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Do High-Involvement Management Practices Enhance Employees' Innovative Behavior?

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Abstract

This thesis studies the connection between High-Involvement Management (HIM) practices and employees' innovative behavior. Opportunity-enhancing, ability-enhancing, and motivation-enhancing HIM practices' connection to the probability for expressing innovative behavior is studied quantitatively using a probit regression and propensity score matching with an extensive set of control variables. Data is obtained from the Finnish MEADOW survey, which contains more than 1000 combined employer-employee observations.

The main finding in the thesis is that opportunity-enhancing and ability-enhancing practices are associated with innovative behavior: In the scale of 0-10, a one-point increase in the aggregate score of the practices is associated with a statistically significant 3.4%-point and 1.3%-point average increase in the probability for innovative behavior for opportunity-enhancing and ability-enhancing practices, respectively. For motivation-enhancing practices, such association is not found.

In addition, propensity score matching reveals that bundling the different practice types is associated with an increase in the probability for innovative behavior, but the association is smaller than the single practice types' combined association. Motivation-enhancing practices show slightly positive, yet insignificant association when not combined with other practices, while ability-enhancing practices show larger associations in magnitude when combined with other practices.

The results are aligned with the vast majority of prior theoretical and empirical studies, and provide interesting future research topics, especially considering the effect of non-monetary incentives, which could not be investigated with the data used in the study, and the potential trade-off between productivity and innovativeness. Prior studies have suggested HIM practices to have a positive association with productivity, and it would be interesting to find out if productivity and innovativeness are complementary, substitutes, or independent of each other.

Keywords Innovative behavior, Finland, High involvement management, Human resource management, Training, Performance Pay, Teamwork

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1. Introduction

In this thesis, I seek to find out if there is a connection between High-Involvement management (HIM) practices and employee innovative behavior. Although Posthuma et al (2013) and Kauhanen (2009) note that there are many potential elements included in HIM, a common definition used e.g. in Appelbaum (2000) is employed here: HIM is a bundle of practices that incentivizes the employee, gives her more control in the company, and enhances her skills. For example, the bundle could consist of performance-related pay, involvement in autonomous teams, and training in teamwork skills. An initial driver for studying HIM in the 1980s was the superior productivity of Japanese manufacturing firms that were using these practices. Lawler (1988), and Huselid (1995), amongst others, analyzed this different way of organizing work, and found that customer focus, teamwork, skill-based pay, and worker input to strategic decisions were some of its key characteristics.

Employee innovative behavior, in turn, is defined as a multi-stage concept capturing the whole innovation process from exploring and generating the idea to selling and implementing it among the organization (De Jong & Den Hartog 2010, Scott & Bruce 1994). Hence, innovative behavior leads to innovations, which further are seen to be the driver for long-term success of firms, and for economic growth, especially in the field of innovation economics starting from Schumpeter (1934). If innovative behavior can be facilitated by the HIM practices, it could form an additional competitive advantage for the firm along with the productivity increase, and speed up growth in the economy.

Both HIM practices and innovative behavior have been studied in the recent decades, and results about their empirical effects on various individual- and firm-level outcomes have been mainly positive: e.g. Camison & Villar-Lopez (2014) associate HIM with technological innovation, Black & Lynch (2004) find that HIM accounted for a maximum of 30% of output growth in manufacturing, and Böckerman et al (2012) find evidence for HIM associated with employee wellbeing. De Jong & Den Hartog (2010) connect innovative behavior with actual innovative output, and Bessant & Caffyn (1997) with continuous improvement. However, only scarce evidence exists about how HIM practices and innovative behavior are linked together, specifically

about the question of HIM practices' ability to enhance innovative behavior, and furthermore innovations. Prieto & Perez-Santana (2014) have conducted a resembling study, finding evidence about some HIM practice categories' positive association with innovative behavior. Nevertheless, their sample size is rather small, which hinders making strong conclusions alone based on their study.

Both research branches – about HIM practices and innovation behavior – are also plagued by overlapping and imperfectly defined concepts, which complicates the discussion (Parzefall et al 2008, Cappelli & Neumark 2001). This partly results from the fact that these phenomena are studied by scholars in multiple fields, each field having their own traditions and approaches in terms of e.g. definitions and methodology (Armbruster et al 2008, Gopalakrishnan & Damanpour 1997). This is also visible in the lack of results presenting magnitudes of the concepts: Only few of the studies present estimated scale effects, while the majority of the studies only are able to state whether there are linkages between HIM/innovative behavior and some other variable. Additionally, interpreting empirical evidence is not straightforward, as the concepts are quite abstract and interlocked: Various phenomena might act as both the dependent and the independent variables, causing causality to run both ways (Parzefall et al 2008). The consequences of the HIM practices are not easy to observe, and some of the practices may have effects only in the long run (Black & Lynch 2004).

1.1 Research design

The main research question in the study is:

"Are new (HIM) work practices positively connected to the employees' innovative behavior?"

In the empirical part, I analyze this hypothetical connection between HIM practices and employee innovative behavior. As the data I use the Finnish MEADOW (Measuring the Dynamics of Organization and Work, more information in www.meadow-project.eu) survey responses collected by Statistics Finland in 2012. The data consists of both employer and employee responses, which helps overcome the common-method bias potentially plaguing studies using data from a single source. The number of responses was 1531 in the case of employers, and 1711 in

the case of employees, and after combining the data and limiting the research to the private sector, i.e. dropping the answers that were collected from public organizations, the total number of responses is 1093. The response rates were 76,1% for the employers and 48,5% for the employees. These numbers and shares are larger than in many other resembling studies, suggesting that selection bias would not likely be a substantial problem.

While the data has been obtained from Finland, the results should also be interpreted bearing in mind the Finnish work system's characteristics. According to Böckerman et al (2012), high unionization rates (approx. 70%) and the importance of social dialogue in the workplace are the main differences between the Finnish and other European, and North American countries. They further deduce that Finnish employees likely can influence the way in which HIM practices are implemented. On the other hand, Alasoini et al (2014) conclude that Finnish workplaces, compared to their counterparts in other EU countries, concentrate more on renewing their processes and organization instead of product, service and marketing innovations. In other words, organizational innovation does not seem to be followed by other types of innovations, and Finnish innovation is centered to continuous improvement instead of radical innovations.

The dependent variable in this study is employee-stated innovative behavior, more specifically the answer to the question "I have developed new or improved products or services to my employer in the last 12 months". Due to the binary nature of the variable, a probit regression and propensity score matching are used to study the connection. The greatest benefit from this approach is the ability to report magnitudes in addition to directions of the correlation to provide more value to the discussion about the practices' economic effects. Only few prior studies have reported magnitudes in addition to the directions of the correlation.

The independent variables include employee-stated use of HIM practices, and a number of control variables, partly employer-stated and partly employee-stated. These control variables attempt to tackle the bias arising from the fact that innovative behavior might be influenced by the individual- or job-level characteristics: some employees' job or personal characteristics might naturally promote the development of new ideas.

Another key limitation of the study is that the cross-sectional nature of the data hampers making deductions about causality, even if the endogeneity problem is alleviated by propensity score matching and a good set of control variables. Also, while concentrating on the development of new or improved products has the advantage that only one specific variable can be examined, it might omit the idea generation phase of innovation behavior as it requires different skills than the development of more complete products. This potential problem might not be as large as suggested in some studies, as De Jong & Den Hartog (2010) found that the stages of employee innovative behavior showed high joint correlations. The essential benefit from this study is the contribution to a field that is not yet extensively studied, especially with exhaustive data sets and from the econometric point of view.

The key results of the study are that two of the three HIM practice groups, namely opportunity- and ability-enhancing HIM practices, are significantly connected to innovative behavior: In the scale of 0-10, a one-point increase in the level of the opportunity- and ability-enhancing practices, respectively, is associated with a 3.4%-point and 1.3%-point increase in the probability for innovative behavior. On the other hand, motivation-enhancing practices are insignificant for innovative behavior. Additionally, two implemented practice groups are associated with approximately a 20%-points increase in the probability for innovative behavior compared to no HIM practices. Although the results are controlled with an extensive amount of variables, no definite causal link can be drawn. However, the results together with the indications that HIM practices improve productivity would suggest that implementing the practices could enhance employees' innovative behavior without compromising their short-term output.

The research consists of a literature review and an empirical analysis. The literature review seeks to present a coherent view of HIM practices and employee innovative behavior. First, HIM practices are placed in the context of organizational innovations. After that, I review the elements of HIM practices and how they influence various outcomes both singularly and grouped together. In the second section of the literature review, I present the concept of employee innovative behavior, discussing both theoretical and empirical contributions on the antecedents of employee innovative behavior and present results on how it influences various outcomes, especially innovation and via that firm performance. I also present prior results on the

connection between HIM practices and employee innovative behavior. After that, the methodology is explained, and empirical results are presented, followed by a concluding chapter.

2. Innovation in organizations

Innovation as a concept is still not rigorously defined, as pointed out by Frankelius (2009) and Gopalakrishnan & Damanpour (1997). However, Frankelius (2009) argues, arising from an etymological study and literature review, that innovation really means something that is new in some area, obtains a foothold in the society, and means something revolutionary for people. OECD (2005) defines innovation as the implementation of a new or significantly improved product, process, or a marketing or organizational method. In both of these definitions, innovation can be seen as two-dimensional, as noted also by Gopalakrishnan & Damanpour (1997): On one hand as an outcome, i.e. a new idea or invention, and on the other hand, the process of introducing something new. In this study, I combine these definitions and consider innovation as a new idea or invention that has been implemented in the practice.

The highly important role of innovations was already recognized by Schumpeter (1934), who proposed that economic development arises from innovations. Since then, the field of innovation economics has tried to clarify how innovation affects the firm or industry as a whole in the sense of increased productivity, profitability and growth (Damanpour & Gopalakrishnan 1997).

Innovations can be groundbreaking in the form of totally new products and services, or optionally smaller-scale, incremental innovations in the form of continuous improvement. OECD (2005) separates these two approaches to innovation, and states that innovative firms may execute either, or both of these innovation types. Bessant & Caffyn (1997) further define continuous improvement more specifically as an organization-wide process of focused and sustained incremental innovation.

2.1 Workplace innovation

Innovations can also be divided into various categories according to their type. OECD(2005) divides innovations to four distinct types, which are closely matched with those presented by Schumpeter (1934) in his groundbreaking work: Firstly, product innovations change the capabilities of goods or services, while process innovations change the production and delivery methods. Marketing innovations bring in new marketing measures and, finally, organizational innovations involve the

implementation of new organizational methods, or as in Armbruster et al (2008), of new managerial and working concepts and practices. OECD (2005) further lists organizational innovations' targets to induce change in three distinct sectors: Business practices, the firm's external relations or, finally, workplace organization. Of these three, the innovations leading to changes in the workplace - workplace innovations - are in the scope of this study, as they form the concept of High-Involvement Management (HIM), which is studied here. Workplace innovations have also been referred to as new management practices, emphasizing that the practices do not have to be completely new, as the concept "workplace innovation" might suggest, but new for the organization implementing the practices (Mol & Birkinshaw 2009). Thus, calling the practices innovations might be somewhat confusing, as they often are not completely new in an area, as in Frankelius' (2009) definition, but only new for the firm.

Another way of defining workplace innovation, contrary to the OECD's (2005) top-down definition, would be to define the concept bottom-up, by investigating what specific types of practices workplace innovation includes. There is a vast amount of different workplace innovations in the literature, but a popular approach has been to group them by their purpose, to those enhancing employees' opportunity to participate, ability, and motivation (e.g. Posthuma et al 2013, Appelbaum et al 2000, Kauhanen 2009, and Armbruster et al 2008). Strictly dividing organizational innovations to three top-down groups, as in OECD (2005), may cause problems if a workplace innovation also leads to a change in business practices or external relations, even though this definition makes it easier to see the bigger picture of workplace innovation in the broader innovation framework. It might be safer to define workplace innovation according to what it includes instead of what it does not include.

Camison and Villar-Lopez (2014) summarize the development of the organizational (in early works, administrative) innovation concept starting from the 1970s: then, administrative innovation was equal to revising organizational structure and processes. Since then, the inclusion of inter- and intra-organizational dimensions and the requirement of the novelty of methods for the firm have emerged. These new characteristics are proposed by e.g. OECD (2005) and Armbruster et al (2008). The definition by OECD (2005) states, that the feature separating organizational (and

hence also workplace) innovation from a mere organizational change is, that an organizational innovation involves the implementation of a previously unused organizational method resulting from management's strategic decisions. However, many organizational innovations may result also from other employees' efforts rather than the management's initiative (Kesting & Ulhoi 2010). Hence, the definition could be loosened in the sense that the innovations are required to be in harmony with the organization's strategy.

The importance of organizational innovation as a distinct concept separated from other innovation types has emerged after the OECD's recognition in 2005, and a number of scholars suggest that organizational innovation is a significant and substantial source of competitive advantage (Mol & Birkinshaw 2009, Camison & Villar-Lopez 2014). However, the empirical evidence on the phenomenon is still incomplete: For instance, there are gaps considering the link between organizational innovations and other innovations, and firm characteristics contributing to organizational innovation (Armbruster et al 2008, Camison & Villar-Lopez 2014, Battisti & Stoneman 2010). Damanpour & Aravind (2012) also point out that organizational innovations are more intangible and their consequences are less observable compared to those of technological innovations, and that the knowledge of various organizational innovations' effects is limited. In addition, numerous scholars state that measuring organizational innovation is difficult due to the complexity of the concept (e.g. Armbruster et al 2008, Cappelli & Neumark 2001, and Black & Lynch 2003). These are important remarks to be kept in mind when contemplating the empirical results and suggestions arising from the results.

3 High-Involvement Management

When a bundle of workplace innovations are combined, they form the concept of "High-involvement Management" (HIM). However, an accurate definition of the concept is lacking, and there are numerous overlapping concepts, such as "High Performance Work Systems" (HPWS) and "Flexible Work Practices" (Kauhanen 2009). In this paper, I use the concept "High-Involvement management", as I am studying innovative behavior that arises more from the involvement effect of the practices instead of the direct performance effect.

There is a plethora of potential elements belonging to HIM: Posthuma et al (2013) found 61 different practice concepts in their literature review of 181 peer-reviewed articles. In an effort to provide coherence to the web of concepts, the HIM practices have been divided into groups or categories: Posthuma et al (2013) identified eight categories, while Appelbaum et al (2000) divided the practices into three categories: Opportunity-to-participate, skill, and motivation/incentives.[1] The main difference between these two taxonomies is that the aforementioned divides the categories by function (e.g. compensation, training, recruiting), while the latter division is made by the purpose of the practices. Even though some of the by-function groups can be seen to contribute to more than one purpose, I argue that many of them can be associated with one main purpose (e.g. compensation is associated mainly to incentives, training is associated mainly to skill, job and work design is associated mainly to opportunity-to-participate), and thus studying the by-purpose groups will paint a concise picture of the phenomenon.

HIM was first shaped up as a concept in the 1980s. A significant motivation for studying the practices was the difference between Japanese and American manufacturing firms in terms of productivity (Cappelli & Neumark 2001). Early contributors include amongst others Lawler (1988), who analyzed work organizational design in terms of job design, organizational structure, performance information, key knowledge, decision power, and reward and personnel policies. In

[1] The eight groups used in Posthuma et al (2013) are Compensation and benefits, Job and work design, Training and development, Recruiting and selection, Employee relations, Communication, Performance management and appraisal, and Promotions. Some authors have also divided the practices into e.g. five or six groups.

his work, characteristics of HIM are that it includes teams and job enrichment, is customer-focused, and includes parallel task forces for major business issues in the organization. In addition, problem solving skills are seen important, workers have input to strategic decisions, are given partial ownership, and their pay is based on skills. It is notable that the main characteristics have been quite stable since Lawler's theory: It seems that there have been multiple concepts describing roughly similar phenomena (e.g. Lawler's Parallel task forces compared to the concept of cross-functional teams).

Naturally due to its roots on the Japanese versus American manufacturing productivity, the focus on HIM has since its inception been on business performance, decentralization and participation: As Wood & Bryson (2009) put it, HIM implies a more co-operative approach between management and workers compared to the Taylorist model. They see that the purpose of the reform is to improve workers' performance by enabling them to participate in the continuous improvement and innovation culture[2]. In other words, it is seen that in the traditional Taylorist setting, the employees' potential and tacit knowledge (As in e.g. De Spiegelaere et al 2012), are partly left unused, as they are only given simple tasks without any need for independent and proactive thinking. By increasing the employees' control and incentives (by e.g. partial ownership) in the firm, they are encouraged to put their capabilities, knowledge, and creativity into better use (Appelbaum et al 2000, Ben-Ner & Jones 1995). Ben-Ner & Jones (1995) suggest that if only one of these is given, the results may even be negative in terms of firm performance. A quite popular view in the literature is that in addition to the incentives and control the employees must have sufficient skills in their work and additionally in HIM-related areas, such as teamwork (e.g. Appelbaum et al 2000, Kauhanen 2009, and Lazear & Gibbs 2000). On the other hand, Kalmi & Kauhanen (2008) present a literature branch that suggests decreasing returns to scale.

[2] Some contributors see this to happen via increased proactivity and adaptation resulting from HIM: Uncertainty considering the exact work roles leads the employee to self-direct herself, and the employee's motivation is increased thanks to incentive pay (Griffin et al 2007, Booth & Frank 1999). The cognitive processes related to this are further discussed under the chapter Employee Innovative Behavior.

Additionally, the process of an optimal work organization reform also varies substantially between companies, as the companies – and the people working in the companies – are very different from each other. An HIM practice, or bundle, cannot be simply copied from one company to another: firstly, consideration of the particular measure's fit is needed, and after that, the measure must be tailored specifically in order to be of use to the company working in some specific industry (Huselid 1995, Bessant & Caffyn 1997). Additionally, Kalmi & Kauhanen (2008) remind that the practices must be of use to both the company (in terms of e.g. increased productivity) and the employees (in terms of e.g. more meaningful jobs or increased wage). The employees likely will not commit to the practices if they do not benefit from them.

Despite the carefully positive, even though uneven, results suggested by literature, HIM is still quite rarely used. Kauhanen (2009), using a data set from 2003, found that even though the majority of employees had elements of high-involvement management in their work, only 8 percent of the employees were in a purely high-involvement job (defined as a job that includes teamwork, incentive pay, and training). Also, there were no clearly dominant bundles. Thus, the suggested bundle of many diverse practices with multiple purposes was not moved into practice, at least yet in 2003. In addition, HIM practices did not typically include everyone in the companies using it, but those in managerial jobs were substantially more often in a high-involvement job. Kauhanen (2009) thus challenged the view of a "new partnership" between employees and employers. These contradictions are interesting, and it is important to find out if the modest HIM exploitation is due to insufficient benefits, challenges in the implementation process, or if decision-makers in firms are simply too conservative to renovate their job types to purely high-involvement and inclusive.

3.1 Key elements of HIM

Even though the elements of HIM are generally seen to be best analyzed additively as a bundle, I will shortly present a few most important elements singularly to form a more accurate understanding of the concept and its pieces. Three core by-function elements are selected (each of which affects mainly one specific by-purpose group); Compensation and benefits (affecting motivation/incentives), training (affecting ability), and finally, job and work design (affecting opportunity-to-participate).

3.1.1 Compensation and benefits

High-involvement management typically includes such compensation schemes that motivate the employee and provide her incentives. A popular theoretical framework posits that employee output is affected by ability and effort, of which effort cannot be observed; additionally, ability has an observable and non-observable portion (Booth & Frank 1999). Due to effort being non-observable, it cannot be directly affected by managers. However, with performance-related compensation the employee can be incentivized to use more effort, as more effort leads to more output, and thus to a bigger pay. The literature also suggests that unobserved ability is a major determinant in whether an employee is on a performance-related compensation scheme, implying that there is an ability bias in the empirical results: More able individuals are found more often in HIM jobs, and thus also in performance-related pay schemes (Booth & Frank 1999, Böckerman et al 2013).

Empirical evidence about the compensation schemes includes mainly establishment-level studies, but efforts have also been made to model the schemes in an industry- or even economy-wide context. A seminal result is presented by Lazear (2000), who found an incentive-related productivity increase of 22 percent, and a 10 percent rise on wages, when a manufacturing firm moved to piece rates from hourly wages. Nevertheless, it has to be noted that this favorable result is produced in one single manufacturing company, which can be seen to suit well in a piece-rate work, and thus the results cannot be as such generalized into other industries.

Piece rates also do not likely improve productivity, when employees' unobservable ability is low and the output of an individual is not easily measureable. In these situations, group-based incentive pay, or profit sharing, might solve this problem. The literature acknowledges that free-riding might be a problem in these schemes, but

that it can be at least partly overcome by implementing other HIM practices, such as teamwork (Ichniowski & Shaw 2003). This result also applies more generally, as it is recommended that the HIM practices are used as a bundle serving each of the purposes. Additionally, monetary compensation should not be used to incentivize employees to generate a greater amount of innovative ideas, as these mainly result from intrinsic motivation, which is not substantially connected to monetary incentives (De Jong & Kemp 2003, Sanders et al 2010, Amabile 1996).

3.1.2 Training

In order to improve employee performance in the work, the employee often has to be trained in the work-specific skills, innovation-related skills, or in both of these. The theoretical view is that providing training enhances the knowledge, skills, and abilities of employees, and additionally provides the ability to do diverse jobs, hence increasing flexibility (Huselid 1995, Posthuma et al 2013). This is the case especially in the firm-specific training that improves the skills needed in the specific firm or job, while a more general type of training can perhaps be seen as a complementary practice to other HIM practices. It may not singularly be much of use to the firm, but may have a crucial role in supporting employees in jobs that include other forms of HIM practices, e.g. job rotation and teamwork.

Bartel (1994) studied the effect of an employee training program on productivity in a panel data setting, and found that firms, whose productivity lagged behind, largely introduced training programs and with the help of these, were able to raise productivity into the level of the comparable businesses. Huselid (1995) concludes that there is an empirical link between the adoption of training programs and productivity growth, and training and financial performance.

Lazear & Gibbs (2009) remind that training naturally has also significant costs, both direct costs from organizing the training and indirect opportunity costs. These have to be taken into account when contemplating the profitability of training. They note that training should be seen as an investment that first incurs a cost but after that starts to produce profits in the form of improved productivity and decreased employee turnover. Thus, training, especially the firm-specific form, also commits the employees to the firm.

3.1.3 Job and work design

Critical for the HIM to succeed is the way in which work is designed. This is related especially to the employee's possibilities to impact the workplace practices, and furthermore make at least small improvements whenever necessary to their own work. Additionally, it can be argued that job design also affects employee motivation, as more diverse jobs might be more meaningful to the employees. As noted earlier in the compensation and training sections, job design, e.g. teamwork can enhance group incentive pay's effectiveness via peer pressure, and training effectiveness via new skills that are put into full use.

Posthuma et al (2013) categorize use of teams, enriched jobs, decentralized decision-making, and job rotation, amongst others, as examples of job and work design-related HIM practices. From all HIM practices, these were the most critical ones to emerge from the Japanese manufacturing management, and spread to the rest of the world starting from the late 1980s, as it was found that these practices were associated with increased productivity (Cappelli & Neumark 2001).

Regarding the effects of job and work design practices, Pot (2011) summarizes that 28 out of 31 studies reported a positive connection between teamwork and organizational performance, with also higher employee commitment often observed. He also points out that the results of introducing cross-functional teams depend on the work culture and the exact job: a culture that emphasizes specialists might hinder the positive effects of teamwork, as might less technical jobs, for example development of a market strategy. On the other hand, Jones et al (2010) find that in a food-processing plant, teamwork alone did not enhance productivity, but when a performance-related pay scheme was introduced in addition, productivity increased in the range of 9% to 20%. Ortega (2001) shows in his theoretical model that job rotation outperforms specialization in the learning point of view, and that rotation is better suited to employees, whose skills are uncertain to the employer (e.g. just hired employees).

3.2 Challenges of measuring HIM effects

There has been a large amount of effort in the literature to measure high-involvement management's effects to firm performance, such as to productivity or value added. The effects are mainly positive, but not without exceptions. However, multiple methodological challenges make it difficult to reach compelling results.

Prior research can be divided to industry-specific studies and studies examining organizations from all industries. The first-mentioned approach has the benefit that its observations probably do not include much unobserved firm-specific characteristics distorting the results, thanks to the fact that plant-specific productivity variables can be studied more closely instead of organization-level variables, which are affected by numerous other factors in addition to work practices. However, industry-specific results are difficult to generalize outside the specific industry, and in many early studies the effects of high-involvement management on wage are omitted (Cappelli & Neumark 2001.)

The other branch, broader cross-industry studies, can be more easily generalized in terms of the results, but the results have been somewhat ambiguous, not pointing a clear causal link between high-involvement practices and firm performance (Camison & Villar-Lopez 2014, Cappelli & Neumark 2001). Additionally, cross-sectional cross-industry studies face problems in controlling for industry-specific factors, but also panel models have their problems: The time between the panels should be long enough to allow changes to occur in the practices, but the longer the time is, the more likely it is that some of the other factors affecting production, or the popularity of the high-involvement practices, change (Cappelli & Neumark 2001). As panel data models assume these other firm-specific effects to stay the same over time, changes in those parameters decrease the credibility of panel settings.

Reforms in the organization of work, for example introducing meetings that take time away from other work, might also improve the performance only after a delay, as it might take some time for the organization to learn to work with these new practices. This further complicates measurement of the practices' effects (Black & Lynch 2004). A further obstacle that might distort the results is, that the data generally does not state whether the practice has been implemented in a good manner. This is a potential problem as the new methods can be formally implemented even though the

management would still stick to the traditional leadership style. In that case, the view of treating these changes as actual changes in the organization is questionable (Black & Lynch 2004)**.** There is also a difference between introducing a practice in theory and in practice: the response may change radically if the same question is asked from management and from shop-floor workers (Sanders et al 2010). Additionally, it might be relevant to estimate the share of employees under various practices instead of a binary scale, capturing only the information of the practice's existence (Armbruster et al 2008).

Also the somewhat obscure conceptual framework hampers the analysis: In addition to the multiple almost similar concepts (HIM, HPWS, etc.) Cappelli & Neumark (2001) state that the concepts include a vast number of different high-involvement practices used in the studies. However, the fact that they can be grouped roughly into e.g. the by-purpose groups of opportunity-to-participate, ability, and motivation and incentives substantially alleviates this problem.

3.3 Empirical results about HIM's effects

Most empirical studies have suggested that HIM's effect on firm performance is positive, even though there are also contrary results: Wood & Bryson (2009) summarize that in the 1990s, empirical studies indicated significant positive links, but subsequent studies paint a more uneven picture. The literature provides a possible explanation that the productivity gains from HIM are offset by higher wages associated with high-involvement work (Cappelli & Neumark 2001). Empirical evidence of this tendency is collected by Böckerman et al (2013): They find a wage premium of around 20% among employees in an HIM job, the exact premium depending on the bundle of work practices. Even though the premium decreases by roughly a fifth when controlling for work history variables, the effect is still significant. This substantial growth of wages in HIM jobs further sets difficulties on stating a positive link between HIM and firm performance.

HIM practices can be seen to affect firm performance via multiple ways: The simplest path would be the direct effect, arising from increased effectiveness as the new work practices are implemented. Camison & Villar-Lopez (2014) find organizational innovation (which is close to the HIM practices defined in this study) and firm

performance positively associated using cross-sectional data, and Mol & Birkinshaw (2009) come to the same conclusion with longitudinal data, but they remind that this relationship might be mediated through other variables. Additionally, this setting poses problems, as firm performance is surely affected by various other measures and it is questionable if this endogeneity can be entirely overcome with even a good set of control variables, or with longitudinal data.

The mediation effect might include multiple variables. HIM practices are positively associated with worker wellbeing (Böckerman et al 2012), and worker wellbeing is in turn associated with increased establishment-productivity (Böckerman & Ilmakunnas 2012). Finally, Huselid (1995) finds that increased productivity leads to improved firm performance together with decreased employee turnover. However, these multiple separate linkages make the actual causal effect, or even link, from HIM to firm performance ambiguous, and again there may be endogeneity associated with all of the results. Camison & Villar-Lopez (2014) find organizational innovations positively associated with process innovation capabilities, and via this positively associated to product innovation capabilities and further firm performance.

In addition to the somewhat positive linkages, also more ambiguous results have emerged. Cappelli & Neumark (2001), using panel data from the years 1977, 1993, and 1996, find that HIM practices raise labor costs, but the effect on productivity is not significant. Thus, they conclude that the overall net effect on firm profitability is unclear. Additionally, they find no synergies between the HIM practices. However, as Black & Lynch (2004) note, the research design of Cappelli & Neumark (2001) causes important limitations: All firms established after 1977, as well as existing firms' new plants opened in the 1980s and 1990s are excluded from the study, which may bias the results downwards, as only the older, and perhaps more conservative establishments are studied. However, the results point out that at least in the case of older firms, the HIM practices might not always be positively associated with performance.

An explanation for the results' large variance considering the link between HIM and firm performance could be that HIM measures are not suitable to all jobs, as suggested by Lawler (1988), or that they are not always well implemented. Cappelli & Neumark (2001) remind that especially longitudinal studies investigating HIM

practices are necessarily covering late adopters of these policies, as the early adopters are already taken the practices into use before the surveys, thus often leaving behind no data to analyze. It would also be logical to suspect that the early adopters are those that benefit from the practices the most, which would cause a downward bias to the results. On the other hand, Böckerman et al (2013) point out that more able individuals are more often working in high-involvement jobs, and this self-selection may cause an upward bias in the HIM's effect on firm performance.

Black & Lynch (2004), also using panel data but this time for the years 1993 and 1996, find HIM practices, or workplace innovations, to account for roughly 30% of the total output growth in manufacturing (i.e. a contribution of 1,4% per year). This is a radically different result from Cappelli & Neumark's (2001) study. However, the 30% should be considered as an upper bound, as Black & Lynch (2004) recognize that some of the practices considered reflect also elements of technological change. Considering these two deviating results and their methodologies, a possible speculative conclusion might arise that changing to HIM practices in traditional workplaces might be harder than in more modern ones, as the more modern ones were omitted in the study that provided more ambiguous results.

The ambiguous results considering HIM's effect to firm performance can be better understood with a theoretical framework quite commonly used in the literature (e.g. Black & Lynch 2004, Cappelli & Neumark 2001): Firm performance is improved with the HIM practices, but the more the employees are involved, the larger are the employee wage costs. This framework would suggest that there is an optimal level of HIM practices, where the firm performance is maximized: i.e. the marginal effects to performance and wages are equal. Hence, in this framework it is possible that a firm implements an excessive amount of HIM practices, and that the optimal level of the practices likely depends on the industry, and the firm in question.

HIM might also lead to decreased health of workers due to stress from the increased responsibilities, thus reducing performance at least in the longer run. However, the evidence about this link is even more mixed than about the link between HIM and firm performance. In the Finnish context, HIM has actually positively influenced employee wellbeing (Böckerman et al (2012). Concluding from the literature, HIM likely needs a consideration of its suitability to the specific workplace before its

careful, tailored implementation. Also the leadership style used to execute HIM likely matters,[3] and there is not one single recipe for success, but different practices work for different firms.

In addition to the possible link to firm performance mediated through worker well-being, HIM practices might also improve productivity by intensifying innovation in the firm. This relation has not yet been studied very thoroughly, and hence it is in the scope of this paper. I seek to find out if HIM is connected to the employees' innovation capabilities and the use of the capabilities in the individual level. This setting is connected to the concept of employee innovative behavior.

[3] Organizational psychologists have studied the impacts of various leadership styles to a number of outcomes, e.g. employees' innovativeness. These results are further discussed under the chapter Employee Innovative Behavior

4 Employee Innovative Behavior

In the rapidly changing and knowledge-based world, the majority of firms have to constantly evolve through new products and services if they aspire to fulfill their customers' demands. One way of enhancing this is to extract innovations in a bottom-up manner, from the employees. Unfortunately, this phenomenon is practically unexplored from an economics point of view: The main research efforts have been conducted by psychologists and organizational theorists. Thus, the results must be interpreted with additional care, especially considering endogeneity issues important in economics, but sometimes considered less in other fields.

The concept of employee innovative behavior and its analysis sheds light on the innovation generation process. The literature states that it is close to creativity, but includes also the implementation of ideas, while creativity includes only the production of novel and useful ideas (e.g. Amabile 1996, De Jong & Den Hartog 2010). Employee innovative behavior is expected to provide a benefit, and result to innovative output (De Jong & Den Hartog 2007). The output can be a small improvement falling into the continuous improvement category, or a more radical innovation requiring a larger amount of work to be implemented.

Innovative behavior is seen to consist of multiple stages: Scott & Bruce (1994) separate idea generation, sponsorship seeking, i.e. selling the idea, and implementing the idea as the process' stages. De Jong & den Hartog (2010) further divide the first stage to exploring and generating ideas, as they argue that they require distinct cognitive abilities. Consequently, it has to be kept in mind that innovative behavior is a multi-dimensional concept, and its different stages can be affected in various ways (Parzefall et al 2008). Specifically, the frameworks describing innovation behavior typically consist of many layers and dimensions forming a fuzzy web that is interconnected in various ways, which certainly complicates the conclusions from empirical or theoretical models. Additionally, the concepts have not yet been fully established even in terms of the basic definitions, e.g. to how many separate relevant stages should innovative behavior be divided, and how they are defined (Gopalakrishnan & Damanpour 1997).

De Jong & Den Hartog's (2010) four stages of innovative behavior are highly and significantly correlated (pairwise correlations range between 0.60 and 0.74) in empirical tests, and hence they suggest that the dimensions can be viewed as a combination in regression analysis without substantially hampering the precision. This indicates that even though innovative behavior is not a one-dimensional concept, its dimensions (at least as defined by De Jong & Den Hartog) are close enough to each other to offer a sufficient precision of the analysis even when the dimensions are combined.

Innovative behavior is an important concept in the innovation context, as it is seen to precede actual innovation and continuous improvement (e.g. De Jong & Den Hartog 2010, Bessant & Caffyn 1997). On the other hand, one of the key barriers to innovation and continuous improvement are old, innovation-blocking behavioral patterns (Bessant & Caffyn 1997). Improving innovative behavior thus could enhance continuous improvement and more radical innovations, and additionally alleviate the implementation stage of further innovations, if innovative behavior is connected with openness to new innovations.

The connection of innovative behavior and actual innovative output strikes as an intuitive one, and de Jong & den Hartog (2010) found it highly significant. Innovation output is further seen as the driver for sustainable, long-term growth in the innovation economics paradigm (Gopalakrishnan & Damanpour 1997). Thus, it seems that innovative behavior is worth aspiring for. By studying innovative behavior, the cognitive processes behind innovation can be untangled, and thus more information can be provided about how to contribute to generating innovations.

4.1 Employee innovative behavior's theoretical antecedents

Parzefall et al (2008) review both theoretical frameworks and empirical studies about factors influencing innovative behavior in organizations. They classify these antecedents to individual, job, team, and organization level factors. However, they also point out that there are interdependencies between the levels and that innovation behavior is a very complicated process. Hence, innovativeness is not necessarily just the outcome, but might also have effects on other innovation-related variables and further outcome variables in both individual and more aggregate levels,

making it hard to state conclusions about causality. This critique has originally been presented by Anderson et al (2004), who propose a more holistic research design to the field. They see that innovative behavior and innovations should be studied in multiple levels and with multiple methods, combining cross-sectional, longitudinal, and experimental research designs. The preceding approaches have largely concentrated to individual level estimated in a cross-sectional setting. However, it is unclear how a more diverse setting could be introduced in a single study without significant methodology problems. One possible answer to this would be meta-analyses, as Anderson et al (2004) propose: In a field as complicated, one might have to resort to combining multiple, narrow research designs that are later observed as complements to each other in an attempt to form a clearer picture of the entire concept, although this option is also suboptimal in terms of credibility and methodological issues. In other words, there is a trade-off between methodological validity emphasized by economists, and descriptive power emphasized by organizational theorists.

Amabile (1996) presents an attempt to form a coherent view of innovative behavior with a theoretical model, in which innovative behavior process is started by an individual's intrinsic motivation, expertise, and creativity skills. These three elements constitute creativity, which impacts innovation (it is important to note that HIM practices are built to enhance employee expertise, motivation, and control – these three elements are very similar to the enablers of creativity). Innovation is also affected by organization-level factors: organizational motivation to innovate, resources, and management practices. Additionally, the organizational-level factors influence personal creativity. Thus, they have a key role as they affect innovation both directly and indirectly, via individual creativity. Intrinsic motivation – the difference between what employees can do and what they will do – is here seen as the catalyst initiating the innovation process. The best results are reached, when the capabilities are matched with high intrinsic motivation, or, stated with HIM-related concepts, both the employee's skill, opportunity-to-participate, and motivation are enhanced with new organizational practices.

Subsequent studies have supplemented and extended Amabile's (1996) theoretical model: Parzefall et al (2008) summarize the main results concerning the drivers of innovative behavior in the four levels: Openness to new experiences, independence

of judgment, self-confidence, flexibility, preference for change, and risk hunger are positively associated with innovative behavior in the individual level (these resemble the ability, motivation, and incentive-scheme considered in the earlier HIM chapter), while job autonomy, lack of routine, reasonable levels of job challenge and time pressure, and clear goals are positively associated with innovative behavior in the job level (these characteristics are quite similar to the characteristics of HIM-jobs). In the team level, diversity in members' skills, knowledge, and disciplines is positively associated with innovative behavior, as long as it does not threaten the team's safety and integration: conflicts among team members should be only minor, and team members should have a solid sense of trust towards each other. This consideration implies that also the quality of teamwork should be analyzed in addition to the existence of teamwork. Finally, an innovation-centered strategy matched with a suitable organizational structure for the firm, and innovation-encouraging leadership and culture are positively associated with innovation behavior. However, Parzefall et al (2008) remind that the organizational-level factors are complex and hard to predict due to the influences from outside the organization, and also difficult to change. To summarize, the individual- and job-level antecedents are very similar to what was discussed in the context of HIM, and the team- and organization-level antecedents pay attention to the quality of HIM practices. This is a prime example of how the field is studied by scholars from different fields reaching resembling conclusions stated in a slightly different way.

An important part of the quite generally defined organizational-level factors is the leadership style: the interaction with others in the workplace, especially with the leaders, greatly affects employees' work behaviors (De Jong & Den Hartog 2007, Anderson et al 2004, Scott & Bruce 1994). As Kesting & Ulhoi (2010) remind, if employees are not awarded time and resources to innovative behavior, they will not come up with new ideas except if they break the firm regulations or innovate in their leisure time. Thus, employee innovative behavior requires management support shown in multiple ways: a "license" to spend time and resources to generating ideas, positive feedback for employees who bring new ideas to the management, collaboration and autonomy, and finally the broader attitude towards employees and the corporate culture in terms of the power distance and the attitude towards failure (Krause 2004, Kesting & Ulhoi 2010). New innovations at least implicitly challenge

the firm's present procedures and are their creator's personal, creative work. Hence, it always requires courage to present the ideas to the management, and if the management is not supportive, the threshold to provide new ideas will raise.

However, the decision process of innovation implementation requires strategic thinking and broad information about the firm and the industry. These are capabilities that regular, shop-floor employees do not typically have. Additionally, they might have cognitive biases, such as favoring the status quo as they have been used to routines. Thus, the management's dilemma is that idea generation should be encouraged, but at the same time there should be a filter for poor ideas (Kesting & Ulhoi 2010.)

Also the individual cognitive processes preceding innovative behavior are worth analyzing to gain further knowledge about how innovative behavior emerges. Carmeli et al (2006) summarize that the process happens through self-leadership, the capability to motivate and navigate to the behaviors and goals that are desired, i.e. to lead oneself. This may happen in the forms of e.g. positive self-talk, concentrating on the positive aspects, self-rewarding, and evaluating own assumptions and thinking patterns. Good self-leadership skills enhance self-efficacy, the belief in the capability to organize and execute actions that lead to the desired goals. In psychological literature, self-efficacy is found to be a mediator between self-leadership and creative performance, and proactive behavior (Carmeli et al 2006, Griffin et al 2007). This is connected to the discussion about shared leadership and "low organizations", in terms of organizational hierarchy. A job design with shared leadership and low hierarchy might influence self-leadership skills, as the freedom and the responsibility for one's own work is increased: If the employees are able to influence the decision-making, they are more motivated to perform well and provide ideas. This is an example of how organization- job- and team-level factors can affect individual-level factors. Carmeli et al (2006) also suggest that shared leadership is needed in organizations emphasizing innovation due to the complex nature of the innovation process. De Jong & Den Hertog (2007) emphasize a consulting leadership style, in the sense that the employees should be consulted about the decisions.

In the Finnish context, these characteristics might be better represented as in the rest of the world, as in the Finnish workplace social dialogue, and hence probably also

shared leadership, is generally held in high value, and employees are generally well-educated, enabling them to be proactive and lead themselves. It is not likely that e.g. self-leadership or teamwork skills, or strict hierarchies would be a barrier to innovative behavior in most Finnish workplaces.

4.2 Empirical results on employee innovative behavior's antecedents

Complementary to the theoretical models, there is some empirical evidence of the means of strengthening innovative behavior in the organization. In this section, I attempt to form an understanding about the main results on how innovative behavior might be affected, aside from the HIM practices (which are discussed next). However, as reminded previously, no studies using a method typical to economics seem to exist, and thus the results must be interpreted carefully, especially for deductions about causality.

In their survey study of an R&D laboratory, Scott & Bruce (1994) find that leader-member exchange quality, support for innovation, managers' role expectations, and career stage are positively associated with individual innovative behavior. Leader-member exchange is related to the relationship between the leader and the employee, and high-quality leader-member exchange includes challenging tasks, support in risky situations, and resources and recognition (De Jong & Den Hartog 2007, Sanders et al 2010). Managers' role expectations, in turn, describe to what extent the manager sees the specific role as an innovator and what kind of expectations of the employee's innovative output she has. Also Krause (2004) emphasizes the role of leadership quality: Innovation-supportive leaders enhance their subordinates' courage to innovate, while managers not open to innovation drive their subordinates to innovation-blocking behaviors, resulting from inadequate support to innovation. On the other hand, systematic problem-solving style was negatively associated with individual innovative behavior in Scott & Bruce's (1994) study, even though they suggest that the best innovators might use both systematic and intuitive styles in different stages of the innovation process. Many of the potential drivers to individual innovative behavior can be seen to represent management support, which Kesting & Ulhoi (2010) see as key enhancer of innovative behavior, and hence the results are aligned with the theoretical contemplations.

However, also contrary results have emerged: De Jong & Kemp (2003) did not find supportive climate associated with individual innovative behavior, although they discuss that the climate may play a role in more radical innovations, which require further movement into uncharted areas, and are thus not completely represented in short-term individual innovative behavior.

Krause (2004) defines intrapsychic coping (seeing that the potential innovation would not have been any good) and flight (physically or mentally escaping the situation by e.g. quitting or concentrating to other matters) as innovation-blocking behaviors, and found that they are negatively associated with autonomy, freedom and expert knowledge of the supervisor. Hence, these three factors might influence innovative behavior by reducing innovation-blocking behaviors, which would facilitate the generation and presentation of new ideas by the employees. Further considering autonomy and freedom, Parker et al (2006) find flexible role orientation, i.e. the employee seeing her job as flexible, positively associated with innovative work behavior. They point out that the role orientation might be as important as the job motivation that is emphasized earlier in Amabile's (1996) theoretical framework.

As an additional antecedent, Parker et al (2006) highlight proactive personality, suggesting that individual innovative behavior is at least partly determined by the employee's own personality, as in Parzefall et al (2008), who separated individual level factors as one of the four dimensions of employee individual behavior's influencers. However, this view is not uniformly accepted in the literature: Amabile (1996), amongst others, argues that innovativeness is something that everyone with normal capacities is capable of when offered support. The view that everyone is not similarly able to innovate brings on important implications: making jobs more autonomous and emphasizing employee innovation might lead to negative outcomes for some non-innovative employees, and coincidentally, self-selection might occur. The issue could be more about self-perceived innovation capabilities instead of the actual capabilities: If there is insufficient support for employee innovation, the employees might not believe that they are capable to create ideas: Bessant & Caffyn (1997) remind that a critical obstacle against involvement in innovation is the disbelief in the creative and innovational abilities. Carmeli et al (2006) state roughly the same in the form that self-leadership skills are connected with employee innovative behavior. To conclude, especially in more traditional workplaces and in those

workplaces that cannot fully choose their employees, the shift to new practices might not be free of trouble due to personnel's actual or perceived lack of innovation capabilities. In these workplaces, organizational attitude towards employee innovative behavior has to be changed together with the implementation of new practices to achieve the desired innovative results. Additionally, training might be even more critical than usually as the employees may have to be trained also in self-leadership skills.

As discussed in the case of HIM practices and firm performance, some job characteristics might have diverse effects on diverse employees: De Spiegelaere et al (2012) find that blue- and white-collar employees' individual innovative work behavior is differently affected by routineness of tasks and job insecurity: White-collar employees' innovative behavior was lower in high-routine tasks, while blue-collar employees' innovative behavior was unaffected by this variable. Job insecurity in turn had a positive association with white-collar employees' innovative behavior and a negative association with blue-collar employees' innovative behavior, suggesting that flexibility is not always good for innovative behavior. These results further support the view that different workplaces and different jobs might require different practices.

The previously presented results emphasize the way in which HR practices are implemented and how they fit in with the leadership style in the organization. Again, this is close to the discussion presented in the HIM section considering the HIM practices' implementation style from an economics point of view, and it is notable that researchers from different disciplines reach similar results, even though the exact phrasing might differ.

4.3 The connection between HIM practices and employee innovative behavior

In a study resembling this research, Prieto & Perez-Santana (2014) investigate ability-enhancing, motivation-enhancing, and opportunity-enhancing HIM practices' association with innovative work behavior in 198 Spanish companies from five industries. These three types of HIM practices are similar to the previously defined three by-purpose groups of HIM. Thus, the study provides an attempt to build a more coherent, systemic view of the work practices' effect on innovative work behavior.

Prieto & Perez-Santana (2014) further hypothesize that the relationship between work practices and innovative work behavior is mediated by supportive management and supportive co-workers. Their hypotheses are confirmed by empirical tests considering ability-enhancing and opportunity-enhancing practices and the mediation, but motivation-enhancing HIM practices' effects were not significant. However, the sample size and the response rate are quite small, which sets uncertainty on the results. On the other hand, support to this view is provided by De Spiegelaere et al (2012), who state that job characteristics are of central importance to employee innovativeness. They also found autonomy, learning opportunities, and organizing tasks (which is close to teamwork in their study) positively associated with innovative behavior.

Sanders et al (2010) find satisfaction with HR practices, especially satisfaction with influence (roughly the same as the opportunities-to-participate defined in this study) and work content, positively related to innovative behavior. This, with the assumption that HIM leads to increased employee satisfaction (as suggested by e.g. Böckerman et al 2012), implies a positive connection between HIM practices and innovative behavior. However, satisfaction to monetary rewards was negatively related in their study. Sanders et al (2010) provide multiple possible explanations for this finding: their measurement of satisfaction to monetary rewards was one-dimensional (i.e. not separating satisfaction to compensation amount as such, as compared to others, and as the compensation process), which might bias the results, or that extrinsic rewards might poison intrinsic motivation, as the psychological contract is turned into a transactional contract by overcompensation.

In the settings where innovations or innovative behavior is the dependent variable it has to be remembered that it is not optimal for the firm to maximize innovative behavior or innovations, but to maximize firm performance. Anderson et al (2004) suggest that this "pro-innovation bias" might be apparent in some studies, and hence the danger to optimize only this variable is kept in mind in this study, although in the Finnish context, more innovative behavior likely is desirable as innovations seem to be currently on a quite low level (Alasoini et al 2014).

5 Methodology

The data used in this study was collected via telephone interviews by Statistics Finland, implementing the MEADOW (Measuring the Dynamics of Organization and Work) survey. The MEADOW project provides guidelines for the collection and interpretation of harmonized data on organizations in the European level[4]. The employer and employee responses are matched, and combined with register data from Statistics Finland.

The type of the analysis conducted is a probit regression, due to the binary dependent variable, describing if the employee has developed a new or improved product for her employer in the last 12 months. This is a different approach compared to most of the work studying employee innovative behavior, as they typically have formed a multidimensional employee innovative behavior scale with factor analysis. However, the dimensions are highly correlated in previous studies (De Jong & Den Hartog 2010), and I argue that the dependent variable describes the whole concept quite well. The prior empirical researches have been conducted with methods typical to organizational theorists and psychologists, and this approach from an economics point of view broadens the understanding of the concept of employee innovative behavior, as it targets also the scale of the effect thanks to the modelling of the probability that a specific employee shows innovative behavior (Baltagi 2011).

A limitation of the methodology is that it does not take into account the quantity or quality of the innovation, but simply divides employees to “innovators” and “non-innovators”, according to their self-stated answer. However, It would be intuitive to think that this more inaccurate design in terms of the dependent variable does not lose too much information compared to a more accurately defined dependent variable, and at least will not introduce any bias, as the innovativeness is only scaled down to two groups, keeping the order similar to what a more detailed scale would provide.

[4] More information about the project can be found from the project’s home page, http://www.meadow-project.eu/.

Based on the conclusions presented in the literature review, the first hypothesis considers the connection between HIM practices and employee innovative behavior:

Hypothesis 1: The use of HIM practices and employee innovative behavior are positively connected.

In addition to this quite general hypothesis, it would be interesting to find out what kind of a combination of the practices is the most efficient. Based on the results about the practices and other outcomes related to e.g. firm performance, I hypothesize:

Hypothesis 2a: Bundles of HIM practices influence employee innovative behavior more than single HIM practices' combined effects.

Hypothesis 2b: The largest influence is reached with a combination that includes elements increasing the employees' opportunity-to-participate, skill, and motivation.

5.1 Model specification

In modelling dichotomous dependent variables, i.e. variables that are not continuous, the regular Ordinary Least Squares (OLS) regression fails to accurately describe the data: The model is by definition linear in the sense that the effect of any explanatory variable on the dependent variable is constant, and thus in the case of a binary dependent variable the estimator's values are not between 0 and 1 for all values of the explanatory variables. A more appropriate form of describing such data would be to model the probability that the dependent variable has the value 1, using a cumulative distribution function (cdf) (Baltagi 2011, Wooldridge 2009.)

This modelling can be done with a binary response model: presented formally, the binary response models estimate the probability that

$$P(y = 1|X) = P(y = 1|x_1, x_2, \dots, x_k)$$ (Wooldridge 2009).

This simply means that given a set of explanatory variables x, the probability that the response is equal to unity is some real value between 0 and 1. To be able to limit the values of the dependent variable to this interval, there must a specific functional form for the explanatory variables. Multiple cdf:s have been used in the literature for this

purpose, but the two most common ones are the probit and the logit models. In the probit model, the function is the normal cdf

$$P(y = 1|X) = G(\beta_0 + X\beta) = G(z) = \Phi(z) = \int_{-\infty}^{z} \phi(v)dv,$$

where $\phi(z)$ is the normal density:

$\phi(z) = e^{-z^2/2}/\sqrt{2\pi}$ (Wooldridge 2009, Baltagi 2011).

The logit model's functional form differs from the probit model in the tails: while the probit's cdf is the one of a t-distribution with infinite degrees of freedom, the logit's cdf resembles the cdf of a t-distribution with 7 degrees of freedom, specifically

$G(z) = \Lambda(z) = \frac{e^z}{1+e^z} = \frac{1}{1+e^{-z}}$. The probit distribution has slightly flatter tails as logit, and thus the predictions will only deviate substantially if there is an extreme amount of observations in the tails (Baltagi 2011). Probit's main advantage compared to the logit model is the assumption of normal distribution of the error term (while logit assumes that the error term has a standard logistic distribution), which is perceived as easier to defend especially among economists (Wooldridge 2009).

While the cdf form solves the problem of modelling a binary dependent variable, the interpretation of the regression coefficients is much less straightforward than in the OLS functional form: unlike for the OLS, the marginal effect of the regression coefficient is not constant: the effect is only constant for the z-score of the cdf. As Wooldridge (2009) puts it,

$$\frac{\partial P(y=1|X)}{\partial x_j} = \frac{dG(\beta_0+X\beta)}{dz} \times \beta_j.$$

Thus, the marginal effect for a change in one regression coefficient depends on the value of the differentiated cdf, i.e. of the probability density function. Furthermore, the marginal effect depends on the values of the other regression coefficients $X\beta$. From this it follows that to state the effect of a variable of interest to the dependent variable, the values of all other variables must be locked to some level.

The model is estimated with a maximum likelihood estimator: the estimator maximizes the log-likelihood function for the observations:

$\sum_{i-1}^{n} \iota_i(\beta)$, where

$\iota_i(\beta) = y_i \log[G(X_i\beta)] + (1 - y_i) \log[1 - G(X_i\beta)]$, and G(·) is the standard normal cdf. (Wooldridge 2009).

5.2 Explanatory variables

To study the effect of HIM practices on innovative behavior, the variety of the practices is useful to compress in order to keep a sufficient amount of degrees of freedom. Hence, following the theoretical background presented earlier, the practices were divided to Opportunity-enhancing, Ability-enhancing, and Motivation-enhancing practices, as shown by the figure below. Each of the indexes measuring the practices was scaled such that the minimum score is 0 and the theoretical maximum score is 10. This way, the coefficients of the indexes are more easily comparable. As the HIM practice variables are obtained from the employee, they take into account both the formal prevalence of the practice, and whether the practice is implemented in such a way that also the employee finds it in her work.

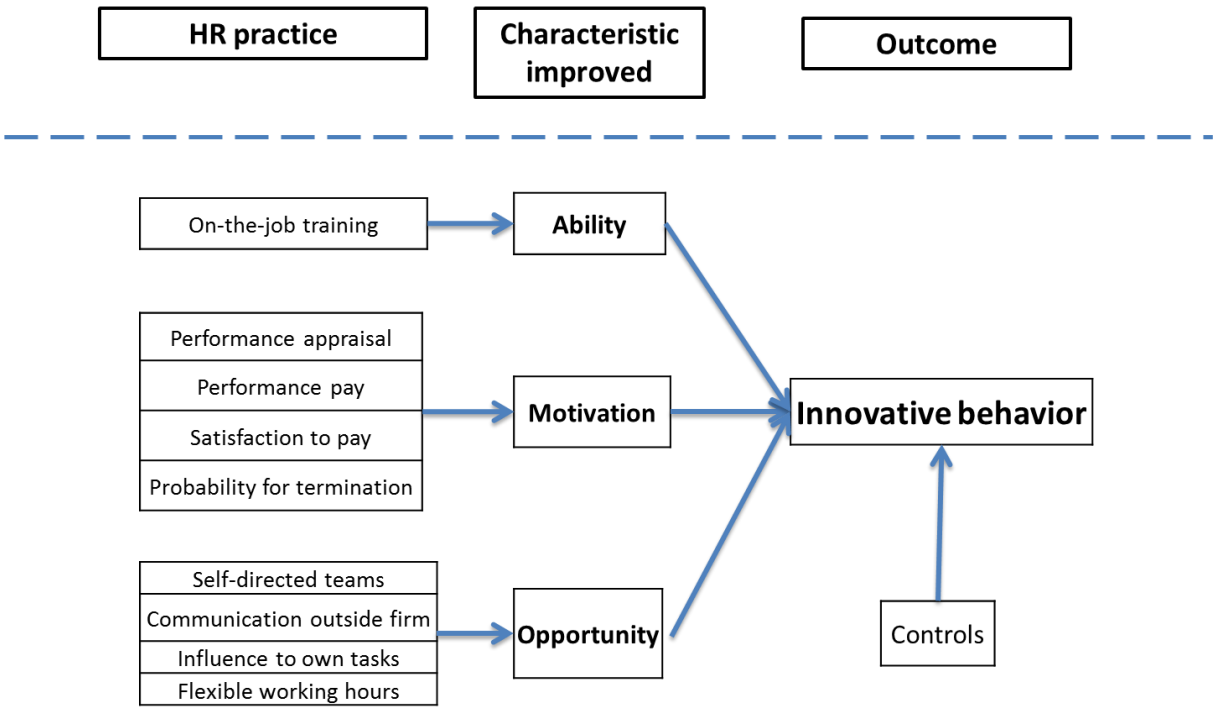


Figure 1: The research design

The ability-enhancing practice score of an individual is comprised of the level (log of amount of days used in training) and variety of on-the-job training she has received,

and it is scaled upwards such that the index's largest value is 10 points and the minimum is 0 points (i.e. the values are multiplied by 1.14). Even though from the figure below one might deduce that the amount of training is emphasized more than the variety of training (as the scale of amount is 0…5.45pts and the scale of variety is 0…4.55pts), in practice the emphasis is on the variety instead, as both its median and mean values are higher than the amount component's respective values[5]. It would be sensible to think that in this case, quality is more important than quantity. The distribution of the ability-enhancing practices' values roughly resembles a normal distribution, but there are plenty of observations having the value 0 (16%) and the distribution is slightly skewed to the higher values.

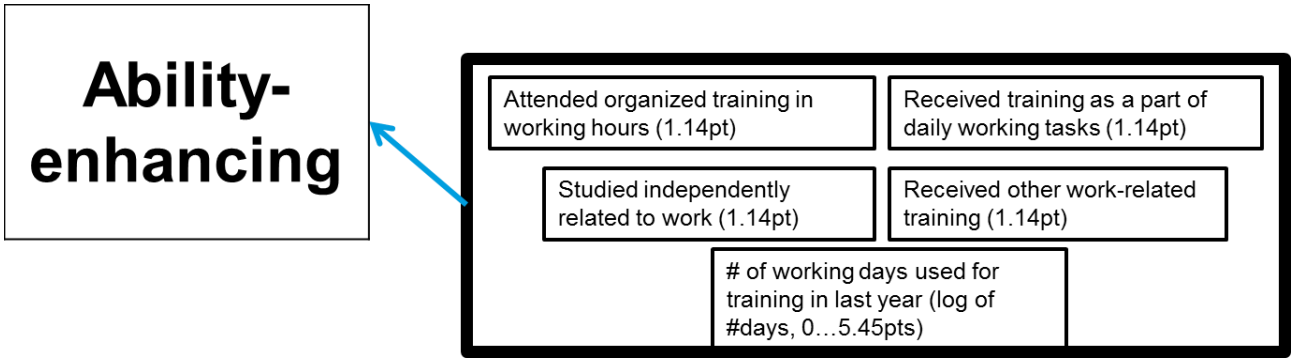


Figure 2: The components of the ability-enhancing practices score

The motivation-enhancing practice score consists of performance appraisal and its effects on the individual's work, performance pay, satisfaction to pay, and the probability for retaining the job for the next 12 months. The score is scaled such that the theoretical minimum and maximum of the score is 0, and 10, respectively (i.e. the values are multiplied by 1.82). Performance appraisal and pay are emphasized more than the certainty of the job, as they are also studied more diversely in the survey. The mean of the motivation-enhancing practices' score is 4.07 and the median 3.92, and the distribution is slightly skewed to the lower values, reflecting the observation that these practices are not as widely used as other practices. An endogeneity issue might arise especially from the probability to retain job and satisfaction to pay variables: It might be that the employee's innovative behavior affects these variables positively.

[5] Means for variety and amount of training are 2.49 and 1.44, respectively, medians 2.28 and 1.58, respectively

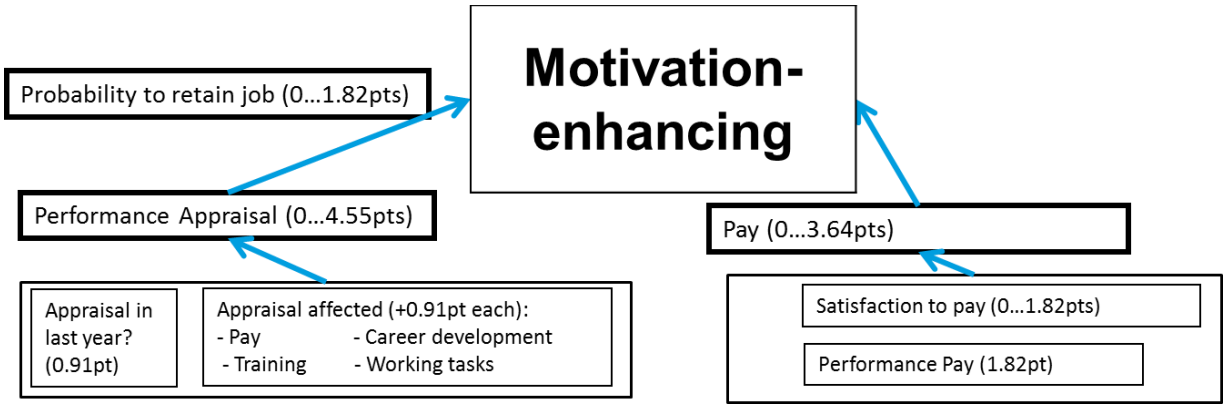


Figure 3: The components of the motivation-enhancing practices score

The opportunity-enhancing practice score is comprised of the level and the quality of the teamwork, communication with people outside the company, flexible working hours, and the individual's influence to her own work tasks. The theoretical minimum of the score is 0, and the maximum 10 points (the score is multiplied by 0.83). The mean of the opportunity-enhancing practices' score is 5.29 and the median 5.42, and the distribution is very close to normal distribution: Slightly excessive observations compared to the normal distribution are found around the values 2 and 7.

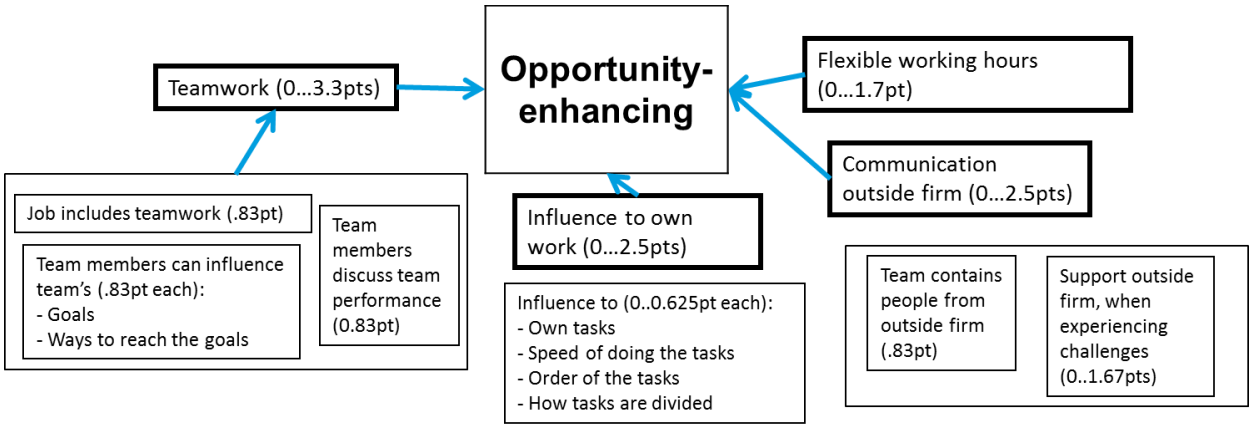


Figure 4: The components of the Opportunity-to-participate-enhancing practices score

The coherence of these explanatory indexes is measured with Cronbach's (1951) alpha metric. This metric is often used in organizational studies, where the indexes are constructed with exploratory factor analysis, to assess the credibility of the indexes (e.g. Prieto & Perez-Santana 2014, Huselid 1995). Alpha is defined as

$\alpha = \frac{n}{n-1}\left(1 - \frac{\sum_i V_i}{V_t}\right)$, where n is the number of components in the index, V_i is the variance of a component after a possible weighting, and V_t is the variance of the

index (Cronbach 1951). Alpha can hence be interpreted as measuring the intercorrelation inside the index: The larger the variance of the index, i.e. the more the components are correlated, the larger will alpha be. In other words, alpha measures the internal consistency of an additive index.

The alphas of the opportunity- and ability-enhancing practices' indexes are both on good levels (0.724 and 0.702, respectively), but the motivation-enhancing practices' alpha is quite poor, only 0.516. Generally, in factor analysis studies, an alpha above 0.6 is seen as an acceptable value. This suggests that the parts of the motivation-enhancing practice index do not fully point to the same direction. Especially performance pay seems to be inconsistent, as without it the alpha would have been on a decent level, at 0.631. However, performance pay was kept in the analysis as economic theory suggests that it is a key part of the concept: A priori theory is prioritized over exploratory investigations to avoid problems arising from data mining.

In general, the alphas are somewhat lower than in the studies that use factor analysis to generate the indexes. However, as discussed previously, the purpose of this study is not to replicate prior research efforts but to offer a new viewpoint; When the indexes are arbitrarily constructed (though based on theory), it is expected that the alphas are not as high as if the indexes had been built by exploratory factor analysis, with the questionnaire designed for factor analysis purposes. All in all, this method has to compromise in the coherence of the indexes compared to organizational studies only in the case of one out of three indexes. On the other hand, the substantial advantages of the approach presented in this study are the ability to obtain a large amount of responses, and an estimate of the scale effects, as the marginal effect of a one-point increase of the index can be estimated.

The effects are controlled with a good variety of variables. One portion of the control variables consists of individual-level characteristics, such as being in a supervisor position, gender, wage class, education class, age, and self-assessed ability to work. Additionally, job-level characteristics (i.e. if the job requires experience, if new skills are learned, and if the job includes teaching others), HIM practices' prevalence in the company, and the company's field of operation and age are controlled for. The fields of operation are (1) industrial, (2) construction, (3) retail, (4) business-to-business services, (5) health and education services, (6) traffic and communication, and (7)

finance, insurance and property services. In the regressions, where the field dummies were entered, construction was the omitted industry.

The three dimensions of the HIM practices are positively correlated with the development of new products and services, and the correlation is statistically significant at 1% level. Additionally, most of the individual-level control variables are positively and significantly correlated with the dependent variable, meaning that male, high-wage and high-education supervisors seem to generate new products and services more often.

	newprodserv	opportunity	ability	motivation	manager	wageclass	male
newprodserv	1.0000						
opportunity	0.3161*	1.0000					
ability	0.2331*	0.3572*	1.0000				
motivation	0.1534*	0.3075*	0.3663*	1.0000			
manager	0.2808*	0.3724*	0.1620*	0.1533*	1.0000		
wageclass	0.2456*	0.3653*	0.3267*	0.2962*	0.3131*	1.0000	
male	0.0838*	0.0645	-0.0066	-0.0178	0.1062*	0.3036*	1.0000
educclass	0.1852*	0.2266*	0.2986*	0.2072*	0.1704*	0.3835*	-0.0944*

Table 1: Correlations of the individual-level variables (1% significance level marked with asterisk(*)

Also the practices' prevalence in the company is positively and significantly correlated with the generation of new products and services, on-the-job training being the exception: Its correlation is practically zero.

	newprodserv	teams_company	perf_appr_company	training_company	flexhrs_company	remotewrk_company
newprodserv	1.0000					
teams_company	0.1166*	1.0000				
perf_appr_company	0.0841*	0.3009*	1.0000			
training_company	0.0042	0.3119*	0.3395*	1.0000		
flexhrs_company	0.1380*	0.2570*	0.2971*	0.1879*	1.0000	
remotewrk_company	0.1069*	0.2962*	0.2881*	0.1750*	0.3340*	1.0000

Table 2: Correlations of the company-level variables (1% significance level marked with asterisk(*)

The job-level controls are highly and significantly correlated with the dependent variable: All of the three pairwise correlations exceed 0.15, and are significant at 1% level. It is slightly questionable if these variables are good controls, as they are somewhat overlapping with the ability-enhancing practices (employees who receive training also likely learn and teach in their work). Special attention is thus paid on these variables' effect on ability-enhancing practices' coefficient, and the two variables are omitted in the matching procedure explained later.

	newprodserv	job_incl_teaching	job_incl_learning	job_demands_exp
newprodserv	1.0000			
job_incl_teaching	0.2612*	1.0000		
job_incl_learning	0.2573*	0.3428*	1.0000	
job_demands_exp	0.1538*	0.1180*	0.0706	1.0000

Table 3: Correlations of the job-level variables (1% significance level marked with asterisk(*)

Contrary to the individual- and job-level controls and the HIM practices, the fields of the companies are much less correlated with the generation of new products and services. This means that the differences of the new products and services generated by employees between the fields are not very substantial. Only the health and education services are positively and significantly correlated with the generation of new products and services at 5%, while the financial, insurance, and property services are negatively and significantly correlated.

	newprodserv	industrial	construction	retail	b2bserv	health_edu	traffic_comm
newprodserv	1.0000						
industrial	0.0151	1.0000					
construction	-0.0471	-0.2907*	1.0000				
retail	0.0275	-0.3133*	-0.1133*	1.0000			
b2bserv	0.0061	-0.2669*	-0.0965*	-0.1041*	1.0000		
health_edu	0.0739*	-0.2892*	-0.1046*	-0.1127*	-0.0960*	1.0000	
traffic_comm	-0.0302	-0.2829*	-0.1023*	-0.1103*	-0.0940*	-0.1018*	1.0000
finan_ins_prop	-0.0604*	-0.2718*	-0.0983*	-0.1060*	-0.0903*	-0.0978*	-0.0957*

Table 4: Correlations of the industry variables (5% significance level marked with asterisk(*)

6 Results

The first hypothesis is tested with a probit regression, checking for robustness with multiple sets of control variables. First, a baseline regression with no controls is executed. After that, control variables are included: first the individual-level controls, then the job-level controls and the HIM practices' prevalence in the company, and finally dummies for the company's field of operation. After that, propensity score matching is used to compare employees working under HIM practices to otherwise similar employees, who do not work under those practices.

6.1 Probit regression for individual HIM elements

As expected, the opportunity- and ability-enhancing practices' coefficients are positive and significant at 1% level for baseline and controls1-regression, supporting hypothesis 1. Opportunity-enhancing practices seem to have a substantially greater influence than ability-enhancing practices, as their average marginal effect (i.e. the average change in the probability for innovative behavior associated with a one-point increase of the opportunity-enhancing practices' score) after extensive controlling is 3.4%-points compared to ability-enhancing practices' 1.3%-points (reported with controls3). Surprisingly, motivation-enhancing practices' effect is not statistically significant even in the absence of control variables.

When analyzing the singular practices more closely (results presented in the appendices), it is seen that teamwork, flexible work hours, freedom in working tasks, communication with clients, and training, i.e. all the opportunity- and ability-enhancing practices studied, are positively and significantly connected with innovative behavior, even after controlling. On the other hand, all motivation-enhancing practices (performance pay, probability to not be fired, and performance appraisal) are insignificant, and performance pay even has a negative coefficient.

Regression fit is measured by Mckelvey-Zavoina's Pseudo R-squared, which is shown to estimate the underlying OLS-R-squared the closest in tests by multiple scholars (Veall & Zimmermann 1996). The statistic is simply calculated as variance explained by the model divided by total variance, $R^2_{MZ} = \frac{\sum_{i=1}^{N}(\hat{Y}_i^* - \bar{Y}^*)^2}{\sum_{i=1}^{N}(\hat{Y}_i^* - \hat{Y}^*)^2 + N\hat{\sigma}^2}$.

Hence, the intuition behind the statistic is that it estimates what portion of the variance the covariates explain. The R-squared-statistics range from 0.2 to 0.37 in the probit regressions, suggesting that even though the model can explain a substantial part of the variance, there are still other factors that influence innovative behavior. While a part of the variance is likely explained by the fact that the dependent variable is self-reported, and different people assess is differently, there will always be omitted variables in addition. Substantial omitted influencers might be e.g. the person's own interest towards developing new ideas, and if the job either formally or informally includes developing new ideas. The aforementioned is connected to intrinsic motivation discussed under section 4, and it could be measured with the company's recruiting practices (which are one of Posthuma et al's(2013) eight practice groups), but unfortunately information about these practices, along with non-monetary benefits also likely connected with intrinsic motivation (Sanders et al 2010), is not found in the data. One limitation of the study thus could be the imperfect consideration of intrinsic motivation. The inclusion of developing new ideas in the job is probably quite well explained by other covariates, which would indicate that at least this factor does not severely make the error term correlated with the dependent variable.

The connection between HIM practices and innovative behavior weakens somewhat, when controls are introduced: Both opportunity-and ability-enhancing practices coefficients become approximately 40% smaller compared to the baseline estimation. Nevertheless, opportunity- and ability-enhancing practices remain positive and significant at 1% and 5% levels, respectively. Manager position, higher education, and high salary are positively and significantly connected with innovative behavior, while self-assessed ability to work (including physical and mental health), age, gender, tenure, marital status, and the company's recent growth are insignificant and hence were omitted from the presented results for brevity. However, the employee's age has a negative coefficient.

Including the company-level variables, i.e. the prevalence of the HIM practices, and the company's age, to the regression provided interesting results: The company's age is significant and negatively connected to innovative behavior, meaning that employees in older companies demonstrate less innovative behavior. It has to be noted here that in older companies, the workforce is likely to be older as well: hence

both older companies' culture and policies and the age of their workforce might have a role in the less prevalent innovative behavior. Even though the employees' age was insignificant, it had a negative coefficient, and it could indeed be that the effect of the employee's age is mediated by the company's age. Company size, measured by the amount of employees, is not significant.

The job-level variables are all positive, significant, and large. This means that the job characteristics seem to have a dominating effect for innovative behavior: The three job-level variables' average marginal effects are all around 10%, which is in the same range as manager position and high wage. Thus, highly educated and paid employees, who are in a manager position, and have a demanding job that includes both learning and teaching are most likely to demonstrate innovative behavior. However, it is notable that even after taking into account these characteristics, which may overlap with especially ability-enhancing practices, opportunity- and ability-enhancing practices still are significantly connected to innovative behavior.

The HIM practices' prevalence in companies, introduced in control variable set 2, is essentially the portion of employees working under the practice in question. These results, ranging from 0-100 percent, are scaled to a range of 0-10 to provide better comparability with the individual-level coefficients. There are two main reasons to include these variables in the regression: firstly, they help to alleviate the self-selection problem to modern firms: innovative people might self-select to companies that utilize HIM practices. On the other hand, it is interesting to see if the inclusion of practices has spillover effects, i.e. if also people who are not directly involved in these practices, even though the practices are used in the company, are more innovative than people working in companies that utilize no HIM practices.

Probit regression results for the probability of developing new products or services in the last 12 months							
	Baseline 1	**Controls 1**	**Controls 2**	**Controls 3**	**Avg marg. eff./C3**	**Baseline 2**	**Controls**
Constant	-1.91*** (0.155)	-1.81*** (0.166)	-2.21*** (0.265)	-2.69*** (0.317)		-2.11*** (0.213)	-2.85*** (0.344)
HIM practices							
Opportunity	0.197*** (0.025)	0.133*** (0.027)	0.111*** (0.029)	0.118*** (0.030)	0.034*** (0.008)	0.194*** (0.032)	0.120*** (0.036)
Ability	0.082*** (0.019)	0.071*** (0.019)	0.049** (0.022)	0.045** (0.022)	0.013** (0.006)	0.092** (0.025)	0.051* (0.029)
Motivation	0.014 (0.026)	0.001 (0.027)	-0.017 (0.028)	-0.008 (0.029)	-0.002 (0.008)	0.082** (0.036)	0.047 (0.037)
HIM bundles							
Opportunity & Motivation						-0.245 (0.185)	-0.265 (0.204)
Opportunity & Ability						0.155 (0.177)	0.105 (0.189)
Ability & Motivation						-0.342 (0.181)	-0.285 (0.192)
Opportunity & Motivation & Ability						0.121 (0.292)	0.197 (0.315)
Manager		0.497*** (0.104)	0.441*** (0.109)	0.417*** (0.110)	0.119*** (0.031)		0.413*** (0.110)
WAGE							
Mid-wage			0.261** (0.129)	0.334** (0.134)	0.096** (0.038)		0.332** (0.134)
High wage		0.178* (0.099)	0.381** (0.151)	0.466*** (0.157)	0.133*** (0.044)		0.460*** (0.156)
EDUCATION							
Higher education		0.529*** (0.162)	0.366* (0.216)	0.347 (0.217)	0.099 (0.062)		0.355 (0.218)
JOB CHARACTERISTICS							
Over 1 year of experience required			0.243** (0.119)	0.265** (0.121)	0.075** (0.034)		0.253** (0.121)
Job includes learning at least once a month			0.359*** (0.106)	0.331*** (0.107)	0.094*** (0.030)		0.318*** (0.107)
Job incl. teaching others at least once a month			0.368*** (0.117)	0.399*** (0.117)	0.114*** (0.033)		0.410*** (0.117)
COMPANY PRACTICES							
Teams in company			0.028* (0.015)	0.025* (0.015)	0.007* (0.004)		0.028* (0.015)
Training in company			-0.040*** (0.015)	-0.042*** (0.016)	-0.012*** (0.004)		-0.041*** (0.015)
Company age			-0.004*** (0.001)	-0.005*** (0.001)	-0.001*** (0.000)		-0.005*** (0.001)
FIELD OF COMPANY							
Industrial				0.461*** (0.170)	0.131*** (0.048)		0.458*** (0.170)
Retail				0.608*** (0.214)	0.174*** (0.060)		0.585*** (0.214)
Health & education services				0.630*** (0.237)	0.180*** (0.063)		0.625*** (0.239)
Observations	1049	1048	1037	1037	1037	1049	1037
Adj. Pseudo R2	0.093	0.126	0.159	0.165	0.165	0.094	0.163

Table 5: The probit regression results: 10% Significance marked with one asterisk(*), 5% significance with two asterisks(**), and 1% significance with three asterisks(***)

The results are presented in the columns “controls 2” and “controls 3”. Only the prevalence of teamwork is positive and significant, however at only 10% significance level. A really interesting result is the negative and very significant coefficient of training in company, which measures roughly the same practice as the ability-enhancing practices index. Even though the ability coefficient slightly outweighs the training in company’s coefficient, and thus the net effect of on-the-job training seems to be positive, an interaction variable was generated to examine the effects of training in the individual and firm level in more detail.

The interaction effect is not as straightforward to interpret in nonlinear regression as in linear regression, where the interaction effect of two independent variables (x_1 and x_2) is the coefficient β_{12} of their interaction variable x_1x_2 (Norton et al 2004). In probit regression with continuous variables, the full interaction effect is obtained by the cross-partial derivative of x1 and x2 to the expected value of the dependent variable, as demonstrated by Norton et al (2004):

$$\frac{\partial^2 E(y|x1, x2, X)}{\partial x_1 \partial x_2} = \frac{\partial^2 \Phi(u)}{\partial x_1 \partial x_2}$$

$$= \beta_{12}\Phi'(u) + (\beta_1 + \beta_{12}x_2)(\beta_2 + \beta_{12}x_1)\Phi''(u),$$

where Φ(u) is the normal Gaussian cdf taking the value defined by the standard interaction regression setting, $u = \beta_1x_1+\beta_2x_2+\beta_{12}x_1x_2+X\beta$, where Xβ is the set of control variables.

The “controls2” regression with the interaction term (in appendices) provides a surprising result: the ability-enhancing practices’ coefficient becomes insignificant, while the firm-level training’s magnitude becomes larger and more significant. The interaction term alone is positive and significant in 5% level. The regression coefficients paint an even more mixed picture, as the interaction term and the ability-enhancing practices’ term have a combined effect of a similar magnitude as the company-level training’s negative coefficient. Hence, it cannot be stated certainly which effect is stronger, as the exact marginal effects depend on the level of the variables. In order to examine the actual interaction effect, a command named “inteff” by Norton et al (2004) is executed. This program calculates the actual interaction effect for every observation.

From the individual interaction effects it can be seen that the effect is more positive for those who are more likely to have demonstrated innovative behavior. In the lowest levels the effect is negative, but not significant, while at the mean level of approximately 0.33, the effect is positive but not yet significant in 5% level. However, in predicted probabilities above 0.6 the effect is significant for the majority of predictions.

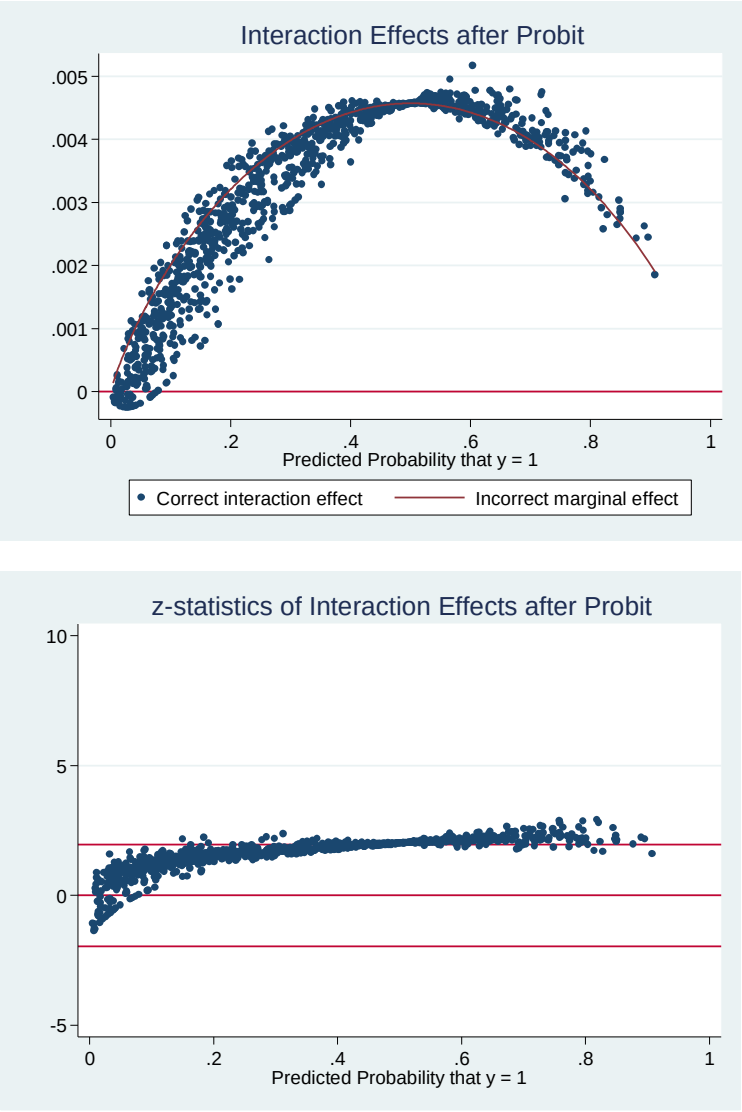


Figure 5: Individual interaction effects between ability and training in company and their z-statistics

To explore the situation from an additional point of view, the observations are grouped by individual ability and training in company, to 2 and 5 groups, respectively. This grouping reveals a potential reason for the ambiguous regression results: the most likely (predicted) innovators are found when around 10-30% of the personnel receive training. This resembles an organization that has a separate development

unit, where innovation activities are centered, but surprisingly these kinds of organizations seem to foster innovative behavior in all employees. Aside from this spike, the slope of the graph is close to level for high-ability and mid-ability employees until the area of the largest training prevalence, and negative for low-ability workers. For most levels of training in company, higher individual training (i.e. ability) is correlated with a higher probability for innovative behavior. This might suggest that aside from a certain level of training in company, innovativeness is centered to the people that receive training, and that there are no spillover effects, or maybe even a negative effect: if a large portion of employees receive training, then those who do not receive the training are very unlikely to produce new products and services.

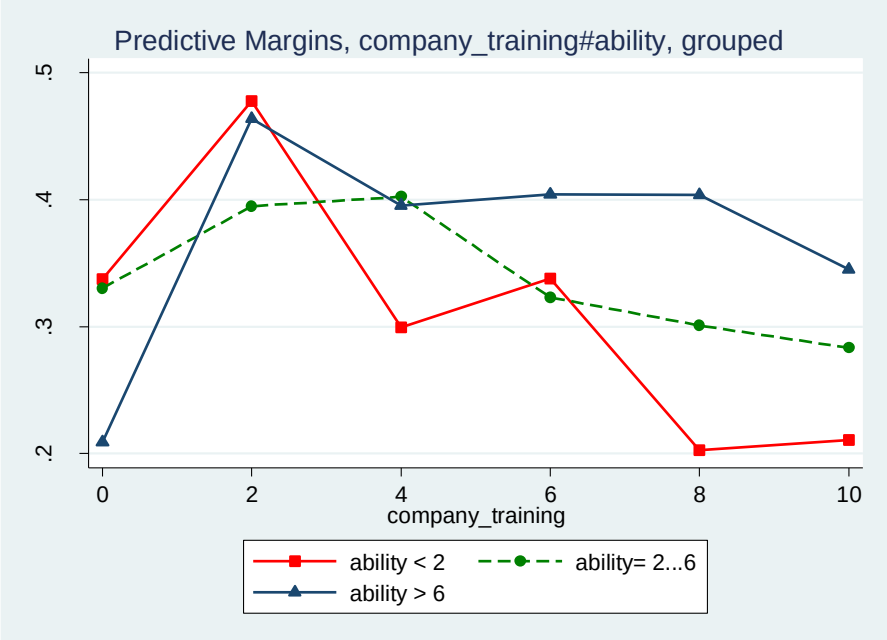


Figure 6: Predicted probabilities for innovative behavior in different individual ability and training in the company levels.

To conclude, the probit regression with control variables suggests that opportunity-enhancing HIM practices are significantly associated with innovative work behavior, and motivation-enhancing practices do not have a connection. Ability-enhancing practices seem to be connected with innovative work behavior; However, there is a slight ambiguity, when controls for the prevalence of the practices in the company and for the job type are included. This is an interesting phenomenon, which would benefit from further research to increase the knowledge of how training really influences innovativeness.

6.1.1 Differences by fields of operation

Different fields of operation and areas are also studied. The results vary in terms of both the fields of operation and area. These seem to matter in the effectiveness of practices, and also in the significance of certain control variables. However, in many fields the amount of observations places even severe limitations to the credibility of the results.

Aside from the traffic and communication sector, opportunity-enhancing practices are positively associated with innovative behavior in every field. Ability-enhancing practices are positively associated in every field of operation except the retail and health & education sectors, and the coefficient is substantially larger and significant in business services, and finance, insurance and property business. This can be interpreted in two ways: either these fields have successfully emphasized innovativeness in training, or in these sectors new product development requires high skills and their constant improvement. The large and significant coefficients on high wage in business services, and high education in finance, insurance, and property business, in addition to ability-enhancing practices would indicate that both explanations have an influence. However, especially in these two fields the sample size is very small, and even the significant results have to be interpreted carefully.

Manager status is positively connected to innovative behavior in every field, but the effects of high wage and higher education vary between fields: The aforementioned has significant and positive effects in business services, traffic and communication, and industrial fields, while the latter has a major effect in industrial and financial, insurance, and property businesses. However, high wage and higher education are correlated especially in finance, insurance, and property business (correlation coefficient =0,43), and the coefficients might be thus distorted especially there.

The effects of the company-level practices are also quite heterogeneous. Teamwork in company is connected to innovativeness in industrial and construction fields, while in finance, insurance, and property business it hampers innovative behavior. This might reflect the fact that a practice is not necessarily optimal for every field, but that different types of work require different practices. On the other hand, it might be that in some fields there is a need for improvements in terms of implementing the practices. Another observation is that unlike in the regression for all fields

simultaneously, the coefficients for training in company are not significant at 1% level in any field. However, the coefficients are negative in every field aside from traffic and communication. The case for remote work is also interesting: The coefficient is very significant in industrial, retail and health and education industries, but in retail and industrial industries it is negative, and in health and education positive.

All in all, the results by the field of operation mostly point to the same direction concerning the HIM practices and the innovative behavior's connection. However, interesting differences arise in the control variables' relations to innovative behavior. It would seem sensible to interpret that these differences are due to the different ways of working and dividing work. This observation highlights the importance of the way of implementing these practices and the role of leadership quality and leader-member-exchange, discussed in section 4.3. Traditionally, these questions have been pondered from the perspective of management and organizational studies, but results from the field of economics could provide added value to the discussion, as requested by Gopalakrishnan & Damanpour (1997).

6.1.2 Differences by area

The companies can also be divided to four groups according to their location: Southern, Western, Eastern, and Northern Finland. The companies and employees in Eastern Finland seem to be quite a bit different from the rest of Finland in their determinants of innovative behavior: The individual-level HIM practices are insignificant and their coefficients are small. The only statistically significant coefficients are those of medium and high wage and experience required in the positive side, and remote work in company in the negative side. Also higher education and manager position's coefficients are large, however not significant.

Southern Finland is the only area, where both opportunity- and ability-enhancing practices are significant and large, making it the region mostly in line with hypothesis 1 (although also the region with the largest sample size). Also the company-level prevalence of training's negative effect is the smallest, and the least significant. On the other hand, in Northern Finland the opportunity-enhancing practices' connection is very large in magnitude, and also significant. There also the company-level training's coefficient is the largest and the most significant. It might be that the job types that are common in Southern Finland and Northern Finland are more suitable

in combining employee-driven innovation and opportunity-and ability-enhancing, and opportunity-enhancing HIM practices, respectively, or that the practices are better implemented there in terms of enhancing innovation.

As is the case in the by-industry regressions, also differences between areas in the control variables' significance and magnitude exist. However, these might originate from the industry differences, as different industries are concentrated in different areas: This is also confirmed to be the case here by a chi-square test between area and industry: The chi-square value is 71.9, implying that the distribution significantly deviates from random at 0.1% significance level. Hence, the differences likely reflect both area and industry effects.

	Probit regression by company's field of operation, the probability of developing new products/services in the last 12 months as the dependent variable						
	Industrial	Construction	Retail	Business services	Education & health	Traffic & communication	Finance, insurance, property
Constant	-2.565***	-2.009	-2.311***	-5.694***	-3.415**	-7.867***	-10.153***
	(0.413)	(1.316)	(0.880)	(1.712)	(1.482)	(1.635)	(1.950)
HIM practices							
Opportunity	0.151***	0.138	0.170*	0.206	0.177	-0.157	0.214
	(0.043)	(0.100)	(0.097)	(0.169)	(0.123)	(0.116)	(0.184)
Ability	0.018	0.037	-0.012	0.420***	-0.035	0.147	0.367***
	(0.032)	(0.090)	(0.087)	(0.161)	(0.106)	(0.109)	(0.119)
Motivation	0.045	-0.019	0.037	-0.366*	-0.187	0.095	-0.148
	(0.042)	(0.107)	(0.104)	(0.193)	(0.123)	(0.126)	(0.180)
Manager	0.244	0.615*	0.839**	0.309	0.049	1.786***	1.138**
	(0.178)	(0.356)	(0.385)	(0.571)	(0.474)	(0.460)	(0.551)
WAGE							
Mid-wage	0.469**	-0.060	0.490	3.290**	-0.239	4.492***	-2.190**
	(0.217)	(0.500)	(0.459)	(1.351)	(0.386)	(0.463)	(0.891)
High wage	0.465*	-0.418	0.160	4.948***	-0.251	4.516***	-1.261
	(0.239)	(0.542)	(0.589)	(1.856)	(0.655)	(0.543)	(1.032)
EDUCATION							
Higher education	0.869**	Omitted	Omitted	0.116	-0.559	-0.982	7.233***
	(0.362)			(0.889)	(0.860)	(0.745)	(1.148)
JOB CHARACTERISTICS							
Over 1 year of experience required	-0.018	0.158	0.764**	0.785	1.423***	1.000*	0.726**
	(0.190)	(0.458)	(0.342)	(0.627)	(0.488)	(0.606)	(0.663)
Job includes learning at least once a month	0.414***	0.143	0.234	1.386	0.339	0.621	3.341***
	(0.159)	(0.388)	(0.364)	(0.904)	(0.457)	(0.613)	(0.802)
Job includes teaching others at least once a month	0.488***	1.244**	0.708**	-1.093	1.346**	-0.349	-1.148*
	(0.171)	(0.577)	(0.356)	(0.757)	(0.553)	(0.595)	(0.628)
COMPANY PRACTICES							
Teams in company	0.059***	0.136**	-0.022	0.106	-0.022	0.072	-0.357***
	(0.022)	(0.066)	(0.052)	(0.093)	(0.071)	(0.074)	(0.109)
Training in company	-0.043**	-0.105**	-0.110**	-0.063	-0.036	0.054	-0.003
	(0.020)	(0.052)	(0.051)	(0.067)	(0.066)	(0.052)	(0.090)
Performance appraisal in company	0.018	0.030	-0.021	-0.083	-0.006	-0.039	0.167
	(0.019)	(0.050)	(0.048)	(0.090)	(0.053)	(0.069)	(0.110)
Remote work in company	-0.118***	-0.015	-0.266**	0.014	0.430***	0.149*	0.035
	(0.040)	(0.108)	(0.113)	(0.071)	(0.120)	(0.083)	(0.098)
Company age	-0.005**	-0.016*	0.005	-0.001	0.007	-0.008*	-0.018**
	(0.002)	(0.008)	(0.006)	(0.013)	(0.005)	(0.005)	(0.008)
Observations	473	98	110	79	94	93	76
McKelvey-Zavoina R2	0.427	0.448	0.571	0.887	0.752	0.823	0.918

Table 6: Probit regressions by industry

Probit regression by company's area, the probability of developing new products/services in the last 12 months as the dependent variable				
	Southern Finland	Western Finland	Eastern Finland	Northern Finland
Constant	-2.455***	-1.545***	-2.673***	-4.822***
	(0.431)	(0.485)	(0.698)	(1.504)
HIM practices				
Opportunity	0.133***	0.115**	0.042	0.303**
	(0.046)	(0.055)	(0.072)	(0.128)
Ability	0.110***	0.078*	-0.032	0.028
	(0.036)	(0.043)	(0.055)	(0.105)
Motivation	-0.044	-0.005	-0.014	-0.070
	(0.042)	(0.057)	(0.079)	(0.139)
Manager	0.369**	0.553**	0.402	1.530***
	(0.157)	(0.218)	(0.352)	(0.550)
WAGE				
Mid-wage	0.050	0.499*	0.865**	0.251
	(0.209)	(0.260)	(0.344)	(0.455)
High wage	0.340	0.499*	0.878**	-0.680
	(0.228)	(0.303)	(0.393)	(0.564)
EDUCATION				
Higher education	0.485	-0.088	0.362	-0.108
	(0.296)	(0.436)	(0.663)	(1.018)
JOB CHARACTERISTICS				
Over 1 year of experience required	0.197	-0.284	0.864***	1.092***
	(0.185)	(0.235)	(0.312)	(0.417)
Job includes learning at least once a month	0.417***	0.104	0.129	1.556***
	(0.162)	(0.214)	(0.350)	(0.412)
Job includes teaching others at least once a month	0.456**	0.373*	0.171	0.704
	(0.185)	(0.226)	(0.343)	(0.516)
COMPANY PRACTICES				
Teams in company	0.028	0.018	0.028	-0.085
	(0.021)	(0.031)	(0.040)	(0.076)
Training in company	-0.031	-0.040	-0.035	-0.128**
	(0.025)	(0.029)	(0.039)	(0.060)
Performance appraisal in company	-0.006	0.039*	0.026	0.114*
	(0.022)	(0.023)	(0.033)	(0.059)
Remote work in company	-0.011	0.045	-0.189**	-0.066
	(0.027)	(0.045)	(0.084)	(0.117)
Company age	-0.004**	-0.007**	0.001	-0.004
	(0.002)	(0.003)	(0.004)	(0.005)
Observations	486	266	167	103
McKelvey-Zavoina R2	0.373	0.350	0.389	0.479

Table 7: Probit regressions by area

6.1.3 Probit regression with HIM practice bundles' effects

Hypothesis 2 (i.e. HIM bundles have synergies) is tested first by including dummies for combinations of HIM practice elements: An employee is considered to be working in such a combinational setting if her practice scores exceed the medians of at least two practice scores. This way, roughly 30% of the employees work under each combination of two practices, and 20% in the combination of all three practices.

Including variables for both singular HIM practices and for combinations of the practices enables to study if the practices work more effectively in bundles than what their combined singular effects would indicate, i.e. if their combined effects are larger than the sum of their individual effects, as is formulated in hypotheses 2a and 2b. The results, shown in the two right-hand side columns in Table 5, mostly do not support this hypothesis. The coefficients for ability&motivation-enhancing practices' bundle, and opportunity&motivation-enhancing practices' bundle are negative, even though insignificant. On the other hand, opportunity&ability-enhancing practices, and a bundle of all three elements, have positive coefficients. Again however, they are not significant. The results thus do not support the hypotheses 2a and 2b: especially if motivation-enhancing practices are included in the bundle, the bundle's effect is less than the singular practices' effects combined. The motivation-enhancing practices' positive and significant (in the absence of control variables) coefficient supports this interpretation: alone the effect may be even slightly positive, but when added to a bundle they are not effective. Once again it has to be kept in mind that all of the bundle dummies are insignificant, suggesting that they may not have substantial bundle benefits or disadvantages in terms of stimulating innovation.

6.2 Propensity score matching for HIM bundles

Another way of trying to solve the employee self-selection problem that causes endogeneity, and to paint a more accurate picture of how much the practices actually matter, is to estimate so-called treatment effects for the observations. Here, the treatment is the existence of HIM practices in the individual level. To assess the effectiveness of the practices in fostering innovation, it would be of interest to find out would the treated persons have demonstrated innovative behavior, had they not received the treatment, i.e. had they not worked under HIM practices. This effect for individual i can be written as

$\tau_i = Y_i(1) - Y_i(0)$ (Caliendo & Kopeinig 2008).

However, only the first outcome is actually observed for each treated individual, and as the assignment to treatment is (very likely) not random, one cannot make direct conclusions about what part of the differences of treated and untreated persons' innovative behavior is caused by the treatment.

Fortunately, these effects can be estimated on the average level. The estimator of interest here is the average treatment effect on the treated, answering the question of what would have happened to the treated individuals were they not treated. Caliendo & Kopeinig (2008) formulate this as

$$\tau_{ATT} = E(\tau|D = 1) = E[Y(1)|D = 1] - E[Y(0)|D = 1],$$

i.e. simply the difference of the treated persons' average innovative behavior and their average innovative behavior had they not worked under HIM practices. The second term can be substituted with $E[Y(0)|D = 0]$, if similar observations to the treated individuals can be found from the untreated individuals.

This searching process for comparable untreated observations is done by estimating propensity scores that measure the probability of being in the treatment group, given the values of observed covariates (Rubin 2001). As it is not feasible to condition on very many covariates due to the curse of dimensionality, the values are combined to a single index, the propensity score (Caliendo & Kopeinig 2008, Heinrich et al 2010). In practice, the treatment variable is regressed on covariates with logit or probit regression. After that, every treated individual is matched with an untreated individual with a similar propensity score, i.e. probability of being treated, given the values of observed covariates (Rubin 2001). The quality of the data, and the matching procedure, can be assessed by checking if the data fulfill two additional assumptions after treatment is assigned.

The first assumption is conditional independence, or unconfoundedness for controls, as in Caliendo & Kopeinig (2008): $Y_0 \perp\!\!\!\perp D|P(X)$, meaning that the potential outcomes are independent of the treatment status, given the propensity score. That is, after taking into account the propensity score, the assignment to treatment is as good as random (Heinrich et al 2010). Unfortunately, there is no direct way of testing

this, and we must settle for qualitatively assessing if there are missing variables that affect the treatment selection and innovative behavior. Heinrich et al (2010) suggest for example checking and removing insignificant variables from the treatment assignment regression to prevent unnecessary disruptions (and this action is done in this study). In other words, the omitted variable bias cannot be completely cured with this method. A potential problem with this specification is that unlike suggested by Heinrich et al (2010), all the covariates, e.g. salary, in the propensity score are not stable or deterministic over time, or measured before the treatment. Thus, the assignment to treatment or the outcome variable might influence, say, salary. However, aside from salary this does not likely cause problems for the selected covariates (which are e.g. age, education, and industry- or firm-wide characteristics).

The second assumption presented in Caliendo & Kopeinig (2008) for estimating average treated effects for treated is the weak overlap condition, $P(D = 1|X) < 1$, which means that for every observation, the reception of the treatment has to be uncertain given the covariates. This is testable by investigating the densities of the treated and untreated groups by propensity scores. If there are lots of observations near the value 1, the results may not be reliable.

Additionally to the two assumptions, there must be enough common support between the treated and the untreated observations to avoid extrapolating. Rubin (2001) summarizes the requirements for common support to avoid bias in propensity score matching: After the adjustment for the propensity score, 1) The difference in the means of the propensity scores for treatment and control groups must be small (less than half a standard deviation) 2) The ratio of the variances of the propensity scores in the two groups must be close to one, and 3) The ratio of the covariates' residuals variances must be close to one. These guidelines were used to inspect the model specifications: the exact process is explained shortly.

To implement matching, a software program, "psmatch2" by Leuven & Sianesi(2003) is used. The program includes tools for testing Rubin's conditions, and hence allows reducing the potential bias arising from the differences between the treatment and the control groups. All control variables used in matching were tested for their statistical significance, and the insignificant ones were omitted from the regression, as presented in Caliendo & Kopeinig (2008) as an option, and suggested by Heinrich

et al (2010). However, the company-level prevalence of the practices was replaced by the industry-level prevalence of the practices, as the former is directly affected by the treatment: if a person is working under HIM practices, it is likely that these practices are more widely in use in the company. In the industry level, this effect will be negligible. Additionally, from the job-level controls, the inclusion of guidance and learning in the job are omitted, as they are most likely directly affected by the assignment to HIM practices. The controls were added in groups, and only the statistically significant ones were kept.

As there are multiple different groups of HIM practices, also multiple different matching specifications were implemented. The number of the practices and additionally the inclusion of opportunity-, ability-, and motivation-enhancing practices were compared in a variety of settings. In all model specifications, the individuals were classified as treated for a practice if their respective HIM practice score was above the median for that respective practice.

Rubin's (2001) first requirement, presented a little earlier, is measured by "Rubin's B", the absolute standardized difference of the means of the propensity score's linear index between the treated and untreated groups (Leuven & Sianesi 2003). None of the specifications had a B of over 50, i.e. half a standard deviation, which Rubin (2001) proposes to be a sign of substantial bias, but a few had a B>25, and they are highlighted to be potentially biased, as proposed by Leuven & Sianesi(2003). The second and third requirements are also checked, but none of the models was bad, i.e. they all fit between 0.5…2 (for the propensity score index in requirement 2, and for each variable in requirement 3). However, a part of the covariates are "of concern", as defined by Leuven & Sianesi(2003): Their residuals' variance ratio is below 0.8 or above 1.25.

Significance is checked with both conventional and bootstrapped standard errors. Their difference is that the conventional standard error cannot account for variance that is originated from the calculation of propensity score or the common support condition (Caliendo & Kopeinig 2008). Bootstrapping, i.e. re-estimating the results (typically at least 50 times), and investigating the distribution of the multiple treatment effects obtained from these samples, attempts to take these additional variances into account, based on the fact that the distribution of the samples approximates the

underlying population distribution. Heinrich et al (2010) and Caliendo & Kopeinig (2008) summarize that while bootstrapping has been proven to not be free of bias, it is still a commonly used tool that is able to estimate the error more accurately than the regular standard error estimate.

Additionally, a caliper of 0.01 for the common support condition is set: That is, all the treated observations that do not have a match in the radius of 0.01 propensity score are omitted: this is done to maintain common support, i.e. avoid extrapolating the model too much. Typically a maximum of 5% of the observations were dropped, and a vast majority of the dropped observations had very high propensity scores, i.e. predicted probabilities for innovative behavior, as can be seen from the figures reported in the next section. While omitting data is never good, neither is extrapolating, or comparing an observation with an unsuitable “match”. There is no conclusion about the use of caliper, but Heinrich et al (2010) state that it may be necessary to use one to control for bias. To study robustness, selected specifications are also estimated without a caliper, and it turns out the results estimated without a caliper are larger in magnitude and more biased than the results that are estimated with a caliper.

In order to be able to study the effect of including a specific practice to a specific practice or set of practices, subsets of the whole set of approximately 1100 observations have to be used. While this inflates the standard errors and makes the effects more ambiguous, the various specifications provide additional information about effects of different practices in various settings. The size of the samples varies from the largest set, including approximately 1100 observations, to a set of approximately 300 observations: thus, even the smallest set should be large enough to offer potentially significant results.

6.2.1 Matching results concerning the amount of practices

The results of the propensity score matching are mostly pointing to the same direction as the probit regression results. However, a major point of focus is the additive effects of the practices: While the probit regression suggested that there are no synergies in combinations of multiple practices, the matching method magnifies the picture by showing that innovative behavior does nevertheless increase with the number of practices. Concluding these two observations suggests that there seems

to be a positive, but decreasing-returns-to-scale connection between innovative behavior and HIM practices.

More specifically, employees working under one HIM practice demonstrate innovative behavior on average 12%-points more often than employees working under no HIM practices, while in the case of two versus zero practices the difference is 24%-points. However, this estimate is slightly biased, as its Rubin's B is 28.4, which is slightly higher than the recommended maximum value of 25. This is reflected in the result of two practices versus one practice: Here the increase of the likelihood to demonstrate innovative behavior is only 4%-points, indicating that the estimates are not completely coherent, even though this difference just fits into the range of one standard error. Thus, the two-versus-zero practice estimate is likely biased upwards, and a reasonable crude estimate would be that one implemented practice group (Ability-enhancing, Motivation-enhancing, Opportunity-enhancing) is connected with a 12%-points increase in the likelihood for innovative behavior, and two implemented practice groups are connected to an increase that is in the range of 16…24%-points.

Also increasing the number of practice groups to three versus one or two is connected with an increase of the innovative behavior (for 8%-points and 4.7%-points, respectively): however, these effects are no longer significant, and the estimate of three practices versus zero practices is severely biased. This can be interpreted to reflect the fact that the people who work in an HIM job including all three practice groups are very different to the people working under no HIM practices, and thus comparable groups are not found.

To sum up, the only statistically significant and not substantially biased effects are the ones of one versus zero and two versus zero practices. On the other hand, all estimates are positive, suggesting that more practices are connected with more innovative behavior.

		Treatment group's practices (exactly)		
		3	2	1
Control group's practices (exactly)	2	0.0806 (0.0644) [0.0686]		
	1	0.0466 (0.0689) [0.0839]	0.0395 (0.0520) [0.0501]	
	0	***0.3938*** ***(0.0641)**** ***[0.0793]****	**0.2411** **(0.0537)*** **[0.0493]***	0.1199 (0.0453)*** [0.0514]**

		Treatment group's practices (at least)		
		3	2	1
Control group's practices (at least)	2	0.0806 (0.0644) [0.0686]		
	1	0.0901 (0.0485)* [0.0585]	0.0562 (0.0483) [0.0401]	
	0	0.0675 (0.0481) [0.0610]	0.1152 (0.0447)*** [0.0433]***	**0.2395** **(0.0488)*** **[0.0436]***

Table 8: The matching results for number of practice groups: In the first row the Average Treatment Effect on Treated, i.e. the difference of the potential outcomes of treated and untreated. In the second and third rows, conventional and bootstrapped standard errors, respectively. Severely misspecified models (both biased and substantially off common support) marked with red color, bold, and italics, slightly misspecified models (only slightly biased and/or slightly off common support) marked with orange color, and bold. Significance is marked with one(10%), two(5%), or three(1% significance level) asterisks.

6.2.2 Matching results concerning specific practice combinations

Also the inclusions of a specific practice group to various settings were studied. The big picture here is similar to the probit regression: Including opportunity- or ability-enhancing practices has a positive relationship to innovative behavior. However, while including motivation-enhancing practices did not have any effect in the probit regression, here the effect is mostly negative, even though not significant. As the sample sets here are typically smaller than in the previous section, also the effects

are less significant. In spite of the statistical insignificance, especially the effects of larger magnitude are worth noticing.

Interestingly, motivation-enhancing practices have a small positive effect versus no HIM practices (4.4%-points, insignificant) to innovative behavior. In the situations where some practice or practices are already implemented, the inclusion of motivation-enhancing practices results in negative, even though insignificant effects (as the settings with ability-enhancing, and ability- and opportunity-enhancing practices combined, were biased or included many observations out of common support, and had remarkably high standard errors compared to other specifications). Thus, even after studying the matching results, there seem to be no positive effects of motivation-enhancing practices to innovative behavior, and combining the motivation-enhancing practices to other practices might even result in negative effects.

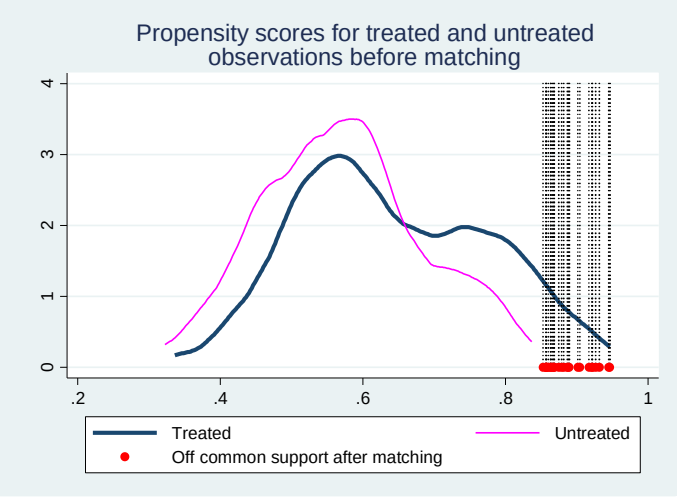
Including opportunity-enhancing practices to any of the settings (Ability- and/or motivation-enhancing practices, or no practices) has a positive connection to innovative behavior, on a magnitude of 11.9%-points to 16.6%-points. None of these effects are significant at 5% significance level. However, when using the full set (i.e., comparing the inclusion of opportunity-enhancing practices to any setting), the effect (13.7%-points) is significant at 5% significance level. Thus, it seems that opportunity-enhancing practices are connected with innovative behavior independent of any other HIM practices.

Ability-enhancing practices tell a similar story to opportunity-enhancing practices, the only difference being the smaller magnitudes of the effects: from 4.4%-points to 12.6%-points. However, when using all the data the effect (10.3%-points) is significant at 1% significance level. Another key result is that ability-enhancing practices, unlike opportunity- or motivation-enhancing ones, typically work best as part of a bundle: the smallest effect is obtained when they are the only HIM practice, and the largest effect is reached when also opportunity- and motivation-enhancing practices are in use. This observation is similar to what is hypothesized in section 3.1.2.

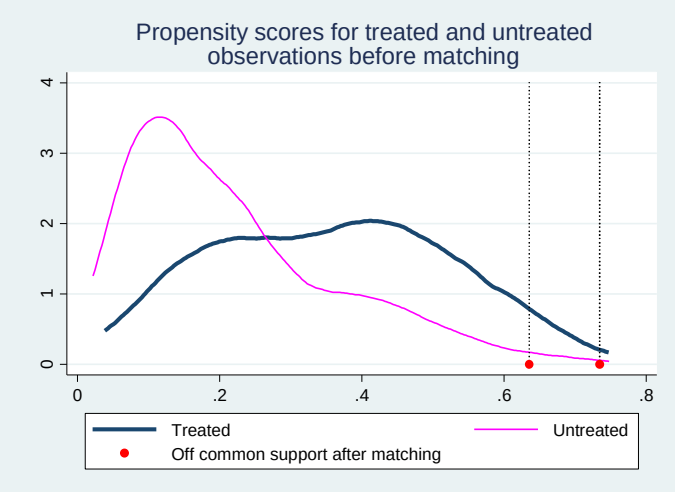
	Adding opportunity to		Adding ability to		Adding motivation to
Ability & motivation	0.1186 (0.1368) [0.1273]	opportunity & motivation	0.1263 (0.0938) [0.1064]	opportunity & ability	-0.1749 (0.1460) [0.1353]
Ability	0.1270 (0.0770)* [0.0675]*	Opportunity	0.1205 (0.0625)* [0.0716]*	Opportunity	-0.0461 (0.0624) [0.0659]
Motivation	0.1655 (0.0949)* [0.0943]*	Motivation	0.0776 (0.0605) [0.0674]	Ability	-0.1606 (0.1218) [0.1299]
nothing	0.1374 (0.0727)** [0.0832]*	nothing	0.0444 (0.0622) [0.0894]	nothing	0.0442 (0.0522) [0.0641]
anything	0.1373 (0.0590)** [0.0646]**	anything	0.103 (0.0408)** [0.0328]***	anything	-0.0240 (0.0411) 0.0454

Table 9: The matching results for specific practice combinations: In the first row the Average Treatment Effect on Treated, i.e. the difference of the potential outcomes of treated and untreated. In the second and third rows, conventional and bootstrapped standard errors, respectively. Severely misspecified models (both biased and substantially off common support) marked with red color, bold, and italics, slightly misspecified models (only slightly biased and/or slightly off common support) marked with orange color, and bold. Significance is marked with one(10%), two(5%), or three(1% significance level) asterisks.

Two-vs-zero practices (below)



One-vs-zero practices (below)



At-least-two-vs-less-than-two practices (below)

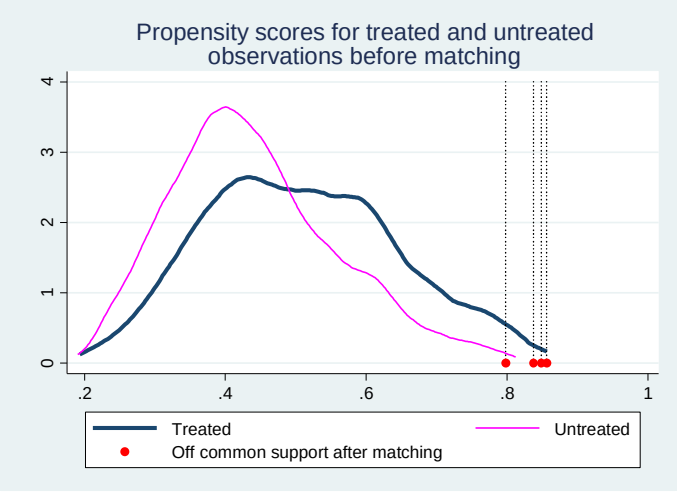


Figure 7: Common support graphs showing kernel densities and observations off common support in three model specifications.

6.2.3. Robustness of the matching results to matching method

Robustness of the results is checked by conducting multiple different matching procedures to three of the model specifications, namely the two-versus-none practices, one-versus-none practices, and three-versus-one-or-two practices. These were selected, as they are significant at 5%, 1%, and 10% significance levels in the chosen matching procedure, respectively, and it is of interest to see if the effect stays significant and has the same magnitude in other matching methods, too. Propensity score matching with logit, five nearest neighbors, kernel, and without caliper were conducted. To obtain comparison to propensity score matching, additionally matching with Inverse-Probability-Weighting (IPW) is conducted. IPW differs from propensity score matching in that it sets weights on each observation according to the inverse of their probability to receive treatment: Larger weights are set to the more unlikely treated individuals when estimating the potential outcomes, in order to better represent the full sample (Stuart 2010).

It is found that the specifications are quite robust to the selected methods: Two-versus-none practices' coefficient ranges from 0.21…0.26, while the original coefficient is 0.24. It is also significant at 1% significance level in all specifications. One-versus-none practices' coefficient ranges in 0.06…0.15 and stays significant at 5% (or even 1%) significance level in all specifications, except the logit propensity score matching. However, in the logit specification a few of the covariates are insignificant and the model is slightly biased. If the insignificant covariates are omitted, the coefficient of one-versus-none practices ranges in 0.11…0.15 and is significant. Two-or-three-versus-one practices' coefficient ranges in 0.05…0.10 and is not significant, except in the specification without caliper and without bootstrapped standard errors. Models with logit show approx. 25% to 50% smaller coefficients, while the models without caliper show approx. 10% larger coefficients for all three specifications. The other methods have no clear pattern of producing substantially larger or smaller coefficients.

Specification	Probit	Logit	Probit, NN(5)	Probit, Kernel	Probit, IPW	Probit, No caliper
Two-vs-zero practices	0.2411 (0.0537)*** [0.0493]***	0.2070 (0.0539)*** [0.0620]***	0.2385 (0.0497)*** [0.0489]***	0.2383 (0.0508)*** [0.0426]***	0.2395 (0.0516)*** [0.0704]***	0.2630 (0.0626)*** [0.0646]***
One-vs-zero practices	0.1199 (0.0453)*** [0.0514]**	0.0568 (0.0466) [0.0480]	0.1050 (0.0394)*** [0.0462]**	0.1219 (0.0383)*** [0.0352]***	0.1241 (0.0359)*** [0.0335]***	0.1487 (0.0543)*** [0.0482]***
At-least-two-vs-less-than-two practices	0.0901 (0.0485)* [0.0585]	0.0619 (0.0489) [0.0529]	0.0726 (0.0472) [0.0517]	0.0573 (0.0434) [0.0451]	0.0486 (0.0430) [0.0389]	0.1011 (0.0479)** [0.0658]

Table 10: Robustness analyses of three matching specifications: Coefficient of the estimated Average Treatment Effect on Treated in the first row, conventional and bootstrapped standard errors in second and third rows, respectively.

7. Conclusions

This thesis focuses on High-Involvement Management (HIM) practices' connection to employees' innovativeness, measured by their innovative behavior. After grouping the HIM practices to three groups according to their purpose: Opportunity-enhancing, ability-enhancing, and motivation-enhancing practices, the major finding is one that confirms the first hypothesis: Opportunity- and ability-enhancing practices are significantly connected to innovative behavior: After extensive controlling, a one-point (in the scale of 0-10) increase of the practice index is connected to 3.4%-point for opportunity-enhancing practices and 1.3%-point increase for ability-enhancing practices in the probability that the employee has developed new or improved products for her employee in the past year. Other important factors for innovative behavior are supervisor position, high wage and education, and a job that requires experience and includes teaching and learning.

Typically, opportunity-enhancing practices enhance innovative behavior independent of other practices in use, while ability-enhancing practices work best as a part of a bundle: Propensity score matching revealed that the employees who have an above-median level of opportunity-enhancing practices in use are 13.7%-points more likely to show innovative behavior than similar employees who have below-average levels of the practices in use. The effect is roughly similar on any practice combinations. In the case of ability-enhancing practices the respective effect is 10.3%-points, and the effect is larger the more practices are implemented: If ability-enhancing practices are the only practice type the effect is only 4.4%-points. Thus, opportunity- and ability-enhancing practices seem to matter in the Finnish context with low hierarchies, well-educated employees and emphasis on dialogue in the workplace.

Unlike other types of practices, motivation-enhancing practices have no positive connection to innovative behavior. If anything, the effect might be even negative: this is represented especially in the matching results, but they have credibility issues due to quality of matching. The reason behind the lack of connection might be that "motivation-enhancing" practices as defined in this study may not form a meaningful concept: Especially performance pay is not very much correlated to the other parts of the index. Furthermore, the motivation-enhancing practices might incentivize the employee to work more efficiently and demonstrate less innovative behavior. On the

other hand, monetary rewards might not be a good way to incentivize employees to innovate in the first place, as suggested in the literature. All in all, the motivation to innovate arises from something else than these “motivation-enhancing” HIM practices.

The second hypothesis, i.e. the HIM practices provide synergies as a bundle, is not supported by the data: Contrary to the hypothesis, an increased number of HIM practice types has positive but decreasing returns to scale in terms of enhancing innovative behavior. The first implemented practice improves the probability for innovative behavior by 12%-points, while the second implemented practice only improves it for 4…12%-points, with some ambiguity on the exact scale of the effect. On the other hand, the motivation-enhancing practices might complicate these results, and at least ability-enhancing practices do work better when they are combined with other practices. Thus, the second hypothesis cannot be rejected with certainty: With another framework considering the motivation-enhancing practices for innovative behavior the results might have been more favorable for this hypothesis.

There are some important limitations in the results: Perhaps the most critical one is the assumption of a random selection process to the HIM jobs: Even though controlled in this study with a large variety of variables, the literature suggest that more able individuals are more often in HIM jobs, causing an upward bias in the results (e.g. Böckerman et al 2013). Additionally, the dependent variable is binary and self-evaluated by the employee, which likely adds noise to the results and hence inflates standard errors. Some important factors affecting especially the motivation for innovative behavior have also been omitted, e.g. non-monetary incentives and recruiting policies likely affecting the employee’s intrinsic motivation, and if the employee’s job description includes developing new products or services. The results may not as such be interpreted as a causal link due to the previous limitations, and also due to causality possibly running both ways, from innovativeness to HIM practices and from HIM practices to innovativeness.

The results presented have important implications for theorists and practitioners: For theorists, it would be of great use to develop a framework for studying the motivation for innovative behavior quantitatively: As a result, a clearer picture could be formed about the factors that affect the motivation to innovate. For practitioners, the result

that two added practice types increase the probability for innovative behavior for approximately 20%-points is a significant one: Combined with the result by other scholars that HIM practices improve productivity by 10…20% at least in manufacturing jobs (e.g. Lazear 2000, Jones et al 2010), this implies that it would be possible to obtain R&D efforts from the existing personnel without compromising for efficiency. Of course, implementing the HIM practices is costly and the ideas from employees might be very different from the ideas from R&D professionals. Nevertheless, it would not be hard to believe that also employees' R&D efforts provide valuable competitive advantage.

Potential further research topics came up in numbers. For example, it would be interesting to find out the driver behind the company-level training's spike at 10-30% level and gain knowledge about efficient ways to organize on-the-job training in the company. Also the effect of non-monetary incentives is unfortunately left mostly out of scope here. Of course, the next steps after innovative behavior would also be very interesting to study: For example, how does innovative behavior develop into innovations and which are the factors that matter for the quality and usability of the innovations? Further, considering the potential trade-off between productivity and innovativeness: How productive are the innovative employees compared to their non-innovative counterparts?

To the author, the most essential conclusions of this study are that opportunity and ability of the employee matter for their innovativeness, and that maintaining these is important for the company to be successful in the long run. Thus, it is worthwhile to utilize and enhance the employees' innovative capabilities instead of blocking them. Also, different ways of organizing work, specifically organizing the HIM practices, are suitable for different organizations, and the implementation style likely matters for the success of these practices.

8. Appendices

Probit regression results for the probability of developing new products or services in the last 12 months	
	Baseline
constant	-1.952***
	(0.204)
OPPORTUNITY-PRACTICES	
teamwork	0.042***
	(0.011)
flexible workhours	0.055***
	(0.013)
opportunity to influence job	0.073***
	(0.020)
communication with clients	0.065***
	(0.015)
ABILITY-PRACTICES	
on-the-job training	0.041***
	(0.014)
MOTIVATION-PRACTICES	
performance pay	-0.008
	(0.001)
probability to retain job	0.005
	(0.018)
performance appraisal	0.024
	(0.017)
Observations	1049
McKelvey-Zavoina R2	0.203

Table 12: Baseline probit regression results for the singular practices.

Probit regression with controls2 and interaction between ability and training in company		
	Controls2	**Average marginal effects**
Ability	-0.021	-0.006
	(0.042)	(0.012)
Training in company	-0.086***	-0.025***
	(0.027)	(0.008)
Interaction	0.011**	0.003**
	(0.006)	(0.002)

Table 11: Probit regression with controls2 and interaction term between ability-enhancing practices and training in company. Note: Interaction term's scale is 10 times ability-enhancing practices' and training in company's scales.

Variables that are included in regression but omitted from presentation due to insignificance		
Controls1	**Controls2**	**Controls3**
Male	Male	Male
	High School	High School
	College	College
	Performance appraisal in company	Performance appraisal in company
	Flexible workhours in company	Flexible workhours in company
	Remote work in company	Remote work in company
		Business services
		Traffic & Communication
		Finance, insurance, or property

Table 13: List of variables that were omitted from the presented results.

Summary of all variables used					
Variable	Obs	Mean	Std. Dev	Min	Max
new products/services	1084	0.327491	0.469515	0	1
opportunity-enhancing	1077	5.289771	1.921247	0.833333	10
ability-enhancing	1088	3.935514	2-482478	0	10
motivation-enhancing	1068	4.06703	1.70596	0	10
manager	1091	0.246563	0.431208	0	1
mid-wage	1093	0.403477	0.490819	0	1
high wage	1093	0.362306	0.480887	0	1
male	1093	0.642269	0.479552	0	1
high or vocational school	1093	0.520586	0.499805	0	1
college	1093	0.271729	0.445055	0	1
higher education	1093	0.075023	0.263549	0	1
Job includes learning once/mth	1093	0.650503	0.477029	0	1
Job includes teaching others once/mth	1093	0.724611	0.446915	0	1
Over one year experience required	1093	0.783166	0.312278	0	1
teams in company	1093	4.840393	3.308986	0	10
performance appraisal in company	1093	6.407502	4.055657	0	10
training in company	1093	6.571272	3.251799	0	10
flexible wrkhrs in company	1093	4.589204	4.099153	0	10
remote work in company	1093	1.387649	2.343908	0	10
industrial sector	1093	0.445563	0.497255	0	1
retail sector	1093	0.108875	0.311625	0	1
business services sector	1093	0.081427	0.273615	0	1
health and education sector	1093	0.094236	0.292291	0	1
traffic or communication sector	1093	0.090576	0.287137	0	1
finance/insurance/property sector	1093	0.084172	0.277773	0	1
company's age	1082	39.64048	38.11353	1	400
opportunity&ability-enhancing	1073	0.296365	0.456867	0	1
opportunity&motivation-enhancing	1059	0.287063	0.452605	0	1
ability&motivation-enhancing	1064	0.31109	0.463157	0	1
A&M&O-enhancing	1055	0.204026	0.403172	0	1

Table 14: Summary statistics of the variables

9. References

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