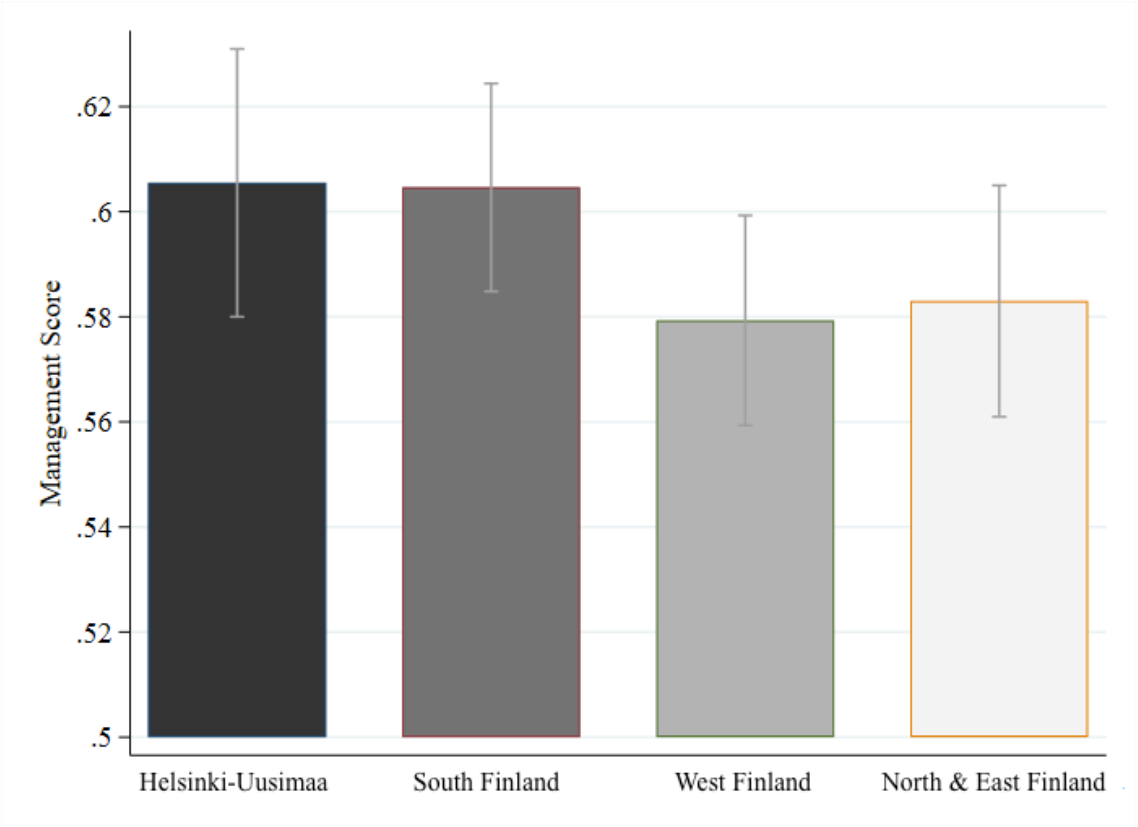

FIGURE 4 Unweighted average management scores by large areas with confidence intervals. Åland is omitted with only two establishments in the FMOP data.

Studies from other countries have found significant differences between geographical areas (i.e. Bloom et al. (2013) and Bloom, Genakos, Sadun & Van Reenen (2012)). By looking at only descriptive statistics, these differences are not as apparent in Finnish large areas. FIGURE 4 demonstrates that the differences in the unweighted average management scores between the Finnish large areas are quite small, especially in relation to the confidence intervals. The differences are also not statistically significant. However, these are unweighted averages that do not take the allocation of workforce into consideration.

TABLE 1 Descriptive statistics.

	Number of establishments	Total number of employees	Aggregate management score	Unweighted management score
Helsinki-Uusimaa	98	12175.2	0.71	0.64
Other large areas	511	54424.0	0.68	0.63
Total	609	66599.2	0.69	0.63

In terms of economic and policy significance, the amount of workforce allocated to establishments with good management practices is an important measure. This allocation of workforce is one part of the aggregate or employment weighted management score, the other part being the unweighted average. A decomposition of management practices could reveal statistically significant cross-regional differences in the allocation term.

4.3 Methods

The decomposition of management practices used in the empirical analysis follows the method developed by Olley and Pakes (1996). In economic literature, these kinds of decompositions have often been used to analyse productivity growth. In the decomposition, aggregate productivity is divided into two terms: unweighted average productivity and a covariance term between productivity and firm size. The part of the differences in productivity that is captured by the latter, also known as the allocation term, is essential, because it describes how much of the input activity is allocated to more productive establishments or enterprises (Hyytinen et al. 2016).

A significant part of the growth and cross-country dispersion of productivity is likely to be caused by the reallocation of resources from enterprises with low productivity to those with high productivity (Maliranta & Määttänen 2015). The covariance-like allocation term of the Olley-Pakes decomposition is a much-used measure for this reallocation, as it is straightforward and has been theoretically and empirically shown to provide meaningful information about its impact. Bartelsman et al. (2013), for example, argue that the allocation term is a robust indicator for the misallocation of resources and that it interacts strongly with frictions and policy induced market distortions.

As with productivity, these qualities make the Olley-Pakes covariance term essential in the analysis of cross-regional differences in management practices, in terms of how they relate to competitiveness. The aggregate (employment weighted) management score can be decomposed into the unweighted average score and the allocation effect, which is a covariance-like term between the management score and the size of the workforce in an establishment. Here, the

allocation term is economically significant because it provides a measure for the amount of workforce that is allocated to establishments with high management scores: the larger the term, the more workforce is working under better management practices. This means that, in terms of competitiveness, the allocation term plays a crucial part when studying cross-regional differences in management practices.

However, standard errors for the components of the management score cannot be procured with the Olley-Pakes (OP) method. This is a serious concern, as estimates drawn from the FMOP data will be affected by sampling error. To obtain standard errors for the OP decomposition, a moment-based procedure, introduced by Hyytinen, Ilmakunnas and Maliranta (2016), is used. This method allows statistical inference and hypothesis testing concerning the magnitude of the OP components, which in turn allows more statistically meaningful cross-regional comparisons of the allocation term.

The procedure is based on a method of moments estimation, which is a way of motivating an ordinary least squares (OLS) estimator (Davidson 2001). Hyytinen et al. (2016) show how the components of the OP decomposition of aggregate productivity can be captured with a generalized method of moments (GMM) approach. Here the basis of the same procedure will be concisely outlined for the aggregate management score in a cross-sectional setting. Following Olley and Pakes (1996), the decomposition is described by the expression

$$M_i = \bar{m} + \sum_{i=1}^{N} (s_i - \bar{s})\,(m_i - \bar{m}), \tag{18}$$

where m_i is the management score of establishment i. s_i is the activity share of establishment i, as measured by labour input shares. This means that $s_i = L_i / \sum_{i=1}^{N} L_i$, where L_i is the number of employees in establishment i and N is the total number of establishments. In equation (18), $\bar{m}_i$ denotes the unweighted mean of the management scores, whereas the weighted or aggregate management score is $M_i = \sum_{i=1}^{N} s_i m_i$. The remaining term $\sum_{i=1}^{N}(s_i - \bar{s})(m_i - \bar{m})$ is the allocation term, where the unweighted mean of the labour input shares is $\bar{s} = 1/N$ and $s_i - \bar{s}$ is the difference of the labour share of establishment i from the unweighted mean. Similarly, $m_i - \bar{m}$ denotes the difference of the management score of establishment i from the unweighted average. (Hyytinen et al. 2016.)

By regressing the management score m_i on a scaled labour input share measure s_i^* and a constant, the terms on the right-hand side of equation (18) can be jointly estimated with an OLS regression. It follows from the population moments expression of the regression

$$E[m_i|s_i] = E[m_i] + cov(m_i, s_i)var(s_i)^{-1}(s_i - E[s_i]), \tag{19}$$

described by Hyytinen et al. (2016), that a GMM estimation can capture the OP components described by the two terms in equation (18). To obtain point estimates for these two components, the activity share measure s_i needs to be scaled as follows: $s_i^* = (s_i - \bar{s})/\hat{\sigma}^2 N$, where $\hat{\sigma}^2$ denotes the sample variance of s_i: $\hat{\sigma}^2 = N^{-1}\sum_{i=1}^{N}(s_i - \bar{s})^2$. Then an OLS regression, where m_i is regressed on s_i^* and a constant, is conducted. The unweighted mean of the management scores $\bar{m}_i$ is obtained from the OLS estimator for the constant, and the allocation term $\sum_{i=1}^{N}(s_i - \bar{s})(m_i - \bar{m})$ equals the coefficient of the slope in the OLS estimation. (Hyytinen et al. 2016.)

A more detailed description of the moment-based approach, with extensions and an application using Finnish firm level data, can be found in Hyytinen et al. (2016).

5 RESULTS

5.1 Premise

The descriptive statistics presented in the previous section would suggest that there are no significant differences in management practices between the large areas of Finland. However, a simple inspection of means gives no insight on possible differences in the covariance-like allocation term. Moreover, Hyytinen et al. (2016) have shown that a regular OP decomposition does not solve this problem. Using employment weights to calculate the allocation term distorts the standard errors of regular means and OLS regressions. To obtain undistorted and heteroscedasticity robust standard errors for the aggregate management score and the allocation term, a procedure based on GMM estimation is used.

5.2 Results from the moment-based approach

TABLE 2 shows the results of the moment-based estimation. The left column shows the point estimates for both areas, whereas the right column shows the associated 95% confidence intervals. The first two numbers for each column are for the unweighted average management score of each area. The second two numbers show the results for the allocation term of each area, and at the bottom is the aggregate (employment weighted) average, which is the sum of the first two components.

The results in TABLE 2 show that the confidence intervals for each term are much narrower for the rest of the Finnish large areas than for Helsinki-Uusimaa. This is not surprising as the number of establishments in the other areas combined is 511, whereas the data contains only 98 establishments in Helsinki-Uusimaa. The allocation terms for Helsinki-Uusimaa and the rest of the country are 9.9% and 7.4% of the aggregate management score, respectively. Furthermore, a visual inspection of the components in TABLE 2 would suggest that significant cross-regional differences in any of the terms are unlikely. However, the results of Hyytinen et al. (2016) indicate that formal statistical inference in the form of hypothesis testing can lead to different conclusions.

Testing the null hypotheses that the two components of the aggregate management score are not different between Helsinki-Uusimaa and the other large areas shows that here the initial observation was not necessarily wrong; the null hypotheses cannot be rejected at any reasonable level of significance. Therefore, based on the analysis presented, no statistically significant differences in management practices or the allocation term between Helsinki-Uusimaa and the rest of the country can be asserted.

TABLE 2 Weighted and unweighted average management scores and allocation term by large area with confidence intervals.

		95% confidence interval	
	Point estimate	Lower bound	Upper bound
Unweighted average management score			
Helsinki-Uusimaa	0.64	0.61	0.66
Other large areas	0.63	0.62	0.64
Allocation term			
Helsinki-Uusimaa	0.07	0.04	0.11
Other large areas	0.05	0.03	0.08
Aggregate average management score			
Helsinki-Uusimaa	0.71	0.67	0.75
Other large areas	0.68	0.66	0.70

The allocation term can also be computed using an OLS regression, but this results in distorted standard errors and does not allow for meaningful statistical cross-regional comparisons, which is why the GMM estimation procedure was used. However, Hyytinen et al. (2016) do not describe a method for including control variables or accounting for industry fixed effects in the moment-based estimation. Therefore, an OLS regression is used to give some approximate indication of how these factors might affect the analysis. The results of the OLS regression can be found in TABLE 3.

Adding employee education (average years of schooling) and productivity (logarithm of revenue/number of employees) as controls has very little effect on the results. The p-values of the differences in both the weighted and un-weighted management scores remain so high, that even though the standard errors are not reliable, this does suggest that the control variables have no meaningful effect on the statistical significance of the results. Correspondingly, adding industry fixed effects with both control variables included does not change the results.

Only when employee education is excluded and industry fixed effects, together with productivity, are included, is the difference in the employment weighted average statistically significant at the 10% confidence level. The average management score is approximately 0.04 lower for the other large areas.

TABLE 3 OLS Regression results

Management score	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
Employment weighted		Yes		Yes		Yes		Yes		Yes		Yes
Other large regions	-0.010	-0.028	-0.014	-0.025	-0.007	-0.034	-0.010	-0.039*	-0.012	-0.036	-0.015	-0.040
	(0.014)	(0.023)	(0.016)	(0.025)	(0.015)	(0.021)	(0.015)	(0.022)	(0.016)	(0.023)	(0.016)	(0.024)
Employee education			0.018***	0.003					0.014***	-0.005	0.012**	-0.006
			(0.005)	(0.008)					(0.005)	(0.008)	(0.006)	(0.008)
Productivity (log)					0.030***	0.044***	0.027***	0.041***	0.032***	0.045***	0.029***	0.042***
					(0.006)	(0.009)	(0.006)	(0.009)	(0.007)	(0.009)	(0.007)	(0.009)
Observations	603	603	519	519	603	603	603	603	519	519	519	519
Industry Fixed Effects							Yes	Yes			Yes	Yes
R^2	0.0007	0.0084	0.0216	0.0083	0.0431	0.0869	0.0699	0.1132	0.0714	0.0851	0.0988	0.1148
Prob > F	0.5057	0.2259	0.0023	0.4936	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Notes: The coefficient for other large regions shows the difference in the mean of the management score in the rest of Finland compared to Helsinki-Uusimaa. Productivity (log) is measured as log(revenue/number of employees). Employee education is measured as the employees' average years of schooling for each establishment. Prob > F is the p-value of the F-test. Standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

This could be considered a somewhat significant difference in magnitude, as the management scores are normalized on a scale of 0 – 1. The difference in the unweighted mean remains non-significant, which could imply that the difference in the aggregate score is caused by differing allocation terms between the two large areas. However, this is very speculative, as the OLS regression allows for meaningful statistical inference concerning only the unweighted average management score.

5.3 Validity of the results

As mentioned in section 4, the data is skewed towards larger establishments and establishment size seems to be positively correlated with the management score. This means that the sample means calculated from the data are very likely to be too high compared to the population means, unless post-stratification weights are used to correct for this non-response bias. It is plausible that the bias could be bigger in one large area than in another, in which case the management scores of the large area with more non-response bias would be overestimated.

Furthermore, the number of establishments in the data is relatively small, which might explain the lack of statistically significant results. The use of large areas in the analysis was chosen partly because of this, and still the number of data points for each area remains somewhat low. The cross-regional differences are also small in magnitude, which might not change with a larger sample, but more could be concluded from small but statistically significant differences. At least the non-significance of the results could be stated with more certainty if the sample size was clearly larger.

The FMOP, like any large-scale survey, does almost certainly suffer from survey noise, but there should be no systematic differences in the amount or type of survey noise between the large areas. Therefore, it is not likely to interfere with the comparisons. Moreover, all analysis was conducted with an additional geographical division, where West Finland was compared to all the other large areas. This change did not yield any statistically significant results. Some rudimentary descriptive analysis was also conducted using Finnish regions (NUTS 3). The results suggest that the statistical non-significance of the cross-regional differences is likely to be preserved on this level of geographical division. However, for some of the regions, the number of establishments in the data is extremely small.

A simple linear regression analysis[17] was also conducted to ensure that the Olley-Pakes components have been correctly estimated with the GMM procedure. The OLS regression resulted in the same coefficients as the moment-based procedure, as intended. Furthermore, the OLS and the moment-based estimations have all been conducted in levels as well as in log-units, both of which returned the same results.

[17] TABLE 3 OLS Regression results

6 CONCLUSIONS

It has long been suggested that the quality of management could play a significant role in explaining differences in productivity. The development of the Management and Organizational Practices Survey tool and its derivatives has greatly aided the empirical scrutiny of this subject. Empirical studies have already found compelling evidence of the link between management practices and productivity, along with other firm-level performance indicators. In many countries, large dispersion in the quality of management practices has been found between establishments, firms, industries and geographical areas.

An examination of Finnish manufacturing establishments using data from the Finnish Management and Organizational Practices Survey showed no significant cross-regional differences when comparing Helsinki-Uusimaa to the rest of the country. An Olley-Pakes decomposition is used the divide the aggregate (employment weighted) management score into an unweighted average component and a covariance-like allocation term. Furthermore, the decomposition is conducted using a moment-based estimation, following Hyytinen et al. (2016), to obtain standard errors for these components. The analysis showed little to no differences in the two components of the aggregate average management score between the large areas of Finland. Mainly, the Olley-Pakes allocation term of the management score seems to have no statistically significant cross-regional variance.

This is important, because it suggests that Helsinki-Uusimaa has no evident competitive advantage in terms of the adoption of structured management practices in the manufacturing sector. Moreover, no apparent cross-regional differences suggests that there is no need to focus effort on improving the management practices of any particular geographical area in Finland, at least on the level of large areas. Large differences are unlikely to exist between regions as well, at least when compared to other countries.

However, restrictions of the data and the inability to include control variables or industry fixed effects in the moment-based estimation gives reason to question the validity of the results. The rudimentary robustness checks, like changing the large area division, support the findings, but are not enough to erase uncertainty. In the future, more comprehensive data could be collected using the FMOP, to remove some of these doubts.

More robust results could also be achieved by combining the FMOP data with the exceptionally rich microdata of Statistics Finland. The shortcomings of the data could then be analyzed more carefully, and more potent measures could be taken to ensure the robustness of the results. Furthermore, cross-country comparisons of the Olley-Pakes components of the management score would give valuable information regarding the differences in the linkage between resource allocation and management practices. Studies examining the allocation term of the management score are still very scarce.

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APPENDIX A: FIGURES AND TABLES

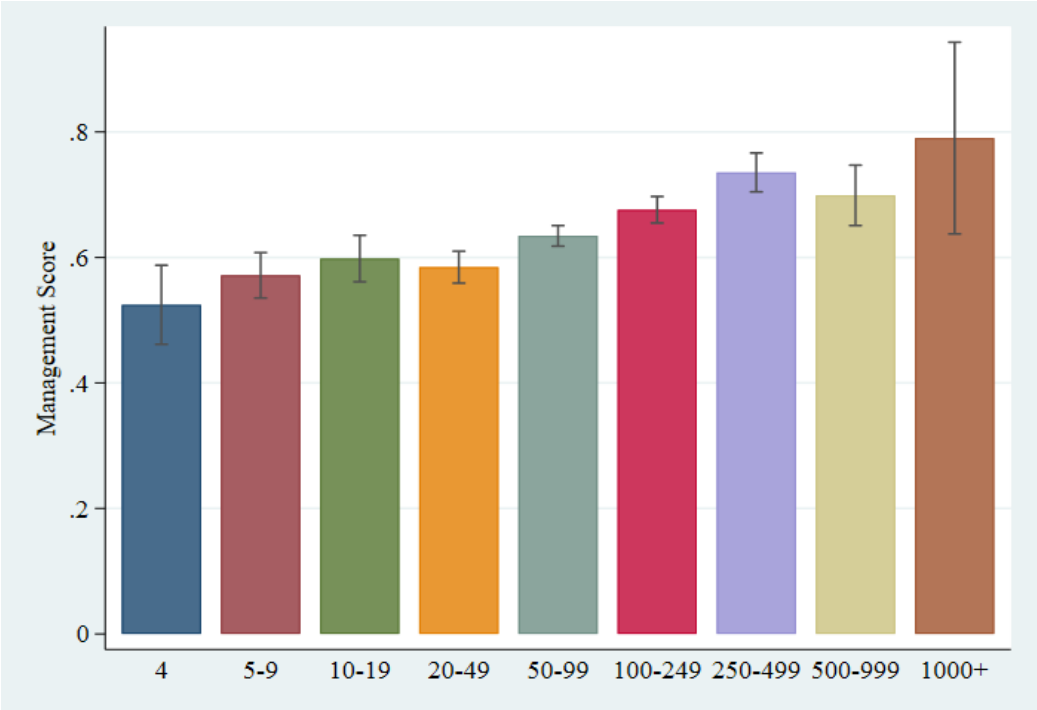

FIGURE A.5 Unweighted average management score by establishment size (number of employees) with confidence intervals.

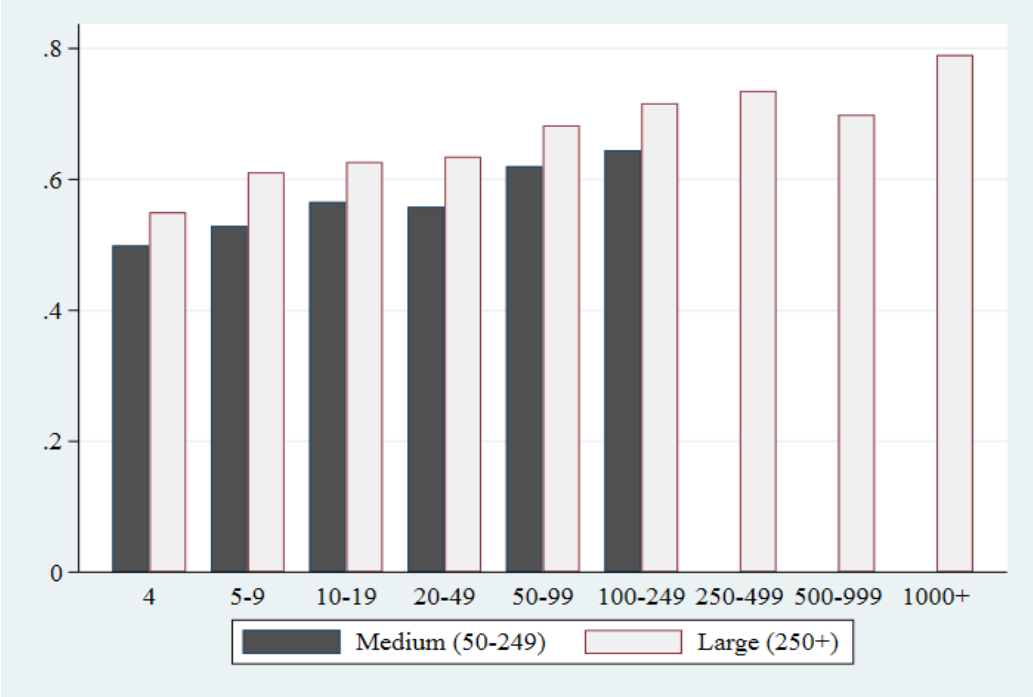

FIGURE A.6 Unweighted average management score by establishment size (number of employees) in medium and large enterprises.

FIGURE A.7 Unweighted average management score by region.

APPENDIX B: DATA DESCRIPTION

Survey Design

Sampling frame

The enterprise-level sampling frame for the 2016 FMOP is based on the total sample of Statistics Finland's Financial statements inquiry for enterprises (TILKES). The TILKES concerns all enterprises that employ over 50 people, as well as enterprises whose turnover is more EUR 40 million or whose balance sheet exceeds EUR 300 million. The inquiry also includes 10-50 employee enterprises, which have been drawn by random sampling, some enterprises with less than 10 employees and all enterprises owned by municipalities. The inquiry includes approximately 6000 enterprises in total. The FMOP sampling frame consists mainly of the over 4-employee manufacturing establishments in over 50-employee enterprises included in the TILKES inquiry. (Statistics Finland 2017.)

Sample

The sample for the 2016 FMOP data collection consisted of 2509 manufacturing establishments with at least 4 employees that were extracted from the manufacturing and non-manufacturing enterprises included in the TILKES based sampling frame. Establishments were classified as manufacturing if they belong to industries 05-39 in the Standard Industrial Classification TOL 2008 (Statistics Finland 2017). A manufacturing establishment with at least 4 employees was picked from the sampling frame if it belonged to an enterprise with more than 50 employees, with an over EUR 40 million turnover or a balance sheet of more than EUR 300 million. The main rule in the sample selection was the number of personnel, but the sample includes 38 units that belong to enterprises with less than 50 employees, due to the other conditions. Because the establishments for the sample were chosen by nonprobability sampling, most of the results can only be generalised to the subset of manufacturing establishments which have at least 4 employees and are a part of an enterprise with at least one of the following qualities: more than 50 employees, a turnover of more than EUR 40 million or a balance sheet that exceeds EUR 300 million. (Statistics Finland 2017.)

Data collection

The first step of data collection was to find a respondent for each establishment in the sample. Telephone interviews were conducted to find plant managers to send the questionnaire to. 10% of the original sample was lost at this phase due to over-coverage and unwillingness to answer. The survey was conducted as an internet questionnaire, the description, instructions and link for which were sent out as an email to the target respondents. Responding was voluntary, and three follow-ups were sent to establishments that could not be reached or did not respond. Over-coverage and establishments that were explicitly unwilling to answer were dropped after each follow-up.

Questionnaire content
To ensure comparability between results, the FMOP questionnaire was replicated from the United States 2010 MOPS[18] as closely as possible. The questionnaire has a total of 35 questions, of which 16 concern management practices. In addition to the 16 management questions, the questionnaire has 13 questions on organizational practices and 6 background questions. The questionnaire concerns the past year (2016), but most of the questions also have a recall component, where respondents are asked to give an answer regarding the circumstances five years earlier (2011). The questions are in Finnish and have been translated to correspond with the questions of the US MOPS. The complete FMOP questionnaire can be found at the end of this document.

Data

The final number of valid responses was 731, with a response rate of approximately 31% after accounting for over-coverage. According to the feedback from the establishments, the voluntary nature of the survey was a major negative factor in the willingness to respond. This can also be seen when comparing the 31% response rate of the FMOP to the 78% response rate of the original 2010 MOPS in the United States, where the survey was mandatory. Technical issues also affected the response rate, as the survey was conducted solely through internet collection. Analysis of total non-response conducted by Statistics Finland showed that the distribution of respondents was skewed towards larger establishments, as measured by the number of personnel. Statistics Finland conducted a post-stratification to provide sample weights that correct for non-response bias. The over-coverage of 146 establishments was also taken into account when constructing the sample weights.

Restriction of data
The industries 05-39 in the Standard Industrial Classification include (in addition to manufacturing) mining and utilities, which were not included in the United States MOPS sample. Therefore, the FMOP analysis is conducted with and without the two additional industries, and removing the industries restricts the data by 98 observations. Furthermore, in accordance with the United States MOPS, only establishments with at least 11 non-missing responses to the 2016 management questions are included in the analysis. This means that an additional 24 (or 28 if mining and utilities are included) establishments, or about 3.8% of the data, are dropped due to item non-response and the final number of establishments used in most of the analysis is 609. Item non-response was more severe in the 2011 recall questions, with a total of 146 establishments with less than 11 non-missing responses. However, the included establishments were chosen based

[18] Available at https://www.census.gov/programs-surveys/mops/technical-documentation/questionnaires.html.

solely on the responses for 2016. There are no establishments in the data that have at least 11 non-missing responses for 2011 but less than 11 non-missing responses for 2016 in the data. Item non-response does not distort the management scores, which are calculated as the unweighted average of the responses, but it would cause bias in estimates regarding individual questions.

Scoring

The responses for each question are normalized on a scale of 0 – 1 and the establishment-level management score is calculated as the unweighted average of the normalized responses. The answer options corresponding with management practices that are considered the most structured are assigned a value of 1 and the least structured practices are assigned a value of 0. Bloom et al. (2017) define more structured management practices as "those that are more specific, formal, frequent or explicit" (Bloom et al. 2017, 28).

The management questions can be divided into three sections: monitoring, targets and incentives. The monitoring section consists of questions 1 – 5 and they ask about the utilization and gathering of information and data in the monitoring of production. Questions 6 – 8 are about the setting of production targets and questions 9 – 16 ask about practices concerning bonuses and incentives, policies on recruitment and promotion as well as policies concerning the dismissal and reassignment of managers and non-managers.

APPENDIX C: FMOP QUESTIONNAIRE FORM

Osa A – Johtaminen

1 Mikä seuraavista kuvaa parhaiten toimipaikassa tehtyjä toimenpiteitä, kun tuotannossa havaittiin ongelma vuosina 2011 ja 2016?

Esimerkki: laadullisen vian löytäminen tuotteesta tai koneiston hajoaminen.

Merkitse yksi vaihtoehto molempien vuosien sarakkeeseen.

	2011	2016
Ongelma korjattiin, mutta muita toimenpiteitä ei tehty		
Ongelma korjattiin ja varmistettiin, ettei ongelmaa ilmene uudelleen		
Ongelma korjattiin ja varmistettiin, ettei ongelmaa ilmene uudelleen. Lisäksi meillä on jatkuvan kehittämisen prosessi tällaisten ongelmien ennakoimiseksi		
Mitään toimenpiteitä ei tehty		
Mitään ongelmaa ei havaittu		
Toimipaikan tietoja ei ole saatavilla vuodelta 2011		

2 Kuinka montaa suoritusmittaria toimipaikassa seurattiin vuosina 2011 ja 2016?

Esimerkiksi tuotannon, kustannusten, hävikin, laadun, varastojen, energian, poissaolojen ja toimitusaikojen mittarit.

Merkitse yksi vaihtoehto molempien vuosien sarakkeeseen.

	2011	2016
1-2 mittaria		
3-9 mittaria		
10 tai useampaa mittaria		
Ei ollenkaan suorituskykymittareita		

Jos suoritusmittareita ei ollut kumpanakaan vuonna, lomake hyppää kysymykseen 6.

3 Kuinka usein toimipaikan **johtajat seurasivat** suoritusmittareita vuosina 2011 ja 2016?

Johtajaksi tässä tulkitaan henkilö, jolla on sellaisia suoria alaisia, joita hän tapaa säännöllisesti, joiden rekrytoimiseen, työehtojen sopimiseen ja ylennyksien tekemiseen hän on osallistunut (esimerkiksi laitoksen johtaja, henkilöstöjohtaja tai laatupäällikkö).

***Merkitse kaikki sopivat vaihtoehdot** molempien vuosien sarakkeeseen.*

	2011	2016
Vuosittain		
Vuosineljänneksittäin		
Kuukausittain		
Viikoittain		
Päivittäin		
Tunneittain tai useammin		
Ei koskaan		

4 Kuinka usein **joku muu** kuin toimipaikan johtaja **seurasi** suoritusmittareita tässä toimipaikassa vuosina 2011 ja 2016?

Muilla kuin johtajilla viitataan tässä kaikkiin muihin toimipaikan työntekijöihin, joita ei voida määritellä johtajiksi edellisen kysymyksen määritelmän mukaisesti.

***Merkitse kaikki sopivat vaihtoehdot** molempien vuosien sarakkeeseen.*

	2011	2016
Vuosittain		
Vuosineljänneksittäin		
Kuukausittain		
Viikoittain		
Päivittäin		
Tunneittain tai useammin		
Ei koskaan		

5 Mihin tuotannosta ja muista suoritusmittareista kertovat tiedot oli sijoitettu toimipaikassa vuosina 2011 ja 2016?

Merkitse yksi vaihtoehto molempien vuosien sarakkeeseen.

	2011	2016
Kaikki tiedot olivat nähtävissä vain yhdessä ja samassa paikassa (esim. tuotantolinjan päässä)		
Tietoja oli nähtävissä useassa paikassa (esim. useassa kohtaa pitkin tuotantolinjaa)		
Toimipaikassa ei ollut nähtävillä kyseisiä tietoja		

6 Mikä seuraavista kuvaa parhaiten tuotantotavoitteiden aikajännettä toimipaikassa vuosina 2011 ja 2016?

Merkitse yksi vaihtoehto molempien vuosien sarakkeeseen.

	2011	2016
Pääpaino oli lyhyen aikavälin tuotantotavoitteissa (alle yksi vuosi)		
Pääpaino oli pitkän aikavälin tuotantotavoitteissa (yli yksi vuosi)		
Sekä lyhyen että pitkän aikavälin tuotantotavoitteissa		
Ei tuotantotavoitteita		

Jos tuotantotavoitteita ei ollut kumpanakaan vuonna, lomake hyppää kysymykseen 13a.

7 Kuinka helppoa tai vaikeaa tavoitteiden saavuttaminen oli vuosina 2011 ja 2016?

Merkitse yksi vaihtoehto molempien vuosien sarakkeeseen.

	2011	2016
Mahdollista saavuttaa ilman suurempaa vaivannäköä		
Mahdollista saavuttaa pienellä vaivannäöllä		
Mahdollista saavuttaa normaalilla vaivannäöllä		
Mahdollista saavuttaa normaalia suuremmalla vaivannäöllä		
Mahdollista saavuttaa vain aivan poikkeuksellisella vaivannäöllä		

8 Ketkä tiesivät tämän toimipaikan tuotantotavoitteista vuosina 2011 ja 2016?

Merkitse yksi vaihtoehto molempien vuosien sarakkeeseen.

	2011	2016
Vain ylimmät johtajat		
Useimmat johtajat ja osa tuotantotyöntekijöistä		
Useimmat johtajat ja useimmat tuotantotyöntekijät		
Kaikki johtajat ja kaikki tuotantotyöntekijät		

9 Mihin **muiden kuin johtajien** tulospalkkiot perustuivat vuosina 2011 ja 2016?

Merkitse kaikki sopivat vaihtoehdot *molempien vuosien sarakkeeseen.*

	2011	2016
Työntekijöiden omaan suoritukseen, jota mitattiin tuotantotavoitteiden avulla		
Tiimien tai työvuorojen suoritukseen, jota mitattiin tuotantotavoitteiden avulla		
Toimipaikan suoritukseen, jota mitattiin tuotantotavoitteiden avulla		
Yrityksen suoritukseen, jota mitattiin tuotantotavoitteiden avulla		
Ei ollut tulospalkkiota		

Jos tulospalkkiota ei ollut kumpanakaan vuonna, lomake hyppää kysymykseen 11.

10 Jos tuotantotavoitteet saavutettiin, mikä osa **muista kuin johtajista** sai tulospalkkion tässä toimipaikassa vuosina 2011 ja 2016?
Merkitse yksi vaihtoehto molempien vuosien sarakkeeseen.

	2011	2016
0 %		
1 - 33 %		
34 - 66 %		
67 - 99 %		
100 %		
Tuotantotavoitteita ei saavutettu		

11 Mihin **johtajien** tulospalkkiot yleensä perustuivat vuosina 2011 ja 2016?
Merkitse kaikki sopivat vaihtoehdot *molempien vuosien sarakkeeseen.*

	2011	2016
Johtajien omaan suoritukseen, jota mitattiin tuotantotavoitteiden avulla		
Tiimin tai työvuoron suoritukseen, jota mitattiin tuotantotavoitteiden avulla		
Toimipaikan suoritukseen, jota mitattiin tuotantotavoitteiden avulla		
Yrityksen suoritukseen, jota mitattiin tuotantotavoitteiden avulla		
Ei tulospalkkioita		

Jos tulospalkkioita ei ollut kumpanakaan vuonna, lomake hyppää kysymykseen 13a.

12 Jos tuotantotavoitteet saavutettiin, mikä osa **johtajista** sai tulospalkkion tässä toimipaikassa vuosina 2011 ja 2016?
Merkitse yksi vaihtoehto molempien vuosien sarakkeeseen.

	2011	2016
0 %		
1 - 33 %		
34 - 66 %		
67 - 99 %		
100 %		
Tuotantotavoitteita ei saavutettu		

13a Mikä oli ensisijainen tapa **muiden kuin johtajien** ylentämiseen tässä toimipaikassa vuosina 2011 ja 2016?
Merkitse yksi vaihtoehto molempien vuosien sarakkeeseen.

	2011	2016
Ylennykset perustuivat ainoastaan suoritukseen ja kyvykkyyteen		
Ylennykset perustuivat osittain suoritukseen ja kyvykkyyteen, ja osittain muihin tekijöihin (esimerkiksi tuttava- tai perhesuhteet)		
Ylennykset perustuivat pääosin muihin tekijöihin kuin suoritukseen tai kyvykkyyteen (esimerkiksi tuttava- tai perhesuhteet)		
Muita kuin johtajia ei yleensä ylennetä		

13b Mitkä alla olevista vaihtoehdoista olivat ensisijaiset kriteerit **muiden kuin johtajien** rekrytoimiseen muualta vuosina 2011 ja 2016?
Numeroi tärkeysjärjestyksessä molempina vuosina asteikolla 1-5.
1 on tärkein, 2 toiseksi tärkein, ... ja 5 vähiten tärkeä.

	2011	2016
Tehtävään liittyvä tietämys ja kyvyt		
Vuorovaikutus- ja neuvottelutaidot		
Tuttu sosiaalisten verkostojen kautta (työskennellyt aikaisemmin tässä yrityksessä/toimipaikassa, kollegojen tuttu, perhesuhteet tms.)		
Täsmällisyys ja luotettavuus annettujen tehtävien suorittamisessa		
Motivaatio suorittamisessa		

14a Mikä oli ensisijainen tapa **johtajien** ylentämiseen tässä toimipaikassa vuosina 2011 ja 2016?

Merkitse yksi vaihtoehto molempien vuosien sarakkeeseen.

	2011	2016
Ylennykset perustuivat ainoastaan suoritukseen ja kyvykkyyteen		
Ylennykset perustuivat osittain suoritukseen ja kyvykkyyteen, ja osittain muihin tekijöihin (esimerkiksi tuttava- tai perhesuhteet)		
Ylennykset perustuivat pääosin muihin tekijöihin kuin suoritukseen tai kyvykkyyteen (esimerkiksi tuttava- tai perhesuhteet)		
Johtajia ei yleensä ylennetä		

14b Mitkä alla olevista vaihtoehdoista olivat ensisijaiset kriteerit **johtajien** rekrytoimiseen muualta vuosina 2011 ja 2016?

Numeroi tärkeysjärjestyksessä molempina vuosina asteikolla 1-5.
1 on tärkein, 2 toiseksi tärkein, ... ja 5 vähiten tärkeä.

	2011	2016
Tehtävään liittyvä tietämys ja kyvyt		
Vuorovaikutus- ja neuvottelutaidot		
Tuttu sosiaalisten verkostojen kautta (työskennellyt aikaisemmin tässä yrityksessä/toimipaikassa, kollegojen tuttu, perhesuhteet yms.)		
Täsmällisyys ja luotettavuus annettujen tehtävien suorittamisessa		
Motivaatio suorittamisessa		

15 Milloin alisuoriutuva **muu kuin johtaja** erotettiin tai siirrettiin uuteen tehtävään vuosina 2011 ja 2016?

Merkitse yksi vaihtoehto molempien vuosien sarakkeeseen.

	2011	2016
Alle kuuden kuukauden jälkeen siitä, kun alisuoriutuminen havaittiin		
Yli kuuden kuukauden kuluttua siitä, kun alisuoriutuminen havaittiin		
Harvoin tai ei koskaan		

16 Milloin alisuoriutuva **johtaja** erotettiin tai siirrettiin uuteen tehtävään vuosina 2011 ja 2016?

Merkitse yksi vaihtoehto molempien vuosien sarakkeeseen.

	2011	2016
Alle kuuden kuukauden jälkeen siitä, kun alisuoriutuminen havaittiin		
Yli kuuden kuukauden kuluttua siitä, kun alisuoriutuminen havaittiin		
Harvoin tai ei koskaan		

Osa B - Organisaatio

17 Sijaitsiko yrityksen pääkonttori samassa paikassa kuin toimipaikka vuosina 2011 ja 2016?

Mikäli kyseessä on yksitoimipaikkainen yritys, merkitse molempien vuosien sarakkeisiin "kyllä".

	2011	2016
Kyllä		
Ei		

Jos kyllä molempina vuosina, lomake hyppää kysymykseen 24.

18 Missä tehtiin päätökset **pysyvien kokoaikaisten työntekijöiden palkkaamisesta** vuosina 2011 ja 2016?

Merkitse yksi vaihtoehto molempien vuosien sarakkeeseen.

	2011	2016
Vain tässä toimipaikassa		
Vain pääkonttorissa		
Sekä tässä toimipaikassa että pääkonttorissa		
Muualla, missä? _____		

19 Missä tehtiin päätökset **yli 10 % palkankorotuksien toteuttamisesta** vuosina 2011 ja 2016?

Merkitse yksi vaihtoehto molempien vuosien sarakkeeseen.

	2011	2016
Vain tässä toimipaikassa		
Vain pääkonttorissa		
Sekä tässä toimipaikassa että pääkonttorissa		
Muualla, missä? _____		

20 Missä tehtiin **uusia tuotteita** koskevat päätökset?

Merkitse yksi vaihtoehto molempien vuosien sarakkeeseen.

	2011	2016
Vain tässä toimipaikassa		
Vain pääkonttorissa		
Sekä tässä toimipaikassa että pääkonttorissa		
Muualla, missä? _____		

21 Missä tehtiin **tuotteiden hinnoittelua** koskevat päätökset vuosina 2011 ja 2016?

Merkitse yksi vaihtoehto molempien vuosien sarakkeeseen.

	2011	2016
Vain tässä toimipaikassa		
Vain pääkonttorissa		
Sekä tässä toimipaikassa että pääkonttorissa		
Muualla, missä? _____		

22 Missä tehtiin tuotteiden **markkinointia** koskevat päätökset vuosina 2011 ja 2016?

Merkitse yksi vaihtoehto molempien vuosien sarakkeeseen.

	2011	2016
Vain tässä toimipaikassa		
Vain pääkonttorissa		
Sekä tässä toimipaikassa että pääkonttorissa		
Muualla, missä? _____		

23 Kuinka paljon euromääräisesti voitiin käyttää investointeihin tässä toimipaikassa ilman valtuutusta pääkonttorista vuosina 2011 ja 2016?

Merkitse yksi vaihtoehto molempien vuosien sarakkeeseen.

	2011	2016
Alle 1000 €		
1000 € - 9999 €		
10 000 € - 99 999 €		
100 000 € - 999 999 €		
1 000 000 € tai enemmän		

24 Kuinka moni toimipaikan henkilöstöstä on suoraan tämän toimipaikan johtajan alaisia (raportoivat johtajalle suoraan) vuosina 2011 ja 2016?

Toimipaikan johtajan alaisia ovat sellaiset työntekijät, jotka ovat organisaatiossa seuraavalla alemmalla tasolla, tapaavat toimipaikan johtajaa säännöllisesti ja joiden rekrytoimiseen, palkkaukseen ja ylenemiseen toimipaikan johtaja on vaikuttanut.

	2011	2016
Alaisten määrä (arviokin riittää)		

25 Kuinka monta organisaatiotasoa tällä toimipaikalla on tuotantotasolta toimipaikan johtotasolle saakka laskettuna vuosina 2011 ja 2016?
Esimerkki: toimipaikassa, jossa on tuotantotaso, tuotannon esimiehet sekä laitoksen johtaja, tasojen lukumäärä on 3.

	2011	2016
Tasojen määrä (arviokin riittää)		

26 Kuka jakoi työtehtäviä tuotantotyöntekijöille tässä toimipaikassa vuosina 2011 ja 2016?
Merkitse yksi vaihtoehto molempien vuosien sarakkeeseen.

	2011	2016
Vain johtajat		
Pääosin johtajat		
Johtajat ja tuotantotyöntekijät yhdessä		
Pääosin tuotantotyöntekijät		
Vain tuotantotyöntekijät		
Joku muu, kuka? _____		

27 Mikä seuraavista kuvaa parhaiten **tiedon saatavuutta** päätöksenteon tueksi tässä toimipaikassa vuosina 2011 ja 2016?
Merkitse yksi vaihtoehto molempien vuosien sarakkeeseen.

	2011	2016
Tietoa ei ollut saatavilla		
Vähän tietoa oli saatavilla		
Kohtuullisesti tietoa oli saatavilla		
Paljon tietoa oli saatavilla		
Kaikki tarvittava tieto päätöksenteon tueksi oli saatavilla		

28 Mikä seuraavista kuvaa parhaiten **tiedon käyttöä** päätöksenteon tukena tässä toimipaikassa vuosina 2011 ja 2016?
Merkitse yksi vaihtoehto molempien vuosien sarakkeeseen.

	2011	2016
Tietoa ei käytetty päätöksenteon tukena		
Päätöksenteko perustuu hieman käytettyyn tietoon		
Päätöksenteko perustuu kohtuullisesti käytettyyn tietoon		
Päätöksenteko perustuu vahvasti käytettyyn tietoon		
Päätöksenteko perustuu kokonaan käytettyyn tietoon		

29 Oppivatko **johtajat** tässä toimipaikassa käytännön johtamisesta miltään seuraavista?
***Merkitse kaikki sopivat vaihtoehdot** molempien vuosien sarakkeeseen.*

	2011	2016
Konsultit		
Kilpailijat		
Alihankkijat, tavarantoimittajat		
Asiakkaat		
Yhdistykset tai konferenssit		
Uudet työntekijät		
Pääkonttori		
Muut, mitkä? _____		
Ei mikään ylläolevista		

Osa C – Taustatiedot

30 Millä organisaation tasolla työskentelit vuonna 2016?

- ☐ Toimitusjohtaja tai muu johtaja, esim. talousjohtaja
- ☐ Usean toimipaikan johtaja
- ☐ Yhden toimipaikan johtaja
- ☐ Jokin muu kuin johtaja
- ☐ Jokin muu, mikä? _____

31 Minä vuonna aloitit työskentelyn tässä toimipaikassa? _____

32 Kuinka monta **johtajaa** tässä toimipaikassa työskenteli 31. joulukuuta 2011 ja työskentelee tällä hetkellä?

Johtajaksi tässä tulkitaan henkilö, jolla on sellaisia suoria alaisia, joita hän tapaa säännöllisesti, joiden rekrytoimiseen, työehtojen sopimiseen ja ylennyksien tekemiseen hän on osallistunut (esimerkiksi laitoksen johtaja, henkilöstöjohtaja tai laatupäällikkö).

31.12.2011	tällä hetkellä

Johtajien lukumäärä tässä toimipaikassa (arviokin riittää)

33 Kuinka monta osa-aikaista ja kokoaikaista **työntekijää** tässä toimipaikassa työskenteli 31. joulukuuta 2011 ja työskentelee tällä hetkellä?

31.12.2011	tällä hetkellä

Muiden kuin johtajien lukumäärä tässä toimipaikassa (arviokin riittää)

34 Kuinka suurella osalla **johtajista** tässä toimipaikassa oli vähintään alempi korkeakoulututkinto vuosina 2011 ja 2016?

Merkitse yksi vaihtoehto molempien vuosien sarakkeeseen.

	2011	2016
20 % tai vähemmän		
21 % - 40 %		
41 % - 60 %		
61 % - 80 %		
Enemmän kuin 80 %		

35 Kuinka suurella osalla **muista kuin johtajista** oli tässä toimipaikassa vähintään alempi korkeakoulututkinto vuosina 2011 ja 2016?

Merkitse yksi vaihtoehto molempien vuosien sarakkeeseen.

	2011	2016
0 %		
1 % - 10 %		
11 % - 20 %		
Enemmän kuin 20 %		

Paljon kiitoksia vastaamisesta!