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Business benefits of leveraging predictive analytics in HR

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Master's thesis

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Abstract of master's thesis

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Abstract

The usage of predictive analytics is lifting its head in the HR area. The business benefits of using predictive analytics in sales are self-evident, but in HR the value is more difficult to prove due to non-monetary and non-standardized measurements. As predictive analytics in general is not yet widely used in Finland, the companies are cautious in taking the first steps towards this capability.

The purpose of this study is to explore and identify the possible business benefits of implementing predictive analytics into the HR area. The basic building blocks needed for predictive analytics are also covered, as well as the main challenges companies identify, in order to understand what could be hindering the analytics evolution in the HR area.

Whereas descriptive analytics concentrates on creating reports and summaries of the past, predictive analytics aims to understand the past but also complements it by understanding the correlations of events, by estimating the future and by predicting probabilities for the whole employee lifecycle; recruiting success, employee management risks and employee retention. The new capabilities delivered though the predictive analytics are meant to help today's HR professionals in making better decisions related to HR activities, accelerating the processes and by eliminating the error of the sole human interpretation.

As to the results of the study, the main benefits perceived were very company specific. However, all the companies saw the greatest value in using predictive analytics in the HR areas they identified to have the biggest business challenges in, or which were otherwise near their core business. Additionally, the most value for predictive analytics was identified specifically in four HR functions; employee acquisition, employee retention, employee engagement and employee well-being. Predictive analytics supports the HR activities, through which the benefits can be gained; increased employee engagement and satisfaction and enhanced performance resulting in increased company performance, customer satisfaction, sales and profitability increase and to cost reductions. Recommendation for each company is to start with quick predictive analytics trials in the areas they perceive as valuable.

The companies perceive their main challenges to rise from the lack of people who would understand both predictive analytics and HR business. Also the general level of the analytics maturity and data harmonization and integration were seen as challenges. Some interviewed companies wanted to have the basic building blocks in place, such as improved data governance processes, data integrations and optimal data quality, before taking the next steps. However, this study encourages the companies to start with targeted actions and to tie the measurements to financial figures with predictive analytics, in order to reach the identified business opportunities.

Keywords HR, HRD, HCM, Analytics, Advanced analytics, Predictive analytics, Data, Human resource, Employee Acquisition, Recruiting, Well-being, Training, Employee management, Employee retention, Attrition, Employee turnover, HR data, Business benefits, Business Value

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Tiivistelmä

Ennakoivan analytiikan käyttö HR osa-alueella on maailmalla kasvamassa. Kun liiketoimintahyödyt ennakoivan analytiikan käytöstä myynnissä ovat itsestään selvät, on HR:ssä arvo vaikeampi todentaa, sillä HR on harvoin sidottu yrityksen taloudellisiin mittareihin niin tehokkaasti kuin olisi mahdollista. Ennakoivan analytiikan käyttö ei ole vielä ylipäätään kovin laajalle levinnyt Suomessa ja yritykset ovat varovaisia ottamaan ensiaskeleet näitä kyvykkyyksiä kohti.

Tutkimuksen tavoitteena on tunnistaa mahdollisia liiketoimintahyötyjä ennakoivan analytiikan käytöstä HR osa-alueella. Tutkimuksessa tunnistetaan myös ennakoivan analytiikan rakennuspalikat ja päähaasteet, jotta ymmärrettäisiin paremmin mikä estää tai hidastaa ennakoivan analytiikan käyttöönottoa.

Kun kuvaileva analytiikka keskittyy luomaan raportteja menneestä, ennakoiva analytiikka pyrkii ymmärtämään mennyttä ja täydentää sitä ymmärtämällä tapahtumien korrelaatiot, arvioimalla tulevaisuutta ja ennustamalla todennäköisyyksiä työntekijöiden koko elinkaaren ajalle; rekrytointimenestyksen, henkilöstöhallinnan riskit ja työntekijöiden vaihtuvuuden. Nämä uudet ennakoivan analytiikan kyvykkyydet tukevat nykyajan HR ammattilaisia parempien päätösten tekemisessä, nopeuttamalla päivittäisiä prosesseja ja eliminoimalla subjektiivisen tulkinnan aiheuttamat virheet.

Tutkielman tuloksena liiketoimintahyötyjen todettiin olevan pääsääntöisesti yrityskohtaisia. Yhteistä jokaiselle yritykselle oli suurimman arvon tunnistaminen juuri siinä HR prosessissa, mikä kyseiselle yritykselle oli liiketoiminnallisesti ydinosaamista tai missä tunnistettiin nykyisellään olevan ongelmia. Esiin nousi kuitenkin neljä HR aluetta, joissa ennakoivasta analytiikasta indikoitiin olevan eniten arvoa: työntekijähankinta, vaihtuvuuden hallinta, työntekijän sitouttaminen ja hyvinvointi. Ennakoivalla analytiikalla tuetaan HR toimintoja, joilla saavutetaan hyödyt; työntekijän tyytyväisyys, sitoutuminen ja parantunut suoritus, joka johtaa kohonneeseen yrityksen suoritukseen, asiakastyytyväisyyteen, myynnin tai kannattavuuden kasvuun ja kustannusten alenemiseen. Tutkimuksen perusteella jokaista yritystä suositellaan aloittamaan kokeilut ennakoivalla analytiikalla ehdotetuista mahdollisuuksista niillä osa-alueilla, mistä tunnistavat olevan suurinta hyötyä.

Suurimmat haasteet yritykset arvioivat olevan ensinnäkin osaajien puute, jotka ymmärtäisivät sekä HR:ää, että ennakoivaa analytiikkaa. Myös yleinen analytiikkamaturiteetin taso ja dataharmonisointi ja -integrointi nähtiin haasteina. Osa yrityksistä pyrki saamaan analytiikan perus rakennuspalikat paikalleen, kuten parantamaan datan laatua ja tietovarastointia ennen ennakoivan analytiikan käyttöönottoa. Tämä tutkimus kuitenkin kannustaa yrityksiä aloittamaan ennakoivan analytiikan parissa kohdennetuilla kokeiluilla, todentamaan tulokset taloudellisesti ja täten jatkamaan tunnistettujen liiketoimintahyötyjen tavoittelua.

Avainsanat HR, HR data, Henkilöstöhallinta, Analytiikka, Edistynyt analytiikka, Ennakoiva analytiikka, Data, Henkilöstöhankinta, Rekrytointi, Hyvinvointi, Koulutus, Henkilöstöjohtaminen, Työntekijävaihtuvuus, Henkilöstön vaihtuvuus, Poistuma, Liiketoimintahyödyt

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A single conversation across the table with a wise man is better than ten years mere study of books.

- *Henry Wadsworth Longfellow*

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1 Introduction into HR analytics

The war on talent is a major challenge for today's companies. Companies are competing on attracting and retaining the talent, developing employees and taking care of their well-being. Understanding predictive analytics and being able to leverage it in daily operations, supports HR business function in this presented challenge.

Since leading analysts in HR area, such as Fitz-enz and Mattox (2014), have been able to predict the return on investments in HR, the early adopters and ones who want to gain competitive advantage, have started to implement analytics into practice as the next big thing in the HR management. When one has done the decision to explore the area of analytics, a logical question often arises; where to start. There are two different starting points for this question; one either has an HR area problem or a question in mind that one wants to tackle through predictive analytics, or one can start with data exploration and see, if something useful comes up. This study concentrates on the first option of identifying in which HR process areas predictive analytics can support the HR business function. Thus this study gives to the HR analytics specialists a starting point of where to start, when considering implementing HR analytics into practice.

Many companies today admit that their biggest assets are their people. To manage the most valuable asset, predictive analytics offers great managerial support. As also Oehler and Falletta (2015) state, in order to believably reason the future investments into the employee management area, one needs to start demonstrating how employee management relates to the business value and how especially predictive analytics can support decision making related to human resources (HR). Previously, the human capital metrics have been lacking on transparency and usability for analysts' purposes, as traditional metrics would require access to the company confidential data according to a study by Royal and O'Donnell (2008). However, they continue that there is a rising demand to generate more enhanced analytics for intangible assets, especially in HR. Thus this study also aims to demonstrate, what the business value of HR predictive analytics consists of.

1.1 Research problem, questions and objectives

The research problem arises from the newness of the topic; one still needs to prove why the predictive analytics is needed in HR. Also when considering starting the predictive analytics

initiatives, one needs to also build the knowledge on which factors affect and what needs to be considered in the implementation.

The thesis objective is to study how to leverage predictive analytics in HR and what is the assumed business value of doing so. The aim is to increase understanding on desirable predictive analytics implementation areas in HR, as a basis for further quantitative analysis. For this reason the thesis covers the following three main research questions;

1. **How is the value of leveraging predictive analytics in HR perceived?**
2. **What are the main building blocks needed in implementing predictive analytics in HR?**
3. **What are the main challenges preventing predictive analytics adoption in HR?**

Thus this research will reason why the predictive analytics should be considered as a valuable HR management support, by investigating what is the perceived business value of it. Additionally the main building blocks of predictive analytics are discussed, to understand what is needed to get to the targets and what could possibly be preventing the progress.

One needs to also consider the limitations of this study. This research is not a guide on how to implement analytics functionalities in practice, nor should this be used as a thorough process improvement guide. There are several step-by-step guides available for those purposes. This is also not a comprehensive list of all possibilities there are on the HR analytics area, but a subset defined via a summary of former research and the expert opinions of the case companies. This research is also technology agnostic, different technologies for implementing HR analytics will not be covered in detail in this study, although general guidelines and opportunities for implementation are discussed.

1.2 Motivation

The main motivations for the research topic comes from the rise of the HR predictive analytics as a critical information management topic. However, the actual functionalities have not yet been implemented too widely in the HR area, especially in Finland, which leaves a researchable gap into this field. Also the evolvement of HR functions from being cost centers to being service providers and business enablers makes the topic interesting for the leaders of companies. The area is still quite new and almost a niche, compared to the predictive analytics

in sales and marketing area. Thus I see a great potential in transforming the knowledge into practice in the format of future work opportunities with quantitative analysis.

Earlier research has been done on the following aspects, which the current research then complements;

1. Predictive analytics implementations in HR. The point of view has concentrated more on "How to", and some examples have been reported what has been applied in case companies. The benefits are often not clearly quantified and evidence supporting the statements can be lacking.
2. Researches have been done during 2000 – 2015 on HR activities affecting the companies' financial outcomes and generating business value, e.g. how increasing employee engagement affects the company performance.

1.3 Methodology

The research is done as a qualitative study with multiple case studies. The study starts with literature review of the topics under research. There is very little existing academic literature directly on HR analytics available. There is more information available on traditional HR reporting basing on historical data reports, but that is not the main scope of this study. Information from different HR reporting literature, HR operational measurement, and predictive analytics literature needs to be combined, to get valuable information to the literature review.

The interviews are conducted as semi-structured interviews backed-up by a questionnaire. This enables more information to be collected and avoids limiting scope and possibilities of interviewees to voice their opinions. Four of the case studies are companies where the internal HR is being interviewed on the usage possibilities of predictive analytics in their companies. The fifth interview is to a service provider, offering employee wellbeing services, which is one HR operational area. This interview concentrates on creating added information on well-being analytics; how they see their clients could benefit from using the analytics together with the HR data.

1.4 Structure of the thesis

The structure of the thesis will comprise of a literature review with explanations on an HR business metrics, predictive analytics framework used, as well as the main challenges and

benefits of analytics adoption identified in the literature. Then the interviewed case companies' point of views are presented, after which the conclusions are drawn and summarized.

More specifically, the research starts with a description of the HR functions and how HR generates business value. This is defined with the help of a literature review. The study covers the full lifecycle of HR operations from employee hires to employee exits in the HR –area. In order to create a better structure to the research, the elements of the study are grouped under these entireties which are later explained more in detail; Employee acquisition, employee management and employee retention.

Secondly, the definitions related to predictive analytics are opened up. Literature review is done to find out information on how the predictive analytics can be used in the HR and what the business value of it is. After this, the main building blocks needed for implementation of the predictive analytics are covered, using TDWI (2015) framework on analytics' maturity. The structure of the thesis is illustrated in high-level in the Figure 1.

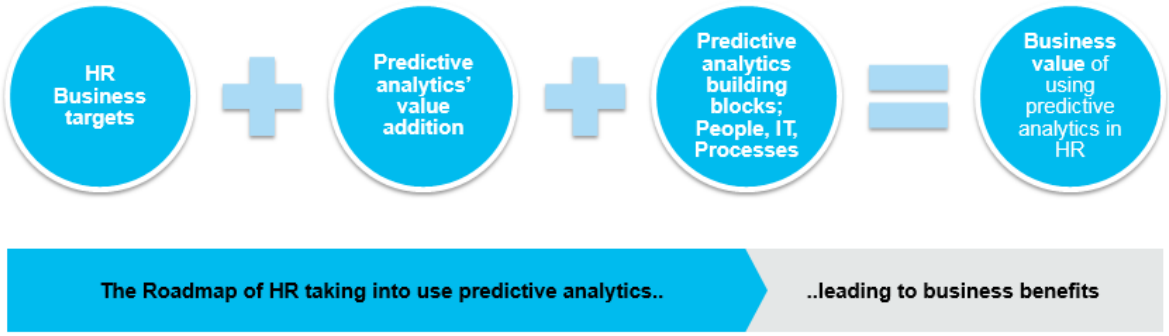


Figure 1. The high-level view to the content of the research.

Thirdly, the case companies are being interviewed, based on the analytics maturity framework and information gained in the literature review. Interviewees' answers are used as such in the conclusions, on what are the challenges and current status with analytics capabilities. The answers are also used for getting a background for the answers on the perceived business value. The comparative illustrations between the companies are done to find out if there are any similarities or differences in the companies' views. At the end the conclusions are drawn and summarized based on both; the literature review and case study findings.

2 Human resource measurements

Ready and Truelove (2011) define that the leaders of successful companies all aim to create a collective ambition for the company. Collective ambition summarizes why the company exists, what the company aims to achieve, how they will collaborate and live according to the core values supporting the purpose. They emphasize that it is not only about the company's profit, but one needs to foster an environment where all the stakeholders are able to succeed and create excellence. Fitz-enz and Mattox (2014) also emphasize that all the companies' plans are done in vain, if there are no capable people to execute the plans. The main roles of the HR –function are to find, hire, engage, develop and sustain a capable and resourceful workforce, who are an essential part of the company.

As the Center for Talent Reporting (2015) formulates; there does not exist yet an official standard yet on how the companies should organize their human capital management functions, but each can decide what suits their needs the best. Some categorization is still needed to cover the measurement and analytics of HR functions in this research, and thus the functions are categorized into the following sub-sections;

- **Employee acquisitions;** Hiring of the employees, areas relating to employee intake
- **Employee management;** Development, rewards and well-being once employees are on-boarded
- **Employee attrition;** Management and possible prevention of employee exits

To understand the context in the different HR areas, it would probably be beneficial to demonstrate how these fit in general to the HR functional landscape. The studies have not unanimously stated which exact set of HR practices is academically the most correct for the companies to manage. Ashton et al. (2004) look at this from the services point of view; they state that the HR should offer the HR process services to all employees, business partner consultancy services to all management and strategic services to the company leadership. In other words, HR should deliver basic processes such as employee training or pay to employees as they do currently, but it needs to start shifting in a direction of a more strategic partner towards the leadership. Paauwe et al. (2013) list top 4 processes to be managed and measured in Human Resource Management (HRM), that repeat in several studies. They are in order of popularity;

1. Training and development
2. Contingent pay and reward schemes

3. Performance management including appraisals
4. Recruitment and candidate selection

Paauwe et al. (2013) present in their research that the HR departments of companies usually contain 2-13 functions per company. A single research often concentrated on 5-6 different HR functions. Miranda (2015) challenges the view on the common functions of the HR and suggests that each company should re-evaluate what they are doing and more importantly, why they are doing it. He states that the HR function is seen often as a member of the team in the company, but not indispensable as such. Each process should be challenged by asking what happens if we do not continue to do this. This could lead to radical changes in the range of HR functions.

As there is no single definition yet on which are the exact main HR functions, or in other words practice areas, this study concentrates on a subset of the available possibilities. The functions studied in this research are the employee acquisitions, management and retention as mentioned earlier. The areas Paauwe et al. (2013) defined above as the "top HRM areas" fall under these three different categories as follows: numbers 1-3 fall under "employee management", that is, how to keep employees in the company and take care of their optimal performance, and number 4 falls under the "employee acquisitions".

This categorization is used both for listing the traditional measures used in each area, but also when listing the opportunities of predictive analytics and its perceived business value. This is done purely to make the research structurally more readable.

2.1 Defining HR KPIs and measurement

Fitz-enz and Mattox (2014) explain that through a shift from the industrial era to a service–based world, the intangible assets and metrics are gaining more and more significance. In some companies the intangible assets, such as employees and their knowledge – the human capital – create up to 80% of the business value. An intangible asset can be defined as an asset without a physical or financial existence such as the leadership, engagement, culture or loyalty, but it can also include items with some written evidence such as patents, research and development. Ashton et al. (2004) continue that up to 83% of the senior line managers state that the HR is critical to business success.

Ashton et al. (2004) add that HR's activities should be directly linked to the company's strategic business goals. Traditionally, HR data and its measurements have focused on the tangible costs of the core HR operations, such as the costs of hiring and training, or for example quantities of the newly hired employees and trainings held. Fitz-enz and Mattox (2014) state that nowadays, in order to gain a competitive advantage, one needs to be able to quantify and report the combination of intangible and tangible assets such as the business effects of the employee engagement or employee culture, and specifically predict those phenomena. Consequently, the following sections discuss both the tangible but also the intangible value, which the human resource functions can create to a company.

2.1.1 HR function as a cost center or a value generating function

Before the transitioning towards a knowledge-based economy, HR department and its functions have merely been seen as a cost center for the company. Also the metrics in HR have been either non-existing or qualitative in nature. Fitz-enz (2010) states that no company can lead its operations based only on unquantifiable indicators. Instead, he has been working on introducing metrics to HR; first measuring the human capital via standard arithmetic methods, but now more lately, evolving towards predictive modeling and advanced calculations. The Center for Talent Reporting (2015) is targeting the same; creating standardized but also advanced measurements to HR functions.

What should companies then measure inside the HR? Ashton et al. (2004) state that largely the same as in any other business areas: profitability either in a financial or in an immaterial sense. Fitz-enz and Mattox (2014) continue that in general it costs to acquire, develop and keep the employees in the company, and it also costs to accumulate and store data on the employees. However, the costs of employees or data bytes should not be measured as such but instead one should consider the operational activities the employees are involved in and how they produce value to the company, in other terms, their efficiency, effectiveness and outcomes of the processes. This is how the emphasis can be turned to profits instead of costs.

Investing into HR operations needs to pay off, but at the moment a lot of investments in the HR area are going to waste. In other words, all the poorly made decisions in the HR area generate costs to companies. Fitz-enz and Mattox (2014) list as examples on the poorly made decisions in the HR area the trainings offered with no or little return on investment, unqualified employees, bad hiring decisions leading to a need to rehire, poor leaders or unmotivated or

disengaged employees. These all are resulting to an inefficient workforce, which does not add value to the company. As a concrete example they point out to a study, which finds that half of the money spent on all employee trainings are wasted. This is a significant amount of money considering the vast amount of private and governmental investments made yearly on trainings. Ashton et al. (2004) add that in order to move away from being a cost collecting function, one needs to find alternative way of working and include effective use of technology to the processes.

As Paauwe et al. (2013) phrase it, the resources that are rare, valuable, inimitable and poorly substitutable, often create the most competitive advantage to organizations. Thus the human resources should also be seen as a strategic asset worth investing in. They also agree that in order to prove the HR's worthiness one should take time to communicate the advances made in the HR processes in financial language, in numbers. Seagraves (2007) gives an example that often when trying to demonstrate business changes in the HR area, the reports show only quantitative changes inside the HR processes, such as the reduction of employee turnover by 10%; it might be a very good internal HR target, but what does it mean in financial terms? Using financial metrics to communicate HR achievements is more effective in promoting its business value, especially when communicating with the leaders.

2.1.2 Human capital measurement

Robinson (2009) describes human capital measurements to be measurements about people that are critical to the company's success. Miranda (2015) clarifies the starting point of where to start the human capital measurement definitions. In order to define what to measure, one has to answer first, what is the important thing that the human resources should do. According to a survey done by Fitz-enz (2010) in most of the companies the HR activities and their measures are not tightly connected to the company strategy, and for example only half of the companies deliver the human capital management (HCM) reports to the top management monthly, most reports even more seldom than that. One of the identified challenges was the lack of motivation as usually the changes in the HR figures did not have direct effect on the pay or rewards of the management. This could be easily fixed for example by different reward models, which however were often not in place. Phillips and Phillips (2009) have recognized the same lack of the top management interest into HR, leading into a need to define more accurate reporting that would awaken leadership interest.

In measuring human capital investments companies may use a multi-level reporting approach which corresponds to the hierarchical nature of the employee structure in the company: positions, teams, departments, units etc. In other words, the metrics can be set for individuals or at any other level of the organization. (Paauwe et al. 2013.) Phillips and Phillips (2009) add that the typical HR measures comprise the output, quality, costs, time and employee engagement. In addition to quantifiable benefit measures, such as cost reduction, HR comprises intangible measures such as decrease of ethics violations or increase in employee engagement.

As an example of the unquantified factors, measures and results at the individual level, Paauwe et al. (2013) mention the general mental ability, which is the ability to reason, solve mathematical and word-based problems and paragraph comprehension. These qualities have been proven to predict higher job performance. Then again people with greater task knowledge, which is the knowledge on a specific job or task at hand, perform better on that specific task. The higher mental or cognitive ability has a similar effect at the team level: the performance of the team is better the higher the team members have their cognitive abilities. Whereas these factors and measures could be proven using predictive analytics and advanced analyses of the correlations, Phillips and Phillips (2009) suggest another way for realizing HR monetary value. They suggest giving an estimated monetary value to each of the unquantifiable characteristics such as value for the increased employee engagement and using the return on investment (ROI) calculation based on the given costs and benefits. Understandably, the estimation is not as reliable as an actual result, thus one should use that method only with care.

Paauwe et al. (2013) continue that there is not only positive correlation of investments on employee level to company result, but the same applies in organizational level. They discovered a positive relation of the HCM investments to organizational performance measures such as positive return on equity, market share and customer satisfaction. Deloitte Award for Innovation in Measuring Human Capital (2004) supports this statement by demonstrating successful investments in the HR area. More importantly, predictive analytics was being leveraged to gain these business benefits. The gained benefits included nationwide savings of £6 million in costs, as the employee turnover decreased, increased customer satisfaction and an increase in the company's sales.

Robinson (2009) states the main challenges in the human capital measurement area to be the intangible measurements. Additionally, the HR area is multidimensional, creating multiple possibilities what to measure. As Paauwe et al. (2013) state, at the organizational level, there is evidence on the importance of the human capital management to the company strategy. Due to

its importance, the organizational level performance measurement, what to measure, could be studied further to increase the knowledge on the area.

2.2 HR's effects to the company and employee performance

The studies of the effects of the HRM to company performance such as turnover, market value or profits, have increased during the last 20 years. Recently Liao et al. (2009) found patterns of the connection between human performance work systems (HPWS) and the company performance in Chinese firms. There are also various other studies mentioned e.g. by Paauwe et al. (2013) indicating the same. However, there is still debate on-going on how significant the effect actually is. The evidence of the positive connection is still often case-specific, where one cannot specify the exact origins of the positive effect, mostly due to inadequate research design. (Paauwe et al. 2013.)

Robinson (2009) gives another point of view to the same; the assumption is that HR has positive business benefits. It is not important what the universally predefined factors are, which cause the increased performance. Instead, each company should take its own data and start working with that from their individual standpoint. Companies should aim towards the data they want to have to receive the information they need to understand.

According to Paauwe et al (2013) the two most obvious problems in the past studies on HR's effects on company performance are the ambiguity of HRM and empirical invalidity. The ambiguity of the HRM has been tackled mainly by two means;

1) By formulating frameworks that can help in giving structure to the problem, or

2) By leveraging concrete HR practices.

Harness (2009) states that most of the HR empirical research has been conducted as surveys or case study researches. Several large-scale data gatherings have been performed in this area, producing factual objective information. The empirical invalidity in HR according to Harness (2009) can still occur in the point-to-point interviews, where the answers are often subjective. Paauwe et al. (2013) also state that the questionnaires, which are often used as the performance data gathering method in the HR area, lack in reliability through people filling in the answers based on biased views. Another lack in this area relates to the fact that there is no consensus in the studies on the causality of the HR practice and employee performance relationship. In other words, there is no clear evidence on the fact whether the employee

performance is increased or decreased based on the HR practice input, or whether the HR practice input follows the employee performance. Both views agree that there is an impact on the employee performance, but direct causality is under debate.

Paauwe et al. (2013) continue that one of the most accepted HR frameworks used is the AMO (ability, motivation and opportunity) framework, according to which HRM enables employees to succeed in the AMO areas, which is creating a strong personnel to the company. Over 50% of the studies on how HR and performance are linked use the AMO framework since year 2000. The AMO theory takes into consideration the employee-level factors in the company performance. It also suggests that through taking actions on increasing the employee motivation, through job design and through implementing participative processes, one can enable motivated employees to perform better, which has a significant positive effect on business. Feather (2007) also notes that employee engagement plays an important role; in the Fortune 500 companies the lowest one fourth of the companies had 50% less engaged employees than the top performing companies. This comes from the voluntary retention, motivation to give more than required, a mindset on a positive workplace and a feeling of a connection with the company. A question still remains, which are the actual detailed actions to be taken to create ability, motivation, opportunity or engagement to produce a positive outcome. Feather (2007) suggests companies to start identifying the key drivers and working on those areas.

Paauwe et al. (2013) illustrate the actual proven employee related factors influencing organizational performance in a graph, modified in Figure 2. The five items in the center are not exhaustive but summarized from several studies. All of the pathways are distinct; each has a distinct effect on organizational performance when HR practices have provided sufficient input to individual employees. The pathways are also not mutually exclusive. It is interesting for the current research to recognize this connection, as through predictive analytics one looks for the correlations and significant measures that influence the outcome to be predicted. The areas in the illustration will thus be incorporated into the interviews, among other findings, to clarify whether and how the companies are currently making the best use of these areas.

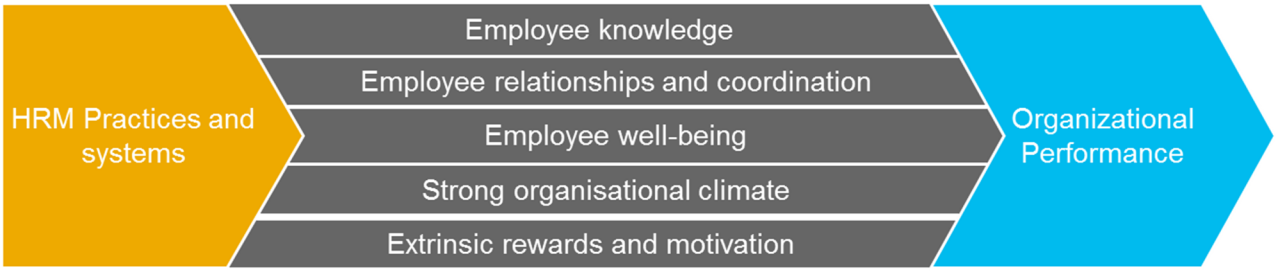


Figure 2. Employee related factors influencing organisational performance.Modified from Paauwe et al. (2013, p. 19)

Paauwe et al. (2013) continue that an assumption prevails that a company's financial performance is often gained with the cost of decreasing the employee well-being. However, they prove this incorrect, through their review of 23 different HR studies, where researchers have investigated the relations of HR and organizational performance. Instead, employee well-being and financial performance can coexist as parallel organizational outcomes.

The Center for Talent Reporting is a non-profit organization founded by several researches and professionals in order to establish business measurement standards into HR. It has a practical approach and a toolset ready for measuring and tracking the company performance in the HR area (Center for Talent Reporting, 2015). They state that even small investments suffice for gaining quantifiable business benefits in the HR area. Furthermore, they present a standardized set of HR measures and reports, and promise that when a company adopts them, significantly greater impact on HR operations will be achieved. By adopting the Talent Development Reporting (TDR) principles, standards and measures, companies will have greater alignment to their strategies, as well as better planning and controlling capabilities. The current research complements this idea and promotes even greater controllability through predictive analytics capabilities.

According to Combs et al. (2006) performance criteria can be measured from two points of view: company- or employee-centered. They summarize the company-centered performance metrics to include the accounting returns, productivity, retention, growth, market returns, and multidimensional metrics and combinations of these. Paauwe et al. (2013), on their part, state that employee-centered outcomes look beyond the company performance and even claim that HRM might not always serve the employees' best interest. However, they acknowledge that the most recent studies combine the two views and suggest that HRM can both lead to enhanced company performance as well as to increased employee well-being. Paauwe at al. (2013)

believe that the following employee performance qualities and measures have a positive correlation to employee performance;

- Affective commitment to the firm
- Willingness to exhibit discretionary behavior
- Intention to stay in the company
- Increased cognitive and physical ability to perform
- Increased skills and performance, leading to creativity, productivity and discretionary.

All in all, the HR practices have an effect on employee performance, which then affects the company performance. Miranda (2015) agrees that the employee retention increases financial benefits for the company. He suggests that this connection should be enforced by creating a "sticky" environment, which prevents the employees from leaving. He states that in long-term employment other factors than monetary benefits start to get value in the employees' working relationships, which creates the "stickiness". Paauwe et al. (2013) illustrate the connection between the HR practice, employee performance and company performance as presented in Figure 3.

Input: HR practice activity	Output: Employee outcomes of HR practices	Output: Company outcomes of HR practices
Motivation and ability enhancement	Increased skills and performance, leading to creativity, productivity and discretionary	Increased profitability, growth and market value

Figure 3. HR practices' effect on company performance. Modified from Paauwe et al. (2013)

An area, where there is very little research on the HR practices' effect on performance, is the public sector area. Paauwe et al. (2013) still note that in public sector the emphasis of the effects is not on the financial profitability as much as on other employee effects – for instance in hospitals the effects of employee well-being to patients. All in all Paauwe et al. (2013) suggest that future HR studies should be purely practice specific, and more targeted to the individual level. Also the scope of the studies should be more detailed, in order to receive more detailed results. They also state that in order to understand the connection between HRM and company performance one needs to understand how HR practices influence the individuals, who collectively influence the company performance. As a conclusion, in all the employee

performance measurement areas there is still room for more comprehensive and detailed cause and effect analyses that could be used as scientifically valid evidence.

2.3 Key HR process metrics

As the Center for Talent Reporting (2015) states, each organization can organize its functions and measures as they see fits the best. Robinson (2009) has created a way to group the HR measures to a hierarchical structure. This method separates the importance and usage of HR measurements of a different kind. The ones on the top of the pyramid are the ultimate business process outcomes, whereas the ones at lower levels are the measures on the way to the business outcomes. Robinson (2009) describes the HR measures at levels from one to four in Figure 4.

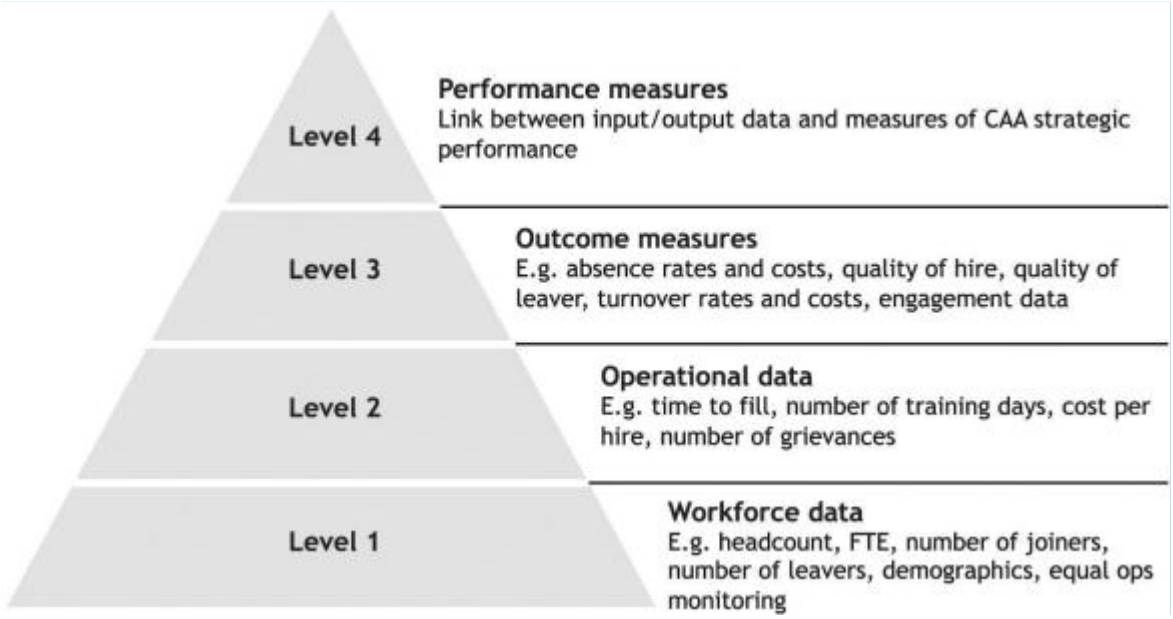


Figure 4. Hierarchy of people measures. Source: Robinson (2009)

1. Level = Fundamental data from employees
2. Level = Operational measures of the HR activities, the success of the organization in managing its HR operations
3. Level = People outcomes, employee centered measures
4. Level = Performance measures developed and measured through causalities e.g. increased employee engagement leading to increased performance. This is the hardest measurement to develop.

Whereas Robinson (2009) has a hierarchical view, the Center for Talent Reporting (2015) has a process area view to the measurements. According to CTR, each of the key processes illustrated in Figure 5 has an effect on the company outcomes. The demonstrated process outcomes are largely positive, such as the sales increase, cost reduction, increased customer satisfaction, employee engagement and inclusion, as well as positive effect on the company culture and employee retention.

Figure 5. Key HR process areas of the research. Modified from Center for Talent Reporting (2015)

The process areas covered in this study are the same that are covered in the Center for Talent Reporting (2015) instructions and standards, with only a few exceptions that were scoped out from this research. The following sections look more into detail what needs to be measured in the employee acquisition, employee management (development) and employee attrition (retention) areas. Consequently, the upcoming sections in the predictive analytics part can help to define the "what is needed to succeed" and "what could be done better instead of the current way" in the future applications of this knowledge.

2.3.1 Employee acquisition and its business metrics

The Center for Talent Reporting (2015), defines the employee acquisition to be one of the HR key processes meant to find and onboard talents to fulfill company's strategic and project needs. The employee acquisition comprises of the talent assessment, selection, recruitment and onboarding.

Some companies view the talent acquisition metrics to be equal to those of the sales metrics such as increase in sales, or reduction in costs, whereas others see them as an

intermediary step towards the final goals. Either way, the metrics that CTR defines are applicable in both cases.

Those metrics include more than a hundred measures classified under "efficiency", "effectiveness" and "outcome". Some examples of these would be such as Total qualified applicants (efficiency) or Quality of hire index (effectiveness). The full list is available online in the Center for Talent (2015) reporting websites. Good starting points, however, are the ones presented in Table 1, categorized as "Tier 1" items in CTR terms, meaning that they would be a good starting point for possible Key Performance Indicators (KPI's).

Table 1: Key performance measures of Talent acquisition. Source:Center of Talent Reporting (2015)

Area	Category	Subcategory	Tier	Measure name
Acquisition	Efficiency	Hiring activity	1	Offer Acceptance Rate
Acquisition	Efficiency	Hiring activity	1	Recruitment Rate
Acquisition	Efficiency	Hiring activity	1	Internal Recruitment Rate
Acquisition	Efficiency	Hiring activity	1	Percent of Hires Referred
Acquisition	Efficiency	Hiring cost	1	Cost-per-Hire
Acquisition	Efficiency	Hiring process	1	Time to Fill
Acquisition	Efficiency	Hiring process	1	Time to Start
Acquisition	Effectiveness	Quality of hire	1	Quality of Hire Index

As CTR also states, each organization should choose those KPI's that are applicable to its business needs. When considering this from the predictive analytics perspective, all of the events that have an outcome and have data available on the event itself, are possibly good targets for the predictive modeling purposes.

2.3.2 Employee management and its business metrics

Employee management comprises in this research of Employee learning and development, performance management, rewards and wellbeing management, in other words all the activities subjected to employee when the employee has joined the company.

Human resource development (HRD) does not have a very standardized description due to its multidisciplinary nature, according to Rigg et al. (2007). Human resource development is in general understood to be the development of people, organizations or groups, where development has narrowly been defined as an increase in the performance. Thereafter the definition has widened to also comprise the elements of psychology, economics and sociology.

Traditionally HRD has been measured by economic terms of the performance of individuals, groups or organizations. Rigg et al. (2007) recognize the wider consequences of

developing resourcefulness of individuals. Seeing employees merely as objects in organizational structure, narrows the measurement of HRD to quantifiable items such as "training days", "expenditure" or "qualifications", whereas the view on employees' value should be more wide-scoped.

The Center for Talent Reporting (2015) tries to answer to the need of quantifying each of the key process areas. The list below contains only the ones aimed to be the KPI's (Tier 1). A full list is again available in their websites.

Table 2: Key performance measures of Employee management. Source Center of Talent Reporting (2015)

Area	Category	Subcategory	Tier	Measure name
Performance	Effectiveness	Performance Perception	1	Pay for Performance
Performance	Effectiveness	Performance Perception	1	Goal Alignment
Performance	Effectiveness	Performance Perception	1	Performance Management Process Fairness
Performance	Efficiency	Pay for Performance	1	Pay for Performance Incentive Differential
Learning	Efficiency	Headcount	1	Unique Participants
Learning	Efficiency	Headcount	1	Total Participants
Learning	Effectiveness	Headcount	1	Percentage of Required Trainees in Compliance
Learning	Efficiency	Activity & Utilization	1	Total Participant Hours of Training
Learning	Efficiency	Activity & Utilization	1	Training Hours per Learner
Learning	Efficiency	Cost	1	L&D Expenditure
Learning	Efficiency	Cost	1	L&D Expenditure per employee
Learning	Efficiency	Cost	1	Cost of Training (SHRM definition)
Learning	Efficiency	Cost	1	Training Cost Factor (TCF)
Learning	Efficiency	Cost	1	Training Cost per Hour (TCH)
Learning	Efficiency	Cost	1	L&D Investment as a Percentage of Payroll
Learning	Efficiency	Career Developmen	1	Percent of Employees with Development Plans
Learning	Efficiency	Career Developmen	1	Percent of Managers with Development Plans
Rewards	Efficiency	Compensation	1	Overtime Cost Percent of Total Compensation
Rewards	Efficiency	Variable Compensation	1	Variable Compensation Percent (VC)
Rewards	Efficiency	Variable Compensation	1	Contingent Labor Percentage
Rewards	Efficiency	Pay for Performance	1	Compa Ratio
Rewards	Efficiency	Benefits	1	Benefit Factor (BF)
Rewards	Efficiency	Labor Cost	1	Labor Cost Revenue Percentage
Rewards	Efficiency	Labor Cost	1	Labor Cost Expense Percentage

The main effectiveness measures in use in the learning area comprise of the cost of trainings, the quantity of participants, and the percentage of employees taking the trainings. More difficult to quantify is the training effectiveness, measured by quality, percentage of tests passed or for example the job impact. The performance management then again has also over 30 measures. One tries to quantify performance goals and discussion, measure performance and potential ratings and also measure how the performance management is seen by the employees. The rewards measurement area has even more measurements listed by CTR. All of these focus more or less on costs and quantities of different employee rewards and benefits; how much

benefits have been provided to each employee group or what are the employee compensation cost factors.

Employee well-being is an area that is not included in the lists of CTR. However, employee well-being is described in the study by Paauwe et al. (2013) as individual's subjective experience of satisfaction at work. This covers the individual's positive and negative experiences at work, but also the organizational commitment to work. As a second dimension or point of view to employee well-being they present the employee health at work such as job-related anxiety, stress, burnout and exhaustion. The health aspects are divided into two categories; negative and positive. Where negative well-being aspect comprise of negative feelings, fatigue or e.g. lack of satisfaction, the positive well-being aspects cover the areas where the negative side is absent, such as energy at work, vitality or thriving. Employee's affection to the firm is named to be the key performance indicator of employee well-being.

All in all, from analytics and prediction perspective, all of these are good subjects for improvements if there is documented data on past events and their outcomes. With the aid of the predictive analytics one can go through what are the key measures in the company currently, and what they could be, should one have predictive capabilities in use in addition to the standard reports. Due to the abundance of possibilities, one just needs to select where to start.

2.3.3 Employee retention and its business metrics

Ghosh et al. (2013) state that the importance of knowing which employees stay and which employees have intention to leave does not only concern the specific employees but has wider effects. An employee leaving the company leaves a gap in those specific skills he or she possesses, but also affects the organizations' social life, possibly damages customer relationships or diminishes the company's rapport toward all the other stakeholders the employee had connections with.

The Center for Talent Reporting (2015) does not handle employee retention or attrition as its own entity, but the theme is grouped under similar topics such as capability management (see Table 3). The capability measures are not directly related to employee attrition, but if one would derive similar metrics for attrition measurement, they would be similar in concentrating on the quantity of critical and open vacancies, or movements of employees from position to another, or out of the company.

Table 3: Key performance measures of Employee retention. Source: Center of Talent Reporting (2015)

Area	Category	Subcategory	Tier	Measure name
Capability	Effectiveness	Career Development	1	Vacancy Rate of Critical Positions
Capability	Effectiveness	Career Development	1	Career Movement Percentage
Capability	Effectiveness	Career Development	1	Percent of Positions with Ready Replacements

Most of these targets seem to be fitting into the levels from 1 to 3 in Robinson's (2009) hierarchy of the people measures model. From the analytics perspective, predictive analytics could help in improving the measures and achieving the actual performance measures and thus the business targets. The rest of this research focuses on how predictive analytics could complement or improve these HR measurements.

3 Predictive analytics in HR

Lawrence (2012) reported the biggest driver of development in the HR area to be predictive analytics. He states that in previous years most people have made the mistake of talking about predictive analytics when they actually meant descriptive analytics i.e. reporting based on summary of historical events. Thus it makes sense to spend a few moments with the definitions of analysis, analytics and predictive analytics.

As said, some believe that a single report on historical events equals an analysis or analytics. A report shows only one dimension of the topic under examination. Regardless how many reports you have in the past, you need to be able to interpret them and draw some conclusions, connections and insights between events and effects before you should state that the action taken has been "an analysis". Thus an analysis can be defined as the interpretation of provided information (Fitz-enz and Mattox 2014.) Analytics then again expand the concept of analysis. Analytics include taking the tools into use for the analysis. Others understand analytics simply as running some statistical models. Purely thinking about just running statistical models to perform analytics would be to Fitz-enz and Mattox (2014) too narrow-minded;

"That would be akin to starting your car and driving off without a travel plan in mind. The changes of arriving at your preferred destination would be slim."

Analytics is the transformation of the data into actionable insight. Analytics is also broadening the concept of analysis to cover the usage of different statistical techniques but it also covers the technological aspects. In today's world, where the amount of data grows continuously, one needs to incorporate machine power to be able to perform the analysis more efficiently. According to Naasz and Nadel (2015) today's possibility of using the machine power in categorizing, analyzing and consolidating data answers today's challenges of rapidly growing data volumes, variety and data velocity. It would be impossible for a human eye to filter out meaningful information out of masses of data without any help of the machine-aided analytics.

Can the analytics simply be described as a series of statistical calculations? Fitz-enz and Mattox (2014) state that no, there is more to analytics than just pure statistics. To them it is also a mental framework and logistics progression, and only after that comes the actual statistical layer. They continue to describe why one would in general want to start implementing analytics as part of any function in the companies. The main value comes from the advantageous management possibilities; instead of tackling one problem at a time, by machine powered

analytics one can predict what the future actions are and react to them proactively and if needed; preventively. In other words, one can start eliminating the recurrence of possible problems before they manifest themselves. This is the direction today's market leaders are taking; enabling one to concentrate on creating valuable actions in the company, instead of only tackling problems as they appear.

3.1 Descriptive, diagnostic, predictive and prescriptive forms of analytics

Naasz and Nadel (2015) state that there are three types of analytics; **descriptive, predictive and prescriptive**. They explain that descriptive analytics aims to describe "what happened", predictive analytics will predict "what will happen" without taking any valued action to prevent it from happening, whereas prescriptive analytics foresees "what is coming ahead" and includes the element of taking actions based on the data. The following widely used illustration from Gartner (2013) clarifies these three levels of analytics, adding the "diagnostic" analytics as its own level as shown in the Figure 6;

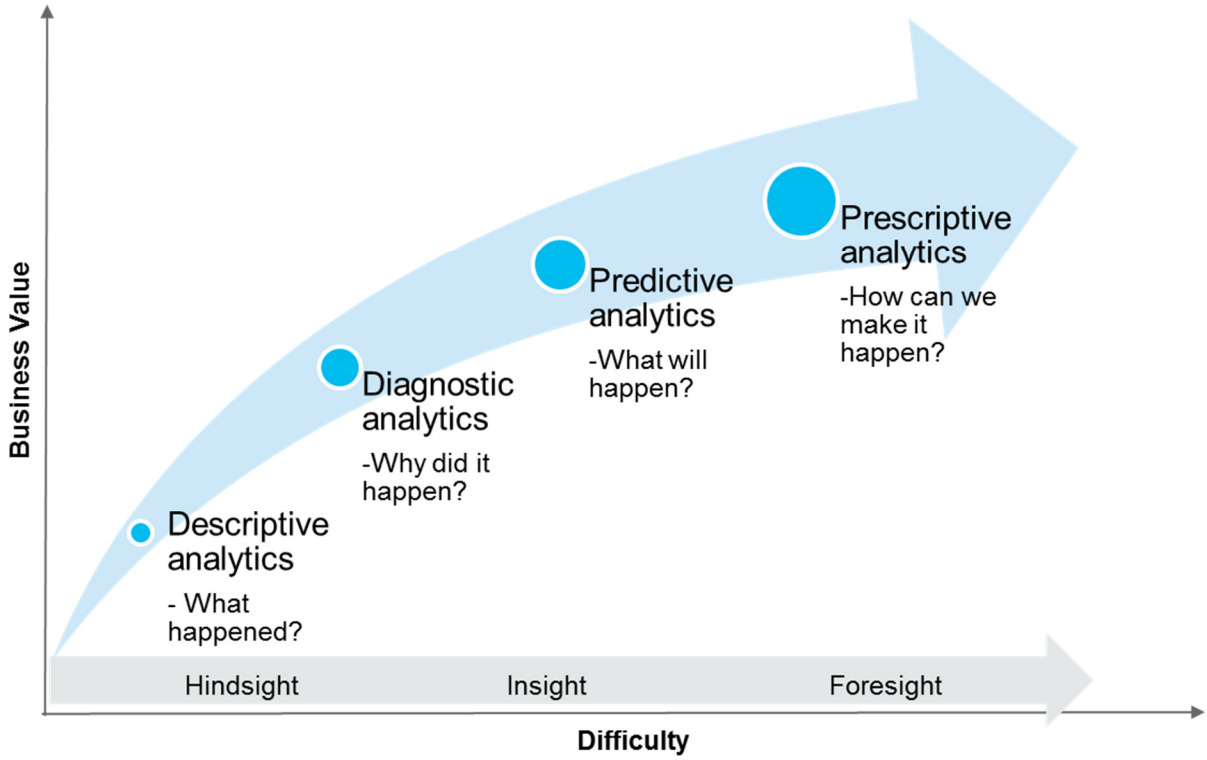


Figure 6. Analytics maturity model. Modified from Gartner (2013)

Also Fitz-enz and Mattox (2014) describe analytics at only three levels, combining the diagnostic analytics, the search of meaningful correlations, to be a part of predictive analytics. The main characteristics of three analytics levels as defined by Fitz-enz and Mattox (2014), amended with Gartner's (2013) description of diagnostic analytics;

- Descriptive analytics
    - Focus on cost reduction and process improvement
    - Data describes relationships and current and historical data patterns and events
    - Example visualization format; Dashboards and scorecards on historical and current events
- Diagnostic analytics
    - Focus is on correlations and cause and effect -relations
    - Data describes relationships and current and historical data patterns but enables discovery of improbable or unpredictable relations
    - Example visualization format; Data discovery dashboards with a strong emphasis on visualizing complex relationships, measures and dimensions, simultaneously
- Predictive analytics
    - Focus on probabilities and potential impact
    - Data describes relationships and current and historical data patterns but includes future events and thus show predicted business impact
    - Example visualization format; Dashboards and scorecards on historical, current and future events
- Prescriptive analytics
    - Focus on decision options and optimization based on predicted future outcomes
    - Data describes the decision alternatives of the future and their business impact
    - Example visualization format; Dashboards and scorecards on the decision alternatives of the future actions to be taken and their business impact

These four value levels of analytics can also be described in the context of actual predictive modelling actions. The steps of the needed statistical procedures to produce business outcomes via analytics are described in the Figure 7;

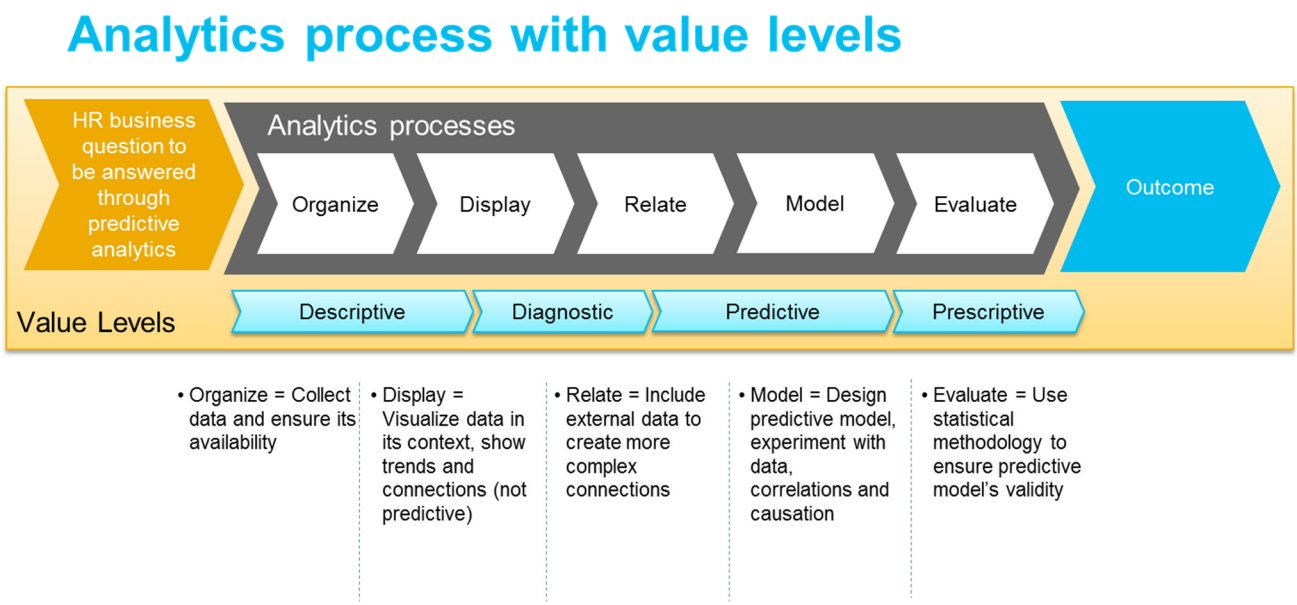


Figure 7. Analytics process with value levels. Modified from Fitz-enz and Mattox (2014)and Gartner (2013)

The above illustration is also a representation of the sequence, how the analytics capabilities could be taken into use. As an example, a frequently used implementation area of the HR analytics could be the prediction of the employee turnover or attrition. In the above mentioned framework, one would most likely first have just data stored in one or more databases on employees = step "Organize". Then one would start to "Display" the data based on past events, for example in simple dashboards. After that phase one could "Relate" and benchmark the current data against other result in the industry, start "Modelling" to be able to predict the changes and finally take "Prescriptive" actions to manage the retention.

By this sequence Fitz-enz and Mattox (2014) aim to demonstrate that there are no shortcuts to be taken to reach predictive analytics, but one needs to build the analytics capabilities in a controlled way one capability after another. However, there are examples on advanced analytics adoption approaches that present a conflicting view. One does not necessarily need to build an extensive data warehouse or a traditional descriptive reporting structure to leverage advanced analytics, such as predictive analytics. Chopra (2014) states that even though traditional descriptive analytics tools are still useful, the predictive analytics tools have a new and a totally separate need they are covering; the data mining tools used in predictive analytics aim at finding patterns from the data in a deductive manner, whereas in descriptive reporting one always uses induction. Using predictive tools, the analyst does not need to know what he is exactly expecting to find, but it is more of a journey to unknown. For

this purpose the data analysts have a different toolset in use than they have for descriptive analytics.

3.1.1 Ethics of using predictive analytics in HR

People are a strategic asset, creating value for the companies. As stated in the introduction, predictive analytics can help to achieve the added business value for the company. On the other hand, Oehler and Falletta (2015) state, that it is not only the companies that will benefit on these advances, but also the employees will benefit on the functionalities. At its best, the usage of analytics helps to identify talent, which might otherwise be left unnoticed. Thus, it leads to a more justified reward system and supports employees by enabling the retention at work. All in all, it can help employees to keep satisfied, engaged and perform their best as the performance also gets noticed.

Oehler and Falletta (2015) also remind, that even though companies assumedly intend to use the data for the analysis rightfully, they should still consider that the actions are both within the limits of the country's laws but also ethical. Even if the legislation is followed by the book, it does not mean that the activity is still ethically correct. The challenge comes from the fact, that in HR data modeling one uses employees' characteristics to create predictive models. Penalizing employees according to their data, which they cannot affect to themselves such as age or origins, would definitely be considered as discrimination. This is why companies need HR professionals who foster fairness and justice throughout all actions.

3.1.2 Relation of the big data to predictive analytics

Predictive analytics capabilities are best implemented into there, where one needs to handle big data. Gartner's (2013) definition for big data is still widely accepted and thus one can say big data comprises the following characteristics;

- Volume = big quantities of data, more than ten GB new data per day
- Velocity = constant increase in data, such as picture feed in Instagram or messages posted in Twitter
- Variety = data that possibly is unstructured such as text message contents, videos or interview replies

Fitz-enz and Mattox (2014) state that the integration of HR systems, automatization and digitalization of HR operations drive the creation of big data sets in the HR area. Luckily, the past and current development of IT systems offer manageable ways for the data gathering and for the further analysis for example in the areas of candidate pool management, talent management, learning management or performance history recordings, just to name a few. According to Harris et al. (2011) the HR department has not been the forerunner on collecting data in the most efficient way, or especially turning the collected data into information about the business performance and outcomes. This is a major challenge and an improvement area for the HR; instead of merely reporting their own performance, one would need to start reporting the business performance.

As Fitz-enz and Mattox (2014) describe it, around 80% of the currently produced data is unstructured such as images, non-numeric data, text and videos. The amount of the data continues to grow alongside the rise of the social media usage and the result will be a mixture of structured and unstructured data. In order to create information from this mixture of fast growing, variable data in HR but also in the other areas, one needs to exploit the logical problem solving and statistical analysis of the data.

3.2 Measuring the benefits of predictive analytics in HR

Why should one then measure business benefits specifically through predictive analytics? Fitz-enz and Mattox (2014) claim that according to their research the companies implementing predictive analytics into the HR area, will see at least a 4% improvement in the productivity. More generally stated, through predictive modeling one can prove the economic value of the investments into HR analytics.

Levenson (2005) reasons why it is specifically advantageous to measure causal relationships instead of just pure ROI or cost-benefit analysis. To him ROI simplifies the process too much, as it combines all the costs and benefits to one number as an outcome. Furthermore, it does not take into account any consideration of underlying factors or context, which can lead to poor decisions. Alternatively, if one manages to encompass all the metrics together, which is hard considering the difficulty of defining HR financial business outcomes, one has taken so much time in combining the information that the decision making process has been slowed down.

Cost-benefit analysis adds the possibility to increase the complexity of the calculation according to Levenson (2005). He explains that the cost-benefit analysis is not all about one final number, but it offers a possibility to review the costs and benefits in detail. However, the difficulty remains how to assign monetary value for all the benefits such as increased innovation or customer satisfaction. Often these kind of unquantified benefits are left out, but by doing so the cost-benefit analysis falls short, as these might after all be crucial to the company's success.

Levenson (2005) continues that instead of tightly summarizing the monetarized benefits, one should first perform an impact analysis. Impact analysis is about identifying causalities between the input factors and output results. The HR leaders are able to list these factors quite easily, but finding out what the connections and causalities are, is the hard part. One needs to combine the behavioral modeling of individual's effect, group dynamics, incentives and behaviors to the same model that then produces the business outcomes. The behavioral modeling, or analysis of causal relationships, is the first half of the problem, whereas generating the predictive models on the result is then the next. The investigation of causalities should really be the key question for those starting the predictive modeling in the HR area. Ashton et al. (2004) continue that today's leaders need to start building the skills on analytics inside the HR teams, as analytics its best leveraged by the HR people who know what is important in HR and how the processes should work. However, they add that sourcing these capabilities from external sources could be the best solution, depending on the case.

Traditionally, one has measured HR as its own capsulated area; how HR as itself performs. One needs this kind of measurement also to be able to improve internal processes. As Chesters (2012) states, there are a lot of variables stored in HR, that can be used as measurements e.g. performance ratings, employee turnover or headcount. Thus, it is important to define accurately which data is available and what should be measured. More importantly then, one should consider what the actual benefit of measuring something is in HR over some other HR factor.

Then again, when measuring HR's business effects, one needs to start looking beyond the HR functionalities. According to Fitz-enz and Mattox (2014) the measurement of benefits in HR advanced analytics area is two-fold; one can realize both financial and economic benefits. The financial benefits are the positive monetary changes one can see on the balance sheet, on the income statement or for example in the stock prices. The economic benefits, also known as the "off-balance sheet assets", comprise the non-monetary positive changes such as the

company reputation among clients or employees, client satisfaction or public relations. All these economic benefits should in the best case turn into a positive cash flow.

As this research only concentrates on identifying possible business benefits, it would be useful for the next researches to actually quantify the business benefits with the above terms; with financial and economic value. Actual quantified figures of the benefits enable among other things a more committed sponsorship in the companies and supports also in the change management.

3.3 Business benefits of adopting HR predictive analytics

Predictive modeling is based on training the algorithms to indicate the probability of an event to happen. Predictive modeling could be characterized as cognitive computing, which refers to a system that can learn by training and evolve once learning new information. The goal with cognitive systems is to be able to interact naturally with humans. This might make people feel insecure or scared for their jobs; a common belief creating insecurity is that a machine can replace people in their jobs in the future. However, neither cognitive computing, nor predictive analytics is meant to replace the HR professionals in their job, but to help them by extending the human capabilities to evaluate and analyze the data. Cognitive computing should help one in everyday tasks and accelerating the speed of processes. Mastering this area should give any company competitive advantage over those not leveraging these capabilities. (IBM, 2015.)

IBM (2015) suggest that the greatest business value will be achieved, when the human qualities of common sense, ethical thinking and independent thinking are combined with machine powered data analytics and statistical calculations. They have tested this in the game of chess, where people are allowed to use computers as assistants, and opponents can be human or computers. The people using computers as an aid and combining that with their intuition were undoubtedly the most successful players.

In more scientific terms, and as Naasz and Nadel (2015) define it, through predictive modeling one gains the following benefits:

- Ability to define the best predictors, which affect the most for the defined outputs
- Measurable and quantifiable information on the influence of different predictors
- A measurable mathematical model of the current state and prediction of the future

All of the above statements are general enough to be applied in any business area and to any business process. As the possibilities are quite vast, it makes sense to define, which are the most potential application areas, where to try predictive modeling. Potentially beneficial implementation areas are identified in the following chapters. The possibilities for using predictive analytics in the HR are discussed under the following categories again: employee acquisition, employee management and employee retention.

3.3.1 Benefits of predictive analytics in employee acquisition

As described in the previous sections about measuring employee acquisition, the process consists of assessing, recruiting and on-boarding employees. The traditional measurements seem to concentrate on summarizing quantities of the employees and e.g. rates how fast people could be on-boarded. These reports are important for creating a view on the current state, but they are lacking in giving any insights on how one could improve processes. The following sections explore the area beyond the summary reports, what else could be achieved.

One example on the financial benefits gained through predictive analytics is demonstrated by Oehler and Falletta (2015) in the area of **predicting the best candidates** for the company. In a transportation company there was a 74% voluntary turnover rate among employees, which resulted in a cost of $68 million. The company then detected, with the application of predictive analytics methods that by increasing the significance of the entrepreneurship, resilience, adaptability and ability to address ambiguity in the candidate evaluation phase they could reduce the annual turnover by 28%. Thus, they were able to reduce turnover costs by $27 million, increase employee satisfaction by 41% and customer satisfaction by 52%.

In the employee acquisition area Fitz-enz and Mattox (2014) point out the need for improving the efficiency of the hiring process, measured by the speed and the quality of the hires. As an outcome of successful hire one reaches better employee engagement, productivity, profitability and controlled retention in the position the employee is engaged in. In other words, the quality of hire needs to be better and the process itself quick.

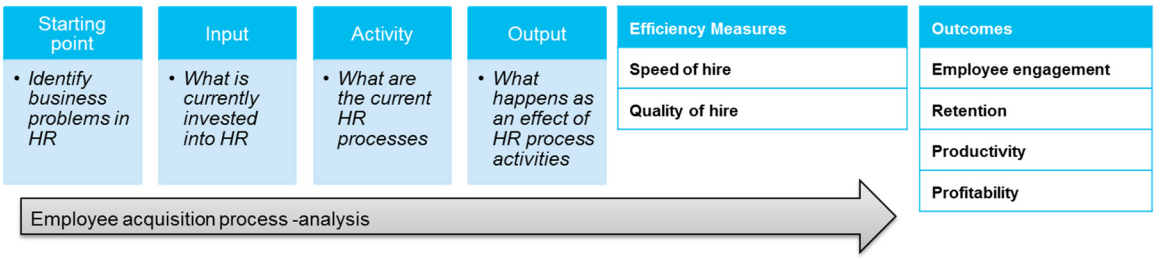


Figure 8. Employee acquisition measures. Source: Fitz-enz and Mattox (2014)

The main possibility identified by Naasz and Nadel (2015) of the usage of computerized analytics in the employee acquisition phase is similar; to make better hiring decisions. This includes looking for job candidates through new channels with masses of data, which would be hard to accomplish efficiently with human interpretation only. More specifically they claim that one should be scanning the social media –channels, resume databases or received applications for matching the most suitable candidates to positions through predicting the future competency and performance of the candidates in the targeted position. One specific example of factors predicting good employee performance, which Farley et al. (1989) mention in the employee recruitment, is the recruiting channel: informal recruiting channels tend to produce better candidates. In other words, predictive analytics can be leveraged to filter candidates from the masses of data based on the definition of the open position. It does not replace the recruiting experts entirely, but can be used as a tool to support in the process.

The main advantage of implementing machine power into the hiring process is that where traditionally HR experts would have made a subjective estimation on candidates' competency, a computer can analyze the possible match objectively. This eliminates the recruiters' choice of eliminating candidates based on their judgement about relevant data. Also personal biases can be avoided by using algorithms in interpreting applications instead of humans, who tend to favor similar personalities as they are themselves. (Naasz and Nadel, 2015.)

The workforce and **talent demand forecasting** is another area worth looking into in predictive analytics. Cappelli (2009) points out the uncertainty of today's business world also in employee movements, which requires ability to adapt to changes. It is hard to predict where one needs workforce as next; in which departments or talent areas. He claims that the traditional workforce forecasting methods have failed, but competition and outsourcing of employees increased. This creates a need for the development of better forecasting methods and ways to anticipate the employee flow. In other words, the new situation with the workforce can be

controlled by managing the risks more effectively and for that purpose more accurate predictions would be useful.

A third area discussed in the literature, where predictive capabilities would be of use, is the recognition and effective management of the **skills needed in the company**. This is partially discussed with the workforce planning introduced by Cappelli (2009), i.e. one needs to know what is needed in the market in the future and prepare for that. Bhattacharya et al. (2005) have an additional point of view to the matter. They state that the company's HR flexibility, created by employees' individual skills, has a significant positive effect on the company's performance. The HR flexibility in this context refers to the HR's ability to respond to changing external demands by being able to adapt employees' skills and by managing the workforce's skills as a whole. This is a new research area, as before there is very little substantial and empirical evidence on the effect on the company outcomes. If one is not able to predict which skills will soon vanish or which will have high demand Bhattacharya et al. (2005) suggest another approach; one can also try to target to employ people, with high behavioral flexibility, ability and willingness to learn new skills. Thus, this question is multifaceted, but all in all managing the skills properly are hypothesized to have a positive effect on the company's performance.

As a summary from the above literature review, the predictive analytics processes are listed for the later interviews in the Table 4. These are used as a starting point for discussion in the context of this study. The usefulness and value are then to be evaluated by the interviews.

Table 4: Summary of the predictive analytics related to the employee acquisition processes

HR Predictive Analytics –processes
Area 1: Predictive employee recruitment
Predict future recruitment needs in the company
Predict the best candidates for the open positions
Predict which skills are needed in the future

Even though the aim of this study is not to provide a step by step implementation guide for each area where predictive analytics is seen beneficial, one example below is given to make the matter more concrete. In general, any analysis starts from the definition of the current state and identification of what could possibly be improved. A specific example of data involved in using analytics in employee acquisition could e.g. be the following, which Fitz-enz and Mattox (2014) have found useful; analyzing how different recruiting channels perform against these measures: 1) well performing individuals 2) the length of employment. To start with this

analysis one would for example need the employee basic data, employee performance data, organizational or position history in the company and the recruiting channel information, highlighted in green in the illustration in Figure 9. The illustration demonstrates the typical data landscape to give some context for the data in question.

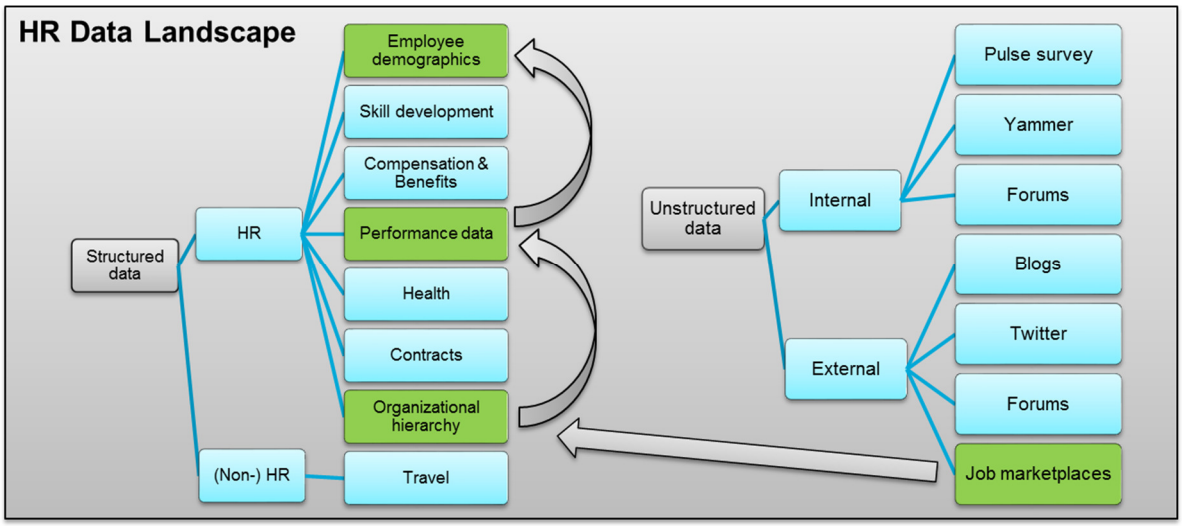


Figure 9. Data used in analytics of acquisition performance. Modified from Bersin (2014), combined with author's experience on the HR system landscapes

However, Guinn (2012) adds an additional view to the issue by defining which information is relevant to an optimal outcome, when hiring an employee. In contrast to traditional belief, he states that the job experience, job knowledge, knowing the right people, education or saying the correct things in the interview do not predict success at work. Instead, he defines that spending time with the candidate, long observation periods and psychometric profiling will reveal the features of employees, which often lead to weak performance on the job: poor listening skills, lack of interpersonal skills, lack of leadership skills, inability to adapt to change, tunnel vision related to work or lack of following through work activities.

Thus, predictive analytics cannot solve everything in the hiring process. Nor can it decide the criteria for success on behalf of the HR experts, nor can it replace the importance of meeting the candidate in person. Specialists still need to define what is actually looked for in the position, how it will be measured and how the employee fits in with the company's workforce and culture. (Guinn 2012.)

3.3.2 Benefits of predictive analytics in employee management

In the employee development area, one can use analytics in structuring the unstructured data of performance reviews and satisfaction surveys and thus enable further decision making and action planning based on the data. (Naasz and Nadel, 2015.) Employee development and management areas covered in this section comprise of all the HR management areas to be taken care of once employee has joined the company; such as competence-, talent and learning-, wellbeing-, compensation and benefit- and performance management.

Predicting employee performance is one area, which companies are interested to control and predict. Anschober et al. (2010) explore this area and state that one attribute differentiating high performing companies from the rest is the effective competence based management. Ability to build, protect and use employees' capabilities is a high advantage on today's competitive markets. In this resource-based view the company can be differentiated from the rest by its ability to deliver what the customer wants better than its competitors. For being able to do so, the company needs to first identify what its core competences are. Then the company needs to take care it has employees and a competence base, which can secure the continuum of the work. Core competencies relate to the unique resources and skills the company has in its employees, which either can lead to differentiated products that cannot be imitated, or to noticeable cost advantages. Whatever the companies' core competencies are, the companies are still relying heavily in people creating the value according to the company's aims. Thus, it pays off to predict the top performers that support the company's goal, whichever the goals are.

Brown (2014) has interesting ideas for **predictive analytics in the context of the rewards**. He states that the total rewards system, offering equal rewards packages to employees cross the organization is getting outdated. Instead of the fixed cost and inflexible system, he recommends a "smart rewards" system, which has been emerging throughout the world. The smart rewards are based on a simpler focus on the core principles, the strong focus of evidence and measurements, increased employee engagement through rewards, and more open communications on rewards. Simply put, employees should know from what they are getting the reward, it should be motivating enough, for each individual as people get engaged for different reasons, in order to produce top performance. Thus, one could conclude, that predictions could support in finding out the best reward system for each employee.

In the current state according to Brown's (2014) studies, very few companies were evaluating the reward effectiveness, but merely doing benchmarking to other companies in the

market. The main challenge was before the lack of data and nowadays the scattering of data on multiple locations; reward data in an external payroll vendor, costs in finance department, and engagement data in HR department and so on. The need has been recognized to integrate this data to manage the rewards more effectively.

On a more operational side of HR, one finds also benefits in talent management and **analytics related to training planning**. Fitz-enz and Mattox (2014) note that the industrial era –view on workforce planning and competence management is outdated, as it would be nearly impossible to create a comprehensive list of skills in the continuously changing information flooded environment. Usability of predictive analytics comes through the ability to predict which trainings create positive return on investments. The most benefit according to Fitz-enz and Mattox (2014) has been realized through providing training that has the biggest applicability to the employee's current job according to the employee's own perception. Predictions could be used at the employee level, or in general in which training is profitable for the company in the long run. Often also companies don't have unlimited budgets for providing trainings, through which one needs to decide on quantities of the trainings per employee.

In the health management area the benefits are understandable in common sense but also proven in various researches. As Barron (2012) writes; "Healthier people are happier and thus more productive too". It is a known fact in **well-being management** that the focus of activities should be in the preventive care and provision of holistic health enhancing activities, as well as in the early detection of the health issues. Furthermore, the services offered should be personal, serving each individual based on their needs. However, cross-organizational analysis is also needed to find out, which of the well-being and healthcare activities have an effect on the HR measures and on the other hand, which activities have very little or no effect on anything. (Barron, 2012.)

Absences from work can be caused by well-being issues but there are many other reasons as well. There are several studies looking into the factors of absences in different industries. Ivancevich (1985) lists several of these studies. In most of them it is stated that absenteeism is costly and disruptive for the companies. There are several factors affecting the absenteeism, for example social factors, organizational factors, the manager role, policies, incentives and deterrents to absence are taken often into account. Interestingly, also the frequency of absences in the past seems to be a predictor for absences in the future. Then again timely actions related to the absences, such as change incentives for attendance and incentives to keep the employee engaged, resulted in significantly lower absences.

Also Swart (2010) recognizes the huge costs, which the employee absences create through diminished profit margins, having to approve overtime for those at work or hiring substitute employees. Thus, it could be worth preparing for it with the predictive analytics capabilities in both the preventive care of the employee but also as part of the normal work scheduling and planning. As Swart (2010) formulates it; automating the data collection of employee absence data enables the companies to analyze the reasons and to effectively intervene where possible, to minimize the costs accrued through absences.

Again, as a summary from the above literature review and through a consultation of a well-being expert interviewed for this study, the following predictive analytics processes summarized in Table 5 are possible valuable implementation targets. The usefulness and value are then to be evaluated later by the interviews.

Table 5: Summary of the predictive analytics related to the employee management processes

HR Predictive Analytics -processes
Area 2: Predictive employee management
Predict who will be the future top performer i.e. predict employee performance
Predict which rewards produce best performance
Predict optimal amount of rewards to be offered
Predict well-being activity needs on employee level (physical and mental health)
Predict optimal amount of well-being activities to be offered
Predict return on investment on well-being activities i.e. best performing activities
Predict training needs on employee level
Predict return on investment of trainings i.e. best performing trainings
Predict optimal amount of trainings to be offered
Predict employee absences
Predict best engagement package (holistic view which factors affect to engagement) for top performers such as reward packages + trainings + career path planning etc.

3.3.3 Benefits of predictive analytics in employee retention

Managing the employees, answering employee's needs and creating a high-level employee engagement benefits the company in many ways. Engaged employees work harder, perform more effectively, give better service to customers and thus influence the company's success. In other words, through increasing the employee engagement one can really enhance company performance through employees. Even though more and more employee satisfaction surveys are being performed in the companies, it does not give the full view to employee engagement, but more in depth analysis needs to be applied. (Baron, 2012.) To prevent

unwanted resignations, one needs to get employees to stay, in other words start using **predictive analytics in the employee engagement** area.

Baron (2012) continues that each organization tends to define the engagement according to their organizational culture, thus the content of the analysis might vary accordingly. However, there are common nominators to the engagement, and by missing one, disengagement begins. These factors, that need to be present in employees' jobs, are satisfaction, motivation and effectiveness. Additionally, engagement changes over time and the target of the engagement differs between employees; some engage more through colleagues or leaders, most however are "task engaged", meaning that they get motivated most about the task itself.

There are two types of engagement, emotional and transactional. Transactionally engaged people perform well in the short term, as they perform as the company expects for the reward they get in return; for example fame or money. This type of engagement however often leads to burnout and moreover, it does not support the employee's common sense of purpose. Emotionally engaged employees believe in the company's purpose and feel a higher level of commitment and wellbeing. As it has also been proven that increasing employee engagement increases performance, it is worthwhile to find out how to increase it and predict which action has which effect on each employee group. (Baron, 2012.)

Oehler and Falletta (2015) give a real life example on the benefits gained through the **predictive analytics for employee retention**. A transportation company started to analyze the performance ratings and predict the performance rating outcomes. This enabled them both to create a more equitable reward model, but also helped identifying future top performers, who could then be targeted with career planning and reward management more specifically, which effectively lead to lower employee turnover. This also led to an annual productivity increase of $1.7 million.

At a more general level, Fitz-enz and Mattox (2014) recommend one to research the **inflow and outflow of employees.** They explain the complexity of the employee retention analysis through a chaos theory comparison. Employees leaving and joining the company in seemingly random cycles may first seem as inexplicable and unpredictable. The researchers of chaotic processes and mathematicians are proving otherwise. An unpredictable looking situation might actually be totally explainable, the analysis might just need more advanced mathematics, such as adding dimensions to calculations.

Tymon et al. (2011) suggest that with the following mechanisms the managers can affect employee turnover:

- the experience of intrinsic rewards; the positive feeling employee gets from the work relates positively to retention; meaningfulness, progress, choice and competence,
- personal commitment to the organization; the more committed, the more likely to stay in the company,
- perceptions of career success; the more positive the employee's view is to career success affected by manager's motivation and intrinsic awards, the less likely is the employee's turnover.

These are one list of assumptions that one could use in the start of the predictive analytics; collect data for these areas and look at the correlations in your company's context. However, there is not a ready-made model or pattern one can say is the right one for companies' employee data, but one needs to collect the data and study it. If one is then able to find a pattern in the seemingly random data, at the best case it can then be explained and thus also controlled. Ultimately by discovering the patterns from the data one increases the efficiency, effectiveness, profitability and ability to control the costs.

It is not only the employee who leaves the company, but also his skills and knowledge is gone at the same time. Shaw (2011) argues that there is a clear negative effect of high turnover rates on the organizational performance. The losses comprise the in-role performance losses and social capital losses among other things, concentrating very much on the loss of the individual's skillset and knowledge in one's working area. Should the turnover rate be high, entire sets of skills could be lost at once. Shaw (2011) continues that should the turnover rate be constantly high, the company is not damaged as much as in a situation, where there is a little turnover and then an employee decides to leave. The employee in a relatively stable job has developed a stronger contextual set of skills in the job, which is then harder to replace. He also argues that the effect on the organizational performance is greater, if the employee leaving is a key performer in the company. It is up to the management to decide what kind of turnover is acceptable but to effectively manage the deficit in skill, one might need to apply **predictive analytics also in skill management**.

Again just a few words what are the possible correlating data points in this HR area. In the HR analytics area, a common way to start employee predictions and modeling is to start

looking for patterns inside specific job groups. According to Fitz-enz and Mattox (2014) the following attributes are often used in sorting the data inside the job groups: reason, tenure, position and supervisor. It is also identified, that the four most common reasons for employees' willingness to leave can be compressed to four nominators. If one of these basic human needs disappears, the employee disengagement begins: need for trust, hope, sense of worth and feeling of competency. These are areas in which the employer can have an effect on, there are additional areas of course such as moving away that one cannot influence. Fitz-enz and Mattox (2014) list 7 specific reasons why employees leave in the Table 6 below;

Table 6: Reasons for retention. Source: Fitz-enz and Mattox (2014)

Common investigation scope	Common sort options	Human needs affecting to employee retention; if 1 is lost disengagement begins	Exact resons to leave (preventable)
Employee job groups	Reason	Trust	Job / workplace was not what was expected
	Tenure	Hope	Mismatch between job and person
	Position	Sense of worth	Too little coaching or feedback
	Supervisor	Feeling competency	Too few growth and advancement opportunities
			Not feeling valued or recognised
			Stress from overwork and work/life balance
			Loss of trust and confidence to senior leaders

These starting points can be used in an analysis of "what is happening" or descriptive analytics. Then again analyzing the correlations between each of these variables and adding data such as employee satisfaction survey results indicating engagement, enable the creation of predictive models, which can be used in prescriptive action planning.

Also in this third area of the HR predictive analytics, employee attrition, a summary is presented in Table 7 from the literature review to be used later in the interviews. The usefulness and value are then to be evaluated by the interviews.

Table 7: Summary of the predictive analytics related to the employee attrition processes

HR Predictive Analytics –processes
Area 3: Predictive employee attrition
Predict resignations on organizational level (amount of resignations)
Predict resignations on employee level
Predict how employee resignations can be prevented
Predict which skills will be lost and when

4 From data to insight; enabling predictive analytics in HR

Having now walked through what is the value of HR for the business, what should be measured in HR and how desirable it is to use predictive analytics in gaining those targets, one could be thinking what is preventing the companies taking action with predictive analytics. There are some basic elements that each company needs to consider on their journey towards the needed elements. These elements are described in various analytics maturity models, from which this research uses TDWI (2015) due to its general but holistic nature. In the following the necessary analytics elements are described with the model, after which the information can be applied to the case companies' interviews.

The analytics dimensions used in the analytics maturity model by TDWI (2015) are used as a framework for this study. These dimensions include infrastructure, data management, organization, governance and analytics, as also described in the Figure 10. TDWI uses the dimensions as a basis of its analytics maturity assessment model, which aims in helping companies to find out where they are at the moment and what are the needed next steps on their journey towards advanced analytics, such as predictive analytics.

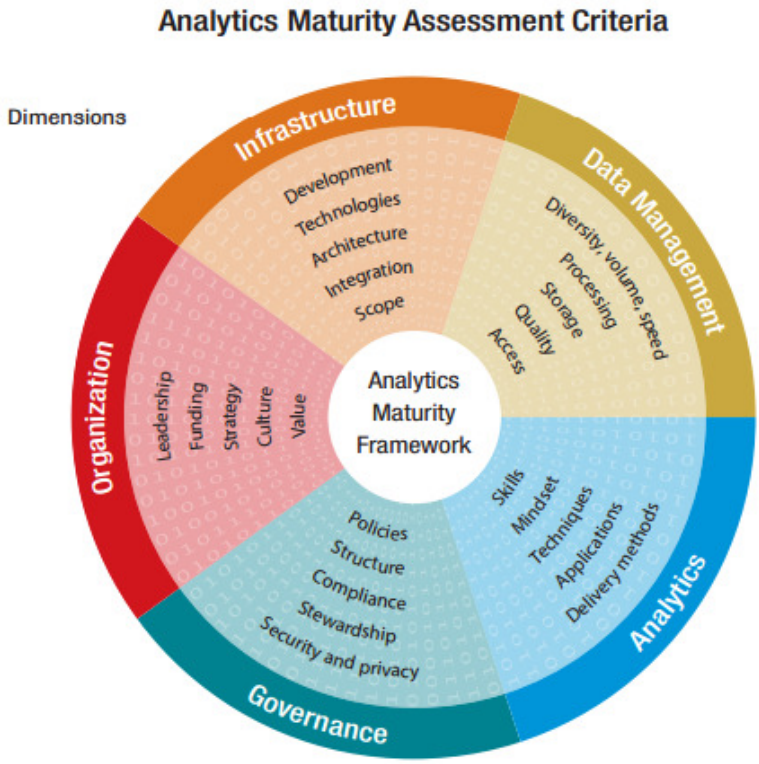


Figure 10. Analytics maturity dimensions. Source:TDWI (2015)

The following sections will cover the concepts presented in the TDWI (2015) framework with additions from other existing literature from the HR perspective; what are these main building blocks that companies should consider in conducting their analytics initiatives. This information on the analytics dimensions is incorporated into the case interviews later in the study, to get an understanding about the current state of the interviewed companies and on what they are currently planning for their future. The current state review performed in this study will not replace the TDWI's (2015) assessment of the company's current state, but it will give some background information for understanding the answers of each interviewee on the assumed business benefits of predictive analytics.

4.1 HR IT Infrastructure enabling the predictive analytics

The infrastructure –dimension in the TDWI (2015) model helps companies on positioning how advanced their IT landscape is to support the analytics capabilities; is analytics currently already widespread and on which level. According to the framework, the companies with mature analytics capabilities are able to still leverage their old data warehouses but additionally also incorporate new features and technologies such as Hadoop or enterprise NoSQL databases and cloud services through their infrastructure strategy. In this case, the whole company embraces the analytics ecosystem, a unified architecture from which all the departments can benefit and which the leadership demands to use in order to achieve the targeted business benefits.

TDWI (2014) states that the increase in computing power enables us to run predictive data models now in minutes that would've taken days or weeks still some decades ago. The lack of accessible and affordable technology hindered the adaptation of the predictive models into daily use. As the prices have gone down and technology widely accessible, it is much more convenient for the companies to start planning the usage. Naasz and Nadel, (2015) add that especially the cloud computing is part of the current technology transformation that has changed companies' IT management strategies since 2007. Nowadays there is no need any more to invest into the maintenance of physical hardware to be able to perform activities like HR analytics. Cloud based analytics already exists and is available cost-effectively.

According to Fitz-enz and Mattox (2014) once the HR data is accessible and available, one needs to take care that other operational area data are available for operational analysis. If one wishes to see the effects of HR actions in financial terms or for example correlation between

marketing and employee movements, one needs to be able to combine all these different sources of information. Bose (2009) states that the biggest challenges in the predictive analytics adoption are the data availability around the organization, the data accessibility due to the regulations and security restrictions. The most capable analytical tool is useless unless one can access the data with it. In today's environment most of the IT departments or knowledgeable business operators can solve the data integrations and accessibility issues fairly easily, thus neither technology nor data availability should be obstacles, which one could not overcome.

The focus of data storage has widened from having internal data storages to external unstructured data storages such as social media feeds. Koch (2015) states that the investments in this area have become more important. There are companies who have invested already in data warehousing and have a structured database for example for business intelligence purposes, and have a stable building ground for implementing their advanced analytics strategy. Koch (2015) continues that there are also those who have not been among the early adopters of business intelligence capabilities and need to start from further behind, but on the other hand they have better tools in use now. They also have opportunities to gain quick wins in creating controlled targeted initiatives. Bose (2009) adds to this view that it is also not advisable to start with the full range of analytics capabilities, but to start with one and add capabilities incrementally. Thus, no major setup is needed in the beginning, but only that much that one can realize the first benefits and get more buy-in for the next steps.

TDWI (2014) continues the BI comparison with analytics and says that it is important to remember that predictive analytics does not replace but it complements business intelligence. Ninety percent of the companies surveyed by TDWI consider starting predictive analytics initiatives only when they already have BI foundations in place, to take the analytics capabilities to the next level. One also needs to understand that predictive analytics is not a subset of BI but needs its own technical additions. Additionally, 73 % of the companies are using predictive analytics for their big data analyses, and predictive analytics has been widely noted as the primary analysis tools for the big data.

4.2 HR Data management, governance and quality

The TDWI (2015) model includes data management and governance as individual building blocks. TDWI's dimension on data management consists of questions related to the nature of the data and on how the company makes sure the data used in the analytics processes is of good

quality and accessible. Data governance then again comprises questions on enabling the data usage to happen; are there enough rules and regulations on how the data is managed, but not too much to prevent the data exploration from happening. The companies on a very low maturity level typically have silos of mostly structured and possibly low-quality data, from which it is time-consuming to pull any reports together. They lack the possibility to conduct basic business analyses with the data without the help of IT, whereas companies with high maturity levels have the infrastructure in place for all the mission critical analytics processes and are able to handle the complex scenarios of data management. Also the mature companies have established data governance practices and have organized data management processes with self-service options where needed.

The rules and regulations are a real obstacle in many aspects with the HR data. A commonly known fact is that HR data is sensitive from nature and cannot be distributed without proper protection. Both governmental regulations and organizational policies apply to HR data. To have a better understanding what the data consists of, a simple model could be drawn to illustrate it. A typical data landscape in a company loosely based on the description from Bersin (2014), combined with the company wide perspective and my own working experience on the HR data, would look somewhat like depicted in Figure 11.

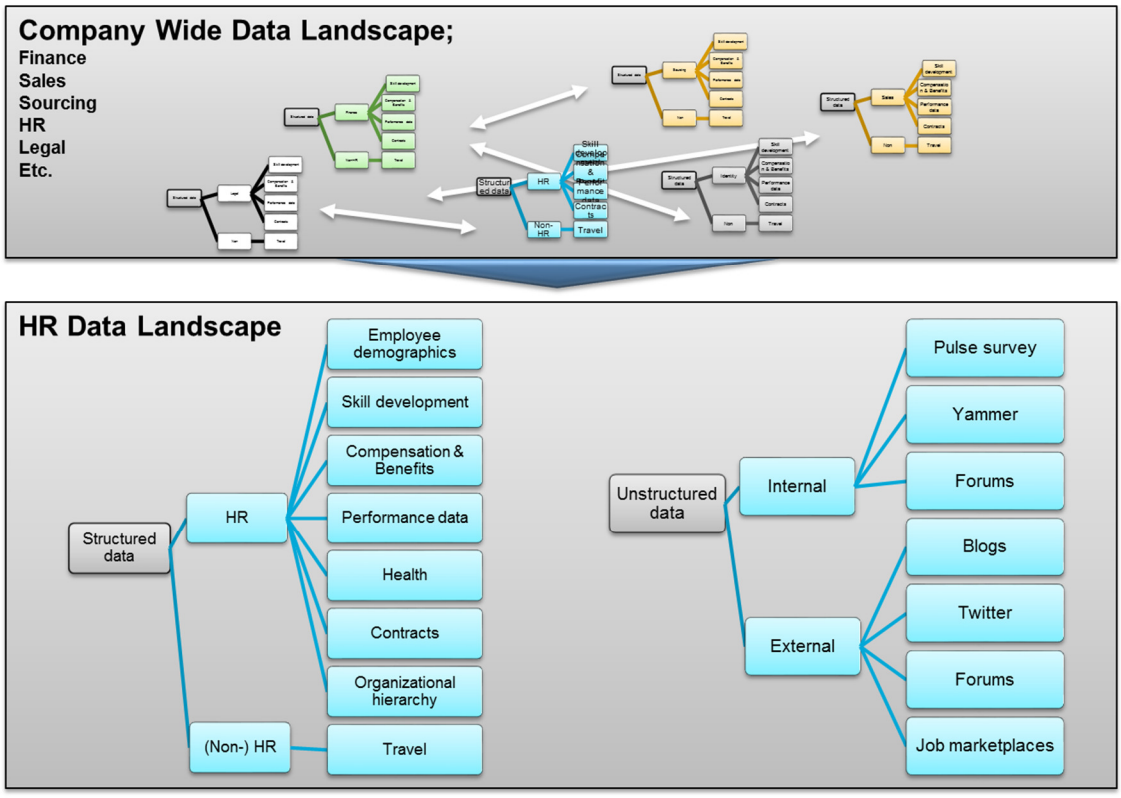


Figure 11. HR data landscape. Modified from Bersin (2014), combined with author's experience on the HR system landscapes

Traditionally, HR departments have collected the structured data, but nowadays there are also several unstructured sources for employee data in use as well; such as personal and professional blog posts, forums or other social media. HR data is often isolated into HR systems, but some integrations can also exists for example to companies' business warehouses collecting all the data companywide, or to financial systems, where the actual costs of the employees exist.

Most employees would probably say that he or she does not want her compensation, health, contract or other personal data to be distributed randomly around, but it needs to be strictly controlled. This is also secured by several country-specific rules and regulations but need to be enforced by the company's data governance decisions and daily management of data.

4.2.1 Characteristics of HR data

HR data does not have a global sets of standards, like there is for example for financial accounting purposes. Having a defined set of standards would enable more precise comparison and benchmarking between companies. However, there is a certain set of measures trying to reach an official status, such as the Talent Development Reporting Principles (TDRP) by the Center for Talent Reporting (CTR). This model is based on performance optimization methodologies. (Fitz-enz and Mattox 2014.)

Data in the HR area is often unstructured, instead of structured in a tabular format containing the same pieces of information for each employee in the company. The data given by the applicants in the job application phase for example is often anomalous between different applications. Also the data collected about the employees via surveys has often open format questions and could be thus is inconsistent between different repliers. (Naasz and Nadel, 2015.)

4.2.2 HR data quality

Robinson (2009) states that one essential factor in a successful data analysis is data quality. Fitz-enz and Mattox (2014) recommend that one should try to find out the as-is state of the following aspects of data, before conducting any further analysis: Missing data, errors in the data such as typos and data entry errors, database errors resulting in misinformed queries and misaligned data. Misaligned data is data that is not found in the same structure with other similar data; thus it would also be misleading in the analysis. Next, one would need to decide the

correcting actions and more importantly, how the achieved level of data quality can be maintained in the future, to enable data to be reported error-free.

Robinson (2009) also notes that it would be a waste of time to wait for perfect data quality as that is impossible. One can use as much time for the data cleansing, harmonization and standardization as one is given to. However, it is better to start from somewhere and once interest and awareness have been created, continue to improve the data quality.

Redman (1998) emphasizes the importance of the data quality work; poor data quality can damage the employee trust, creating organizational mistrust but itcan also lead to operational problems: to poor decision-making ability and increased operational costs. Briggs (2011) states that the data quality issue should be tackled in pieces; first starting with high priority items and all in all proceed one part at a time. One could summarize, that enhancing data quality is important work related to the predictive analytics. However, the lacking data quality should not be seen as an obstacle preventing trials with predictive analytics.

4.3 Analytics; Design of statistical modeling of HR data

The analytics dimension in the TDWI (2015) comprises the following questions: what kind of analytics is used in the company, how the analytics are delivered throughout the organization and how analytics influences the business decisions made. In analytically immature organizations, the advanced analytics is very much non-existent. Instead, spreadsheets are in use and delivered to those, who happen to need them at different points in time. Often in these kind of companies people do not have data in use to make educated decisions. Then again in very mature companies all types of analytics capabilities are in use, a defined center of excellence – an analytics team consisting both IT and business people - is continuously developing analytics capabilities and many formats of data are available such as real-time data, or unstructured and structured data. Information produced via advanced analytics is efficiently used in the decision making process.

The reasoning why predictive modeling should in general be performed is explained in this research through increased business value. Chopra (2014) states that all companies implementing predictive analytics have gained some level of business value through it. However, there is another point of view about why the analytics should be used specifically in the HR area, which is related to the nature of employee movements in the company. Fitz-enz and Mattox (2014) explain that at first for example the entrance and leaving of employees might

seem chaotic, without predictable pattern, but this is exactly where predictive modeling steps into the picture. The changes are not steady or linear, but have fluctuations due to various external and internal reasons. Once the hidden pattern is found, it can be explained and only then controlled. All management decisions need to be based on information, then only one can really lead the company operations, including HR.

Chopra (2014) describes that the prediction process starts from the definition of the objectives, after which the data is analyzed and prepared, the model is build, and the work continued until the objective is fulfilled. One needs to decide on best modeling technique based on the current problem or through trying different options. Chopra (2014) continues that nowadays it is common to apply several modeling methods to a problem and select the best performing method only afterwards. Fitz-enz and Mattox (2014) mention a few specific examples; with regression and correlation analysis it is possible to find the relations of single variables such as the correlation of training to performance, whereas with the analysis of variance (ANOVA) the differences between groups such as the productivity between trained and untrained staff are detected better.

When it comes to different statistical techniques of modelling, there are numerous options available, but to mention just a few alternatives; Paauwe et al. (2013) have identified the following approaches used in previous research to the statistical modeling of HR data;

1) Designs concentrating on analyzing all variables at once, i.e. at one point in time. The weakness of this approach is obviously the lacking possibility to causal analysis.
2) Designs called "Quasi-longitudinal design" evaluate the HR practice at one point in time and the performance effect at later point in time
3) Designs called "Authentic longitudinal design" evaluate the HR practice and the performance in several different points in time and thus is the most effective in describing causal relationships

Chopra (2014) adds that the modern tools and possibilities to relatively easily try different methods for each problem. Also the user interfaces of these tools have developed and are more user friendly nowadays. In other words, even people without deep mathematical and statistical capabilities could be able to create effective models.

Although there are some measurement issues and reliability issues, as defined in the previous chapters in this study, part of the studies have managed to demonstrate positive correlation between HR practice and company performance. One example on these is presented

by van de Voorde et al. (2010), who demonstrated that using two sets of employee survey data gathered in different points in time, one can predict the business unit profits.

4.4 HR Organization; the analytics team and leadership

The TDWI (2015) analytics maturity assessment model handles the questions on the organizational strategy, leadership and organization of people for enabling analytics under one dimension; the organization. A lot of the interpretation of analytics maturity of the companies revolves around the cooperation between IT and business. The stronger the cooperation, the better the results in analytics initiatives. Companies with very mature analytics capabilities also have strong leadership support, enforcing the usage of analytics throughout the company on multiple channels and devices.

TDWI (2015) also disapproves the organization of analytics capabilities per department; then one tends to operate in silos without knowing what the other team is working on, and the possible benefits on synergies will be left unnoticed and unused. In the best case, the analytics would be provided as a service from a centralized source, which demands working tightly side-by-side with the business organization.

All in all, as in any operations, also in the analytics team the people create the value. Fitz-enz and Mattox (2014) define that an optimal analytics team should consist of people who can both handle statistics but also have wider set of skills to go beyond the mathematical analysis. One needs people who can interpret the data and find patterns in it. According to TDWI (2014) one recent trend in this area is that more and more business users start to take the use of the technology. The self-directed, more and more visual and easy-to-use data exploration tools enable business people to adopt the ad hoc reporting tools first but later also some more advanced analytics tools.

Strong leadership support is needed in the analytics initiatives. Ashton et al. (2004) state that it is no more the traditional HR people who will be the future HR leaders, but there is room in the top positions also for analytics experts. Increasingly one should be able to use professional consulting skills and advanced analytics for decision making in the HR area. As TDWI (2014) formulates it, the main reason companies are implementing predictive analytics is to increase business performance. Those companies recognizing the value of predictive analytics are the forerunners in their market. The business leaders have started to realize that it

is not enough to look at the past to remain competitive, but one needs to try to create insights about the future and act proactively.

A very effective way to capture leadership's attention is to figure out what interests them the most. Fitz-enz and Mattox (2014) share this view and list some of the most obvious points of interest; revenue creation, profitability or for example market share. This depends greatly on current global and local market situation; if the interest is more on savings or on generating growth. Thus to awake leadership interest, it makes sense to investigate first what is currently the interest of the company in question.

Once the main points of interests are known, one still has to remember that leadership is often not just one person. The analytics expert, who is trying to pitch the ideas to be taken into use, has to find sponsors and mentors with whom she or he can convince the people with decision making power. Without the leadership support the analytics project will not have the financing and the change in organizational culture it desperately needs. (Fitz-enz and Mattox 2014.)

4.5 Sequence of actions in implementing predictive analytics in HR

The following summarizes the above mentioned analytics building blocks, giving them a logical order as described by Fitz-enz and Mattox (2014):

1. Start with a business need on implementing predictive analytics. Once the need has been identified, reasoned and awareness established especially to management, start to look for the **leadership support**, including a budget and change management support.
2. As next find the **team of analytics specialists** needed in the analytics work, as described in previous chapters.
3. Once the capable people are onboard, plan what kind of **IT landscape**, i.e. which tools support the initiative.
4. Next start executing the plan and **managing the data** accordingly;
    a. Determine the key performance indicators; what is the target being modelled or looked for
        i. Check **data availability**
        ii. Extract and format the data
        iii. Check, fix and monitor **data quality**
    b. Analyze and report the data

i. Execute **data modeling; after reaching prescriptive and inferential modeling; predictive modeling**
ii. Validate the statistical significance
iii. Display the results visually in reports; communicate the information.
iv. Use the results as a basis for discussion and decide on needed actions. That is, only after correct stakeholders get to discuss on the data, valuable action can be taken.

Should any of these building blocks be missing, it will be difficult to complete the analytics initiative. However, once established, it is possible to start enjoying the hypothesized business benefits at first hand.

5 Case studies

The research method is a multiple case study, where the data is collected via semi-structured interviews backed up with a structured questionnaire. Firstly, the current usage of the analytics building blocks is interviewed from the case companies. The companies also estimate what are the main challenges in each area. After that the case companies evaluate the proposed HR analytics processes; what is their current state with each of the processes and how they perceive the business value of each one.

The first part of the interviews is about the analytics building blocks. The interview questions on the analytics building blocks and their challenges are based on the TDWI (2015) framework. The framework states that predictive analytics comprises a defined set of capabilities such as skills and technologies, in the questionnaire referred as "building blocks" of predictive analytics. These building blocks include the areas of infrastructure, organization, data management, governance and analytics. The term analytics is interpreted here as the implementation areas of the analytics, in other words the analytics processes. These should be taken care of, to effectively perform predictive analytics.

The second part is about more accurate evaluation per analytics process area. The companies are interviewed on what is their current state with each of these analytics dimensions and if there are any challenges related to each of them. The interviewees' answers are then summarized and further analyzed. The current state analysis is supported by case companies' evaluations per each process area. A summary on the current state of the companies and on the main identified challenges is created based on the interviews. The evaluations on the current state are backed up by a questionnaire per each HR process area. The companies evaluate their analytics maturity by Gartner's (2013) analytics maturity model in each defined process area. The process areas are defined and listed earlier in this research as a summary of the literature review in Tables 4, 5 and 7.

Thirdly, the companies evaluate the business value of each of the process areas. The research proposes that the implementation of predictive analytics in HR has a positive effect on the organizations' outcomes as defined in this study earlier by Naasz and Nadel (2015), Fitz-enz and Mattox (2014), Bhattacharya et.al (2005), Barron (2012), Swart (2010), and Baron (2012), for instance. Different companies' perceptions to these statements are interviewed to understand, if they share this view on the business value. The interviewees will estimate and reason the business value to a set of predictive analytics processes collected in this study. The

interviewees are given a possibility to add their own processes, should something important to them be missing from the list.

The case companies were selected for the interviews based on a preliminary estimation that their current maturity stages in the HR analytics would differ from each other. The aim was to get different points of view to the study. The interviewees' demographics and case companies' information are summarized in the Table 8.

Table 8: Company and interviewee demographics

	Case 1	Case 2, interview nr. 1	Case 2, interview nr. 2	Case 3	Case 4	Case 4 Global view
Company size and industry	Large-sized* company in forest industry	Large-sized* company in financial and insurance sector	Large-sized* company in financial and insurance sector	Large-sized* company in real estate, environmental and industrial cleaning services	Large-sized* company in management consulting, technology and outsourcing services	Same as previous, but global team's perspective
Company operating location	Global (interviewee represents mainly Finland)	Finland	Finland	Finland	Global (interviewee represents mainly Finland)	Global
Title	Director of the HR systems and tools	Project manager in Health and Wellbeing area	HR Business partner, personnel manager	Owner of the real estate service planning and production processes	HR Business partner	Operational lead of HR analytics
Interviewee's history in the current role / altogether in the HR & analytics area	>1 year / 9 years	<1 year / 12 years	3 years/ 7 years	2 years/ 8 years	3,5 years / >6 years	4 years / >10 years

*Large-sized = over 1000 employees

Additionally, a well-being provider company representative was interviewed in order to get a better understanding how employee well-being connects to predictive analytics. The structured questions on wellbeing analytics, which were then presented to case companies, were created based on this interview.

5.1 Case 1

The depiction of the first case is based on the interview of the director of the HR systems and tools from a large globally operating company in the forest industry. The interviewee has worked in the current position in the HR services organization, which is part of the HR business organization, since May 2015 and has joined the company in 2014. More specifically, the interviewee acts as a business information officer, looking at the big picture of the whole system landscape working in close cooperation with business and IT people. The interviewee also leads a small team, which is responsible for specific system development activities. The interviewee

has gained technical data warehousing expertise and HR business process development experience in other companies since 2006.

As a general overview concerning the current state of the analytics in the company, the interviewee describes that the company has currently descriptive analytics in use, from which some are global functionalities and many local ones. The company is slowly progressing towards having global data and global analytics services in place and possibly also advanced analytics capabilities, but to the interviewee's opinion this needs to happen systematically during time, without skipping any of the needed basic elements. In general, the biggest challenges in the HR analytics and predictive analytics area are related to the data quality and disorganization, the need for growing the skills of the HR people, and the knowledge of all the stakeholders on the analytics capabilities.

5.1.1 Main building blocks

Process areas

The company group level HR has the following process areas in place: compensation & benefits, leadership & talent management including training, workforce planning function including reporting process definitions, and occupational health and safety. Locally, there are service centers in Finland, Sweden and Germany covering the following process areas: local recruiting, training, payroll and exit management process.

Each of the local areas has their own key performance indicators (KPI's). There are some global KPI's in use e.g. health and safety related measures or the lost time accident (LTA), how much time is lost in the case of accidents. The headcount, full-time equivalent (FTE) or quantities of leavers would be other examples of the common global measures in use. The HR measures in general are mostly internal and HR specific, not largely tied yet to business or financial outcomes.

System landscape

The system landscape from the HR analytics perspective consists of a recruiting system, which includes its own reporting. There is also one main employee master data management system, where some ad hoc reports can be produced. An additional data warehousing tool is used for basic descriptive reporting. This is the most important HR reporting tool for the company at the moment. There are no separate predictive analytics tools in use for HR at the

moment. Local payroll systems are in use in each country, where basic payroll reports are produced for operative purposes. Time management systems are used at the local level. Also basic spreadsheets are used quite extensively in the reporting.

People and Talent

The reporting work from the organization perspective is scattered; all factories have their own reporting by the factory HR people, mainly due to historical reasons. Recently, the company has started to shift to a more centralized view; first aiming at a country level consolidation and as next at a global harmonization. At the moment there are very few people dedicated to global level HR reporting; thus the priorities are still in the day to day business; annual reports and FTE reporting. The company is not actively searching people with predictive analytics capabilities. The small team lead by the interviewee aims to create descriptive analytics at the global level and they will grow this talent organically, first taking care of the basics before going into predictive functionalities.

Data quality

The master data belongs to the basic elements that the company needs to organize. Master data quality is told to be one of the major challenges at the moment for the company, due to historical reasons. The employee data is still local in many countries and the maintenance practices are not standardized. Currently there are initiatives planned and on-going on developing more coherent data globally.

Motivations

The main motivation to start exploring predictive analytics more in the company would be an internal order for it from the different divisions, from the business side. The interviewee states that this might be possible, if one demonstrated the concrete benefits of the implementation to the company leadership. The company still has internal development needs in understanding the benefits of the different KPI's. The company is following the market development in the area, but the interviewee has a strong view that it needs time to change the organizational understanding about these capabilities. Leadership support for the HR descriptive reporting has been growing during the past few years and at the moment there is strong leadership support for the HR reporting.

The interviewee points out the talent as one of the major challenges for the company in proceeding from descriptive analytics to predictive analytics. To interviewee's opinion, the company would need people who understand analytics, mathematics and statistics, but who

would also know the HR business and process area. Secondly, the company would still need to train people in HR and in leadership to understand the business benefits. It is more understandable to discuss the sales figures and financial measurements, but in HR there are no international standards or direct links to financial benefits. Also, if the benefits are shown only in a long-term and not quantifiable there and then, it is harder to sell the functionality to management.

Future

As next, the company aims to develop the global data standards and data maintenance practices further. Also the automatization of certain reporting is currently being planned. All in all, the development activities concentrate on developing the descriptive reporting first and gradually shifting then further in this roadmap.

5.2 Case 2

The depiction of the second case is based on interviews of two employees from a large banking and insurance company operating locally in Finland. There are two interviewees, because in addition to discussing the analytics from the internal HR services point of view, the company is selling HR analytics as a service to their clients. This is a remarkable strategic activity, but also a modern innovation on what one can do with predictive analytics, thus it is worth investigating the HR analytics from this perspective as well. First, a specialist is interviewed on the health and wellbeing analytics provided as a service. Then a HR specialist is interviewed for getting an overall understanding about the HR predictive analytics.

The first interviewee is a project manager in the area of Health and Wellbeing. He is responsible for the company's health & wellbeing business area, one of the four strategic business areas of the company. The interviewee has technical education including mathematical and statistical studies and he has a working history in the healthcare projects in other companies since 2003. In the current company he has worked for around half a year.

The second interviewee has worked as a HR business partner and personnel manager in the company for the last three years. Earlier he has been working in the same company in the recruiting and compensation areas. Each personnel manager in the company has responsibility on one business unit and the interviewee is responsible for the service area personnel. He is also familiar with the HR analytics but mainly in the end user role.

As a short summary of the company's status in the HR analytics area, both interviewees describe that the company has descriptive analytics in use as well as some diagnostic analytics. The company has predictive analytics in use in other business areas than HR, for example for client risk evaluations. In general the biggest HR business challenge is the new restructuring of the organization, which creates a lot of workload to the HR business organization as such. The development of analytics capabilities would only be the next step after the basic organization and processes are stabilized. The only exception would be the emerging of the health and wellbeing analytics as a service.

5.2.1 Main building blocks

Process areas

The HR business partner describes the structure of the HR organization. The HR of the company consists of the HR leadership, which leads the centralized talent development team, HR legal and health organization, the process development team, the HR management and the contract management team. Each HR manager has their own business unit to manage and they are responsible more for daily operations, whereas process teams are mainly responsible for the development of the processes. The HR has the traditional KPI's in use such as headcount and turnover and all the measures are mainly internal, not tied specifically to company financial outcomes. The HR business partner notes, that currently the company is missing a dedicated person, who would be primarily responsible for the HR reporting.

System landscape

From the HR business partner point of view the company has sufficient tools in use for storing data, analyzing and reporting it. The core employee data is in one centralized system, which is connected to a data mining and modeling tool and to a reporting tool available for the managers. The company is currently centralizing all the relevant reporting into the managerial reporting tool, as now some reports are still scattered elsewhere. The major challenge in this area is that they lack a dedicated person who could efficiently operate in this analytics landscape.

The project manager in health and wellbeing analytics area is not only interested in the company's internal systems, but would need to find a way to collect the health and wellbeing data from the client's employees. There are many challenges in the data integration area: the healthcare data is scattered nationwide, the data is on personal devices, in various cloud services

and inside the client networks. The current vision is to create data hubs capable of handling the data collection and integration needs. The main challenge in this area will be the ease of use for the client; the data collection needs to happen effortlessly from the client perspective and at the same time the results need to be visible.

People and Talent

The HR business partner describes that in the internal HR organization the main problem is the current lack of the HR analytics organization and responsible people. Thus a lot of the possible data and analytics development initiatives are on hold, until the situation with the organization changes.

In offering the wellbeing and health –analytics as a service, the interviewed project manager has not defined yet in detail which new roles are needed in the future. However, in the general the data and analytics handling capabilities will be emphasized in the future. This demand is created through the digitalization, as the data amounts continue to grow and are being generated from new sources.

While selling the analytics capability to clients, one is aiming to process the data analysis in the backend systems as effective as possible. For this reason, the company may need to reorganize the current activities the client service people are performing. The doctors are still needed in the diagnostics of diseases, but the follow up of the described health plans could be performed by anyone. The data security is not seen as a huge obstacle by the project manager, as long as one follows legislation and moreover, has the approval of the clients to store the information. The trend has been, that people have started to share their information more anyway, and the real motivation to share the data is of course created when they get concrete benefits out of doing so.

Data quality

The HR Business partner describes that the HR data is managed in the operational teams; for example, the contract management team is responsible for contract management data input. There is no centralized data management or governance organization. The ICT organization is responsible for the system development and maintenance and controllers partially responsible for the management reports, and some cooperation exists between these organizations. The HR business partner, however, estimates that the data is of fairly good quality.

From the client organization's health and wellbeing data perspective the data normalization and harmonization are major challenges. The data is scattered in various sources in various formats.

Motivations

The company aims to be profitable in all its activities. Thus the need for starting to use the analytics and predictive analytics comes from the need to create cost savings. In the health care management area this comes naturally by pushing the services closer to customers and by keeping customers healthy with predictive treatment. There is also strong leadership support for these activities. Currently there are still several options in the case company, on how this can be reached and what the next steps should be.

Future

The latest HR development planning has been revolving around the training analytics and compensation model analytics, according to the HR business partner. The current compensation model has been receiving some criticism and could be the next improvement area in the HR. However, as the wellbeing analytics is such a significant part in the company's offering, it will most likely be the forerunner area on the predictive analytics for the case company.

5.2.2 Employee analytics as a service to clients

The company is different from the other interviewed companies in a way that it is not only planning employee analytics inside their local HR, but they are aiming to serve people analytics to their customers as well. The project manager of the wellbeing and health analytics describes that this is a new strategic area whereby they want to create new business opportunities and growth to traditional insurance business. The insurance business as such is quite saturated from the business growth perspective, but with the new strategic approach the company aims to create new ways for insurance business to work. In short, they aim to prevent damages before they happen with the help of predictive and prescriptive analytics. In other words, instead of only thinking about predictive analytics in a sense of "how we can make something happen", they are interested to find out "how we can prevent the unwanted events from occurring", e.g. preventing unwanted health risk from realizing.

This strategic vision has a very wide scope and vast potential, covering areas such as the healthcare of the elderly people, working people's healthcare management or even the whole

reform of social and healthcare management currently on-going in Finland. The service to be offered would be holistic. This means that instead of just offering a new type of more specified or discounted insurance based on individual's lifestyle choices, the case company would offer a holistic customer service to client companies, monitoring people's health and taking actions preventively.

To the question of profitability of the analytics services, the interviewee says it is hard to monetize the value of the healthcare activities to convince top management. The benefits and profitability of investments into the healthcare can be reasoned in a long term, but it is hard to quantify and demonstrate the short-term effects. To be profitable, the company needs to offer the holistic healthcare management service as a one-stop provider very cost-efficiently. This includes the virtualization of the service network among other thing. Once receiving savings from the effective healthcare provision to employees, one can then invest the savings in predictive caretaking of the people; invest the money in keeping the employees healthy.

The current trend in the wellbeing analytics according to the interviewee is that the measurement of the people data is getting easier all the time. The evolvement of the technologies and readiness to gather data enables the analytics of the data. The biggest challenges then again come from creating reliable enough models; the modeler needs to be able to identify the correct variables and prove the correlations, which are not obvious in all areas. For example, for many actual sicknesses there are prediction models already existing, but then again for many illnesses, such as depression, there are not yet ready-made prediction models. All in all, this is a new area to be concurred with a lot of work ahead.

5.3 Case 3

The next case company is a service company offering real estate services and management, environmental services, sanitation services, industrial cleaning services. The interviewee has been working in the current role for two years. He is the owner of the real estate service planning and production processes, responsible for example of the project planning and management of a new big ERP implementation project. The ERP in this case company revolves around the workforce and workforce capacity planning. Before that, he has worked in the company in the HR area, in the workforce planning and analytics from the production planning perspective. The interviewee has experience also on analytics, reporting and KPIs related to the HR. Before

joining the current company, he has worked as a consultant in human resource and workforce planning areas.

The company is doing descriptive analytics in some HR areas, but more in other business functions. The company is not yet practicing predictive analytics at all in the HR area. The case company's biggest challenge is to get the basic data management in place, as their current system does not support data collection very well.

5.3.1 Main building blocks

Process areas

In the case company the HR and IT functions are part of the centralized services provided for the different business units. HR consists of the recruiting, finance and payroll, human resource development, well-being, compensation and benefits and resourcing, in the meaning of workforce planning. The HR KPIs are mainly HR internal measures. In other words, they have not tied the HR targets to financial outcomes. There is interest to develop measurements and reporting into that direction, in order to be able to demonstrate the business benefits of the HR actions to the management more clearly.

System landscape

The interviewee describes that HR is still quite isolated from the other business development activities; HR has systems and some reports, which are supported by the IT, but there are no development processes on-going at the time. There is one main HR system in use, which contains the basic employee data. The current HR data for reporting is retrieved from there and manipulated manually. The system is structurally old and it has limitations in providing sufficient information for the reporting usage. The interviewee states this as their biggest challenge in the HR area at the moment, the old system that does not support the data collection. The company has not found yet a sufficient solution for their purpose to replace the old technology; they are missing a light and cost effective solution to store the HR data.

People and Talent

The case company has people with BI, analytics and some predictive analytics skills. The company is interested in growing their team with analytics skills, not only specifically predictive analytics but more of business intelligence and traditional descriptive analytics skills.

The challenge in HR analytics organization is, that currently there are no people who would be driving the usage of analytics capabilities on the HR business side.

Data quality

The lack of storing data in general in the HR area is a major issue, created by the current old system. Thus the data quality might also be lacking. Also data sensitivity creates challenges in the data management; it has been more difficult to experiment with HR data than other areas, as data sensitivity creates limitations on the access rights. Data governance and processes are centrally managed in the BI team and the awareness is only starting to grow in the HR data management area.

Motivations

The interviewee estimates that the biggest pull and need for implementing analytics would come from an internal experiment, an example or a quick win, that would demonstrate the usefulness of the analytics capabilities. The need has to come from the business side, which is challenging, as traditionally business tries to be action and solution oriented without considering the possibility for technology aided analytics helping in the process.

The interviewee further believes that the leadership support is there, should one demonstrate the business benefits and want to initiate activities to correct the HR's data situation. At the moment there have not been very many initiatives to fix the situation as everyone has got used to the status with the old system.

Future

The main challenge in the HR area is the old system in use. Another challenge is the lack of talent which would understand both the HR business and would be analytics oriented at the same time. The latter one has been developing positively and analytics awareness is increasing in the HR area.

The matching of the workforce availability to the need, in other words the capacity planning, is for the case company one of the key interest areas around the predictive analytics, being the core business that the company offers. There is no active plan on proceeding in this area at the moment, but the team keeps on discussing improving the HR data collection first and goes on from there.

5.4 Case 4

The case is described by a HR business partner of an international professional service company, offering business and technology consulting as well as outsourcing services in Finland. To get a broader view to the predictive analytics usage, also a global expert from the same company is interviewed and the results are presented in the later sections. The HR business partner is responsible for supporting all the business units in Finland in a wide range of activities, but is also specifically responsible for the compensation and benefits area. The interviewee has been working in the company for 3.5 years and altogether in the HR area more than six years.

The company in Finland is doing only descriptive analytics in the HR area, but there are also forward-looking initiatives and plans on developing the usage of analytics further. The target for the company in the HR area is to find ways to provide more insights from the current data. For example, the "women leadership" is quite an important theme for the company that would benefit from the usage of predictive analytics; how to attract and keep women in higher positions in the company.

Even though locally in Finland the company is only doing descriptive analytics, globally the organization is offering predictive analytics as a service for the HR internal organizations worldwide. As mentioned before, two interviews were conducted to get the point of view from an interviewee, who is already involved in predictive analytics. First the local situation is discussed, after which the global offering and opportunities are presented.

5.4.1 Main building blocks

Process areas

The HR consists of the recruiting, talent and supply chain (internal staffing) and field HR functions. The field HR includes all the other areas except recruiting or staffing. Each function has its own country level lead or a Nordic lead. Each function has been organized to serve all business areas of the matrix organization in Finland. The company has locally in Finland a lot of internal KPIs in use, which are followed regularly, but these are not tied to company financial outcomes yet. The KPIs are internal HR measurements. In other words, it has not been tracked yet, how the HR actions connect with the company financial outcomes. One understands

conceptually how the low retention rate for instance keeps the costs low in the recruiting and training areas, but the effect is not reported in the financial terms.

System landscape

The basic employee data exists in a centralized system. Reports are regularly pulled out from this centralized system in an excel format. There is no specific data warehousing or reporting toolset in use for HR, but the needed reports are delivered from an offshore centralized location or pulled out from the local tool per the local HRs, where applicable. The main tool in use is still the Excel, for the ease of use and availability for all.

People and Talent

Currently, the local HR does not have many people working specifically in the analytics area. Some cooperation for developing the current practices is being done with the company's analytics –capability group, the same which is serving the client organizations' needs. Then again the daily operational reports are retrieved from the global centralized team, which is seen as convenient at the time. However, should one want something else from the standard reports, the process takes more time, and according to the interviewee the HR team could benefit from a local support.

Data quality

The data governance and management is operated also in a centralized offshore team. The data quality is being actively monitored and corrected, and global processes are in use in the operational data management area. This data management work is very important as the organization is huge and organizational structures complex, and currently the data quality is kept at a very good level.

Motivations

The push to develop HR into a more analytical direction and towards the predictive analytics arises from the need to be more credible in all actions. One would want to demonstrate the leadership the current state more effectively and believably, and having numbers and exact predictions would back up this work. The company is also looking at the global and competitor situation on analytics usage, but this would not be the primary driver for taking action. The leadership also expects that HR will organize itself effectively in the analytics area, but currently the plan how to go on is not fixed.

Future

The global team is offering analytics implementations as a service, but it is not yet in use in Finland. In the current fiscal one is targeting to start using HR data more effectively and to create insights on data, but as said the plan is not yet fixed. Currently one is finding out the exact needs and formulating the vision for the future.

5.4.2 Global team offering the predictive analytics to internal HR's

The second interviewee is part of the internal global talent strategy team, responsible for leading the operational centrally provided employee analytics services in the company. The interviewee has a MSc degree in statistics and has worked in the HR analytics in the company for four years but has been working in the area already before the current role. The global team has people within local HR's and they also collaborate with different digital analytics teams to develop the functionalities.

Typically, the team develops global initiatives targeted to cover the most local HR needs. The tool, through which the local HRs could use the service, is globally available and used in most regions. Some countries are not yet using it though specifically in Europe and the whole EALA region. Some legislation reasons are hindering the usage, but also communication is partially missing, as the service has been only lately opened to all the regions.

The areas in which the team offers the predictive analytics capabilities are the following; Talent analytics, workforce planning, training, retention & attrition, engagement (including wellbeing). Each of these areas has a wide range of more specific prediction models that are globally usable. The tool offering these capabilities already for a longer time in certain GUs such as Asian countries, where one has had already time to realize some significant business benefits. In preventing one employee from leaving the organization for instance, the benefit received would be 1.5-3 times the annual salary of the employee in question. On average, if the salary is $50 000, then considering the amount of employee movement in the Asian market, the benefits are noticeable. The effect was tracked in cooperation with a certain local HR team. The global team sent them a list of "the employees in risk of leaving in the next six months". The gained benefit was calculated from the difference in the turnover rate of people, who the managers had a "stay conversation" with, to those who they did not have a conversation with. The rate of staying was significantly higher among those who the manager had contacted. In several other areas, the HR teams have been able to optimize the budget in use for HR; e.g. by

defining which trainings are inefficient and can be quit or targeting the recruiting budget correctly.

Even though the exact reports and figures were not shown through their business sensitivity, some more examples were listed by the interviewee. A typical globally applicable example in the recruiting area is the prediction of the quality of joiners. There are several factors that predict good quality, e.g. the recruitments coming through employee referrals tend to be of higher quality, which the recruiters will then target more closely. Another example would come from the training area; one predicts the amount of trainings need. In certain regions, the amount how much the new joiner has been trained to the new position correlates positively and directly to the employee performance. Also the effectiveness of trainings is measured; does the training effect to the attrition, retention, engagement, performance and multiple other factors. Generally at least five years of the data is needed to provide any kind of insight or prediction on the employee data, but it is case specific. In smaller stable regions even less data, such as data for three years, are able to create strong predictions.

The current trend in analytics inside the company from the interviewee's point of view is that people are perceiving the area more as a core business to be practiced, than an addition to HR. Traditionally one thinks that the HR can operate without analyzing the actions. Engagement activities for instance can be organized, and one can estimate, if it had effect or not to employees and be perfectly satisfied with these subjectively given estimations. Nowadays there are capabilities to more credible measurements of business impact. Thus there are continuously growing interest and expanding usage of the analytics. The motivation is mainly coming from top-down starting from the leadership. The interviewee estimates that only the insecurity of the leaders to trust the results of analytics could be hindering the progress.

The interviewee does not see any challenges on the technological side; the global team provides the analytics as a service, requiring no specific additional skills from the local HR. The only challenge in the start is, that the local HR needs to be able to clarify what their core business problem is and what needs to be investigated, if there are any specifics the analytics person should know about the business. Then again the local HR needs to trust the results of the analysis, as the results might not always be what is expected. Starting to use the global service should not be costly either as they are mostly in place; only if local customization is needed, that adds some development costs.

5.5 Well-Being area; subject matter interview

The specialist interview concentrates on answering two topics: how the employee wellbeing connects to employee and company performance and how one can leverage predictive analytics in this area. The interviewee is a CEO of a small well-being provider company, established eight years ago. The company provides a range of well-being services as a one stop shop, including trainings and services in nutrition, recovery, physical and mental health, achieving optimal energy levels and work life balance. The main reason being that it is much more efficient to develop multiple areas of the wellbeing of each person instead of just one aspect of life; e.g. when one learns to control physical well-being, he or she can build on it and learn the mental well-being management as well.

The interviewee runs the business and manages the key accounts of the company. The main tasks as key account manager includes creating the well-being plans with the customer steering groups, to enable companies' workforces' ability to perform in order to support the strategic goals of the firms.

5.5.1 Well-being and analytics concepts

According to the interviewee the ability to perform, or performance, is a wide concept. When an employer has skills and knowledge, he or she must also have ability to use the skills, which demands ability to perform and well-being. Well-being comprises of physical and mental wellbeing, but also the holistic energy, with which you deliver your skills into actual outputs, how you can do your work productively and effectively with good optimal vitality. In the most optimal case this means that even if the employee is loaded down with work, he or she has the energy to perform also outside work. If the work takes all the energy from employee, often the employee is unsatisfied to the job and thus productivity or performance also suffers.

5.5.2 As-is state of predictive analytics in the wellbeing area

The predictive analytics is not yet widely linked to the planning and management of the well-being activities, but the most companies still concentrate on having the basics of the well-being aspects correctly set up. The wellbeing data is often used in descriptive manner. The usual customer expectation is, that they need to be able to target the well-being services to employees optimally, as they cannot afford to spend more than what is needed to each employee.

The measurement of the well-being is challenging, as often the expectations are high. At the moment the wellbeing data in the companies is scattered and not well connected to the other

data in the company. Then again if the input is low, one will not be able to expect much in return. In an optimal case all the employee related areas would be covered holistically when measuring the wellbeing, to be able to see the correlations.

5.5.3 Business value of well-being analytics

The interviewee validates the employee analytics processes used in the questionnaire, in the Appendix Table A2, and states that they cover the wellbeing analytics implementation areas well. However, the interviewee adds that each company needs to specify their own specific measurement per their individual business needs.

One aims to manage and control the situation in life and at work through measurements. According to the interviewee there are two views to the wellbeing management; each employee is responsible of course on their own wellbeing and should be enabled to do that, but in some cases it would be beneficial to predict the need and to contact the employee proactively.

The interviewee explains that the wellbeing measures used in the companies are both financial and so called "soft-measures", e.g. how employee understands his own resilience or how his capability has evolved during the past months. Also the working culture, would be something that is already measured, but could be included more into the wellbeing management and measurements. One has rarely linked the well-being measures directly to the actual company performance. However, some companies have given business or financial value also to the soft measures, thus translating it to actual figures.

The well-being measurement is mainly performed though employee questionnaires. They are not analyzed at the employee level, but at the organizational and unit level. The interventions are targeted at a team level. The employee level measurement is done based on the employee's subjective measurement on single events offered to the employee. In the company level the employee satisfaction survey measures the engagement of the units, the employee wellness questionnaire measures the wellbeing of the units, and work performance in traditional standards is then measured through employee scorecards of some sort. All of these measurement areas complement each other and through advanced analytics one could find correlations in them.

5.5.4 Readiness of companies to implement predictive analytics

The readiness to perform data analytics in well-being data overall is good. The leadership support for well-being activities in general is often already in place, when the interviewee goes to talk with the clients, as they have already recognized the need to involve a well-being

provider in the scene. The need for predictive wellbeing analytics is not yet as obvious although there is interest.

There are also some challenges preventing prediction capabilities from taking off. The collected and stored data volumes are not yet high enough for analysis, they are scattered and need integration work that has not yet been done or regulations, such as the health legislation in Finland, prevent using the data. However, the interviewee estimates that integrating the data into financial measures would provide enough information to motivate the companies into leveraging predictive analytics. For efficient analysis the data quantities in their case companies should be greater and data organized in a way that it can be analyzed.

An additional challenge in adopting the wellbeing activities and related analytics from the interviewee's point of view is the affordability; what is affordable for the company considering the related consulting costs and implementation costs. If the return on investment is not obvious, companies will not buy it. The boundaries of real life are to be considered; what is actually doable and what is the optimal amount of wellbeing services to be provided for each employee.

The interviewee was involved in one trial with a client company, where an expert analyzed the company's wellbeing survey data with a tool developed for the health care analysis. At that time, the data quantities in use were not large enough to create meaningful results. The interviewee has seen then same trend also in other companies; data is still dispersed, waiting to be combined for meaningful analysis.

All in all, the interviewee estimates that there is a lot of interest in the market to integrate wellbeing data into company performance, but the uncertainty of results and financial restrictions might slow down the progress in companies actually taking action on it. Also having a ready-made product offering this functionality needed would make the marketing easier, now one would need to sell consultant hours to explore and make trials with the data.

The interviewee's company is not involved in any predictive analytics initiatives with the client companies currently. The latest trends according to the interviewee are in concentrating in targeting the services more effectively, enabling employees to be more productive, and providing these holistic well-being services as effectively as possible, using the latest digitalized platforms and other means than just traditionally one to one meetings. The interest in the holistic well-being support and long-term services to companies also enables long-term data gathering and thus later possibly further analyses.

6 Results of the case studies

The results of the interviews are presented in this section, to be able to answer the research questions. First the usage of the analytics building blocks is discussed in the case companies' context. Then a summary of the companies' current usage of the analytics is presented and analyzed. As next, the perceived business value of the predictive analytics is presented as a summary, and also per each case company individually. At the end the main challenges in adopting the analytics building blocks are identified.

6.1 Building blocks of the analytics in HR

Each company was asked about the main analytics building blocks; their HR infrastructure, data management, governance, organization and analytics. Thus it makes sense now to recap the assumptions of the study for each of the building blocks, and see if there are some common dominators in the interviewees' replies in each of the areas.

6.1.1 Building block; infrastructure

The assumption on the needed infrastructure in this study is that one does not need a complex data warehousing system or another kind of expensive technology setup, to start experimenting with predictive analytics. The forerunners of analytics are able to take the use of the new existing inexpensive alternatives, overcoming the problems in the traditional rigid IT analytics landscape. New tools and a thought setup of systems is needed, along with people who know how to operate them. One surely needs to organize the descriptive reporting in an effective way as described in the study earlier, but the lack of some technology in the descriptive reporting area should not be an obstacle to get the benefits out from the predictive area.

In the case companies' interviews three out of four companies referred to the fact that they do not yet have sufficient technology currently in use to be able to perform predictive analytics. Case company 1 specifically mentioned that they want to progress step by step and gradually towards predictive analytics, first setting up the basic data management and governance processes before moving further on the analytics steps. Case company 4 would not see the gradual evolution as a mandatory step, as they are anyway used to ordering the needed

analytics implementations as a service. As long as they have the data in place, which they do, they could order the analytics on top of that as a service.

6.1.2 Building block; data management and governance

In the data management and governance area there were issues hindering the analytics adoption in some of the companies. The assumption on the needed data management and governance practices in this research from the technological point of view is that with the current technologies the provision of data for the use of analytics should be possible in any company. One needs flexible ways for experimenting with data, but on the other hand also rules and regulations on what is allowed and by whom. From the data management perspective the companies should strive away from the silos of data towards capability to pull data from every corner of the company for the data analyses, and in the optimal case offer the results as a self-service for the people needing the information.

This was largely not the reality in the case companies. Case company 3 reported that the data is currently not available in the HR area to be reported further. This is due to the old technology, which does not store any kind of historical data. Thus even though different technologies are available, it is not self-evident the data would be easily available in all the companies yet. In case companies 1, 2 and 4 the data was stored and one was able to pull different descriptive reports out of it, but none of the companies were offering the descriptive analytics solutions as easily usable and modifiable self-services to the users of the reports. Instead the reports had been predefined and often needed manual work by a specialist before they could be called reports.

Furthermore, in all of the interviewed companies the data was in silos, each HR operation had its own data, which was difficult to combine to a holistic view. Case companies 1, 2 and 3 saw data management, harmonization and development work as very challenging at the moment. Case companies 1, 2 and had planned or on-going activities to develop their data management practices further at least in some of the HR areas to have a sufficient level of data to use for reporting and predictive analytics. The case company 4 was the only one who stated that the data management practices work well at the moment and the data overall is in good quality. This is due to the fact the data management and governance practices are largely offered and managed from the global organization, who is already very advanced in the HR data management and analytics area. All in all, none of the companies were utilizing their data to

predictive analytics yet, except the global team in the case company 4, nor were they using the unstructured data streams in their current data analyses as effectively as they could.

6.1.3 Building block; organization

The assumption on the analytics organization according to the study is that one should foster the relationship between IT and business teams; the stronger the relationship, the better results in analytics initiatives. A strong leadership support is also needed for defining what is needed in the company but also in helping running the analytics programs successfully through. One should also control different parts of the organization and in the best case centralize the analytics offerings, so the benefits on the synergies are gained.

The case company 1 has started to centralize its operations on the data management area. This would be a recommendable approach for the future predictive analytics services as well. They already have people working, who understand analytics and predictive analytics, however they lack people who would understand both the predictive analytics and HR business processes. The case company 2 lacks a HR analytics organization in total. In the wellbeing and health area where their strategy is to sell the analytics as a service, the new job descriptions still also need to be defined. The company still recognizes the need for emphasizing the analytics handling capabilities in the future. The case company 3 then again has analytics and predictive analytics people available, but currently no one in the HR business side who would be driving the analytics usage. The case company 4 also has people with predictive analytics knowledge in the global organization, but not in the internal HR. The business leaders are however driving towards getting the capabilities to local use. One could conclude that without a business need and leadership support, the predictive analytics initiatives will not start nor move forward. There seems to be people in the market who know predictive analytics, maybe less so still with combined HR business skills. However, the need to start building HR analytics has to rise from the business.

6.1.4 Building block; analytics

The analytics process areas listed in Table 9 were identified in the literature as possible implementation areas of predictive analytics in HR. Each process area was later evaluated per each case company; at which level the company is currently performing analytics and how they perceive the business value.

Table 9: HR predictive analytics process areas

Area 1: Predictive employee recruitment	
Recruit	Predict future recruitment needs in the company
Recruit	Predict the best candidates for the open positions
Recruit	Predict which skills are needed in the future
Area 2: Predictive employee "maintenance"; development, rewards and well-being	
Rewards	Predict who will be the future top performer i.e. predict employee performance
Rewards	Predict which rewards produce best performance
Rewards	Predict optimal amount of rewards to be offered
Well-being	Predict well-being activity needs on employee level (physical and mental health)
Well-being	Predict optimal amount of well-being activities to be offered
Well-being	Predict return on investment on well-being activities i.e. best performing
Training	Predict training needs on employee level
Training	Predict return on investment of trainings i.e. best performing trainings
Training	Predict optimal amount of trainings to be offered
Absences	Predict employee absences
Enagagement	Predict best engagement package (holistic view which factors affect) for top performers; reward packages+trainings+career path
Area 3: Predictive employee attrition	
Attrition	Predict resignations on organisational level (amount of resignations)
Attrition	Predict resignations on employee level
Attrition	Predict how employee resignations can be prevented
Attrition	Predict which skills will be lost and when

None of the case companies had a clear analytics roadmap plan on how to proceed from here in the HR area. Only exceptions were the wellbeing analytics in the case company 2, which had taken the area as a strategic initiative, and the case company 4, which was performing and continuously developing predictive analytics further at global level. Otherwise the companies had not yet planned their analytics roadmap further. As they identified, specific factors were hindering the process, such as other day-to-day priorities in HR, which left no time and energy for analytics work, no urgent need or motivation from the business side, no personnel who could proceed with the analytics or the lacking data sources, from which one could perform the analytics.

6.2 Companies' current usage of HR predictive analytics processes

The assumption of the study on analytics use is that the usage of the predictive analytics generates business value to the companies. All management decisions should be based on data and information, and companies need to define what is specifically important for them in their

business context. Figure 12 below describes the current usage of the analytics in the case companies. The scale starts from 0= no data collected to be used in the analytics and continues up to 5= the most mature stage of analytics, prescriptive analytics, is in use in the named process area. The case company 4 is offering and using the predictive and partially prescriptive capabilities on global level, and for comparison purposes and for getting an idea what is globally available, this view is included in the picture.

Process area	HR Predictive Analytics -processes	Case 1 current usage	Case 2 current usage	Case 3 current usage	Case 4 current usage	Case 4 current global usage
Area 1: Predictive employee recruitment						
Recruitment	Predict future recruitment needs in the company	2	2	2	2	4
Recruitment	Predict the best candidates for the open positions	2	2	2	1	4
Recruitment	Predict which skills are needed in the future	1	0	0	1	4
Area 2: Predictive employee management						
Performance	Predict who will be the future top performer i.e. predict employee performance	2	2	1	1	2
Rewards	Predict which rewards produce best performance	2	1	1	1	2
Rewards	Predict optimal amount of rewards to be offered	2	1	1	1	2
Enagagement	Predict best engagement package for top performers, (e.g.reward packages, trainings,	2	0	2	2	3
Well-being	Predict well-being activity needs on employee level (physical and mental health)	2	1	2	2	3
Well-being	Predict optimal amount of well-being activities to be offered	2	0	2	2	3
Well-being	Predict return on investment on well-being activities i.e. best performing activities	1	0	2	2	3
Training	Predict training needs on employee level	2	2	1	2	3
Training	Predict return on investment of trainings i.e. best performing trainings	1	1	0	2	3
Training	Predict optimal amount of trainings to be offered	2	1	1	2	3
Absences	Predict employee absences	2	2	2	1	2
Area 3: Predictive employee attrition						
Attrition	Predict resignations on organisational level (amount of resignations)	2	2	2	2	4
Attrition	Predict resignations on employee level	2	2	2	2	4
Attrition	Predict how employee resignations can be prevented	2	2	2	1	4
Attrition	Predict which skills will be lost and when	2	1	0	1	4
	TOTAL SCORE	**33**	**16**	**20**	**23**	**43**

Current usage	
0	0 No data exists
1	1 Data exists, not reported
2	2 Descriptive reporting in use
3	3 Predictive analytics in use
4	4 Prescriptive analytics in use

Figure 12. Current level of usage of the analytics processes

It seems that the case company 2 is at the most immature level of the companies from the perspective of usage of the analytics, with four areas missing the data in total to be reported,

and six areas where there is data, but no descriptive analytics, in other words no reporting, in use. Case company 3 is somewhat more ahead of the other company on the HR analytics, still with three areas where one collects no data and five areas where there is no reporting in use. Case company 4 collects data in Finland locally in all the interviewed areas, but has no reporting in use in eight of them. Case company 1 is only missing reporting on three of the interviewed areas and has the highest total score of analytics usage out of the case companies, still based on descriptive reporting. Then again the case company 4 has globally operating units, which are performing predictive analytics and prescriptive analytics in most of the interviewed areas. The other case companies are not yet this far on their analytics roadmap. The level of analytics does not matter as such, as there might be areas where the company does not need more advanced analytics. To understand the gap between where the companies are now, and where they could be, the companies were also interviewed on how they would see the value of predictive analytics in each of the areas. That will be covered in a later section "perceived business value of predictive analytics".

The values given to the level of usage give indication where the company is currently at, but cannot be used as an only source of information. It also became clear in the interviews that even though the companies describe of having "descriptive" reporting in use, the reporting was not necessarily automatized and could be based on extensive manual work. Thus one cannot assume that all is well in those areas either, but the companies might need to still work for example on having the basic regulatory and legally required reporting more efficient. The value given also does not give any indication on how the analytics work in general is organized, led and advertised in the company, in other words it does not take into consideration the other analytics building blocks. Thus, to get a better understanding about the exact maturity level, each company could still do a more detailed analysis, taking all the analytics building blocks into the same picture e.g. with the TDWI's (2015) tool, which they offer for the self-assessment.

As a generalization the illustration shows that the companies are not yet using predictive analytics locally in Finland. The sample set only contains four companies, but the interviewees stated this was their understanding about the market situation in general. There would be interest to proceed, but there were also challenges such as lack of analytics people, lack of tools, no specific need and motivation from the business side or other priorities in daily tasks that takes all the capacity of the company at the moment.

6.3 Companies' current usage of HR predictive analytics; most used process areas

In this section we will have another look at the HR process areas, where analytics is in the case companies currently used. Each of the HR analytics processes has been categorized in this research into HR functions, which are modified from the Fitz-enz and Mattox (2014) and Center for Talent Reporting (2015) definitions: employee recruitment, employee attrition, and employee management containing performance, rewards, engagement, well-being, training and absences. The aim is to find out the common denominators in analytics usage per HR function.

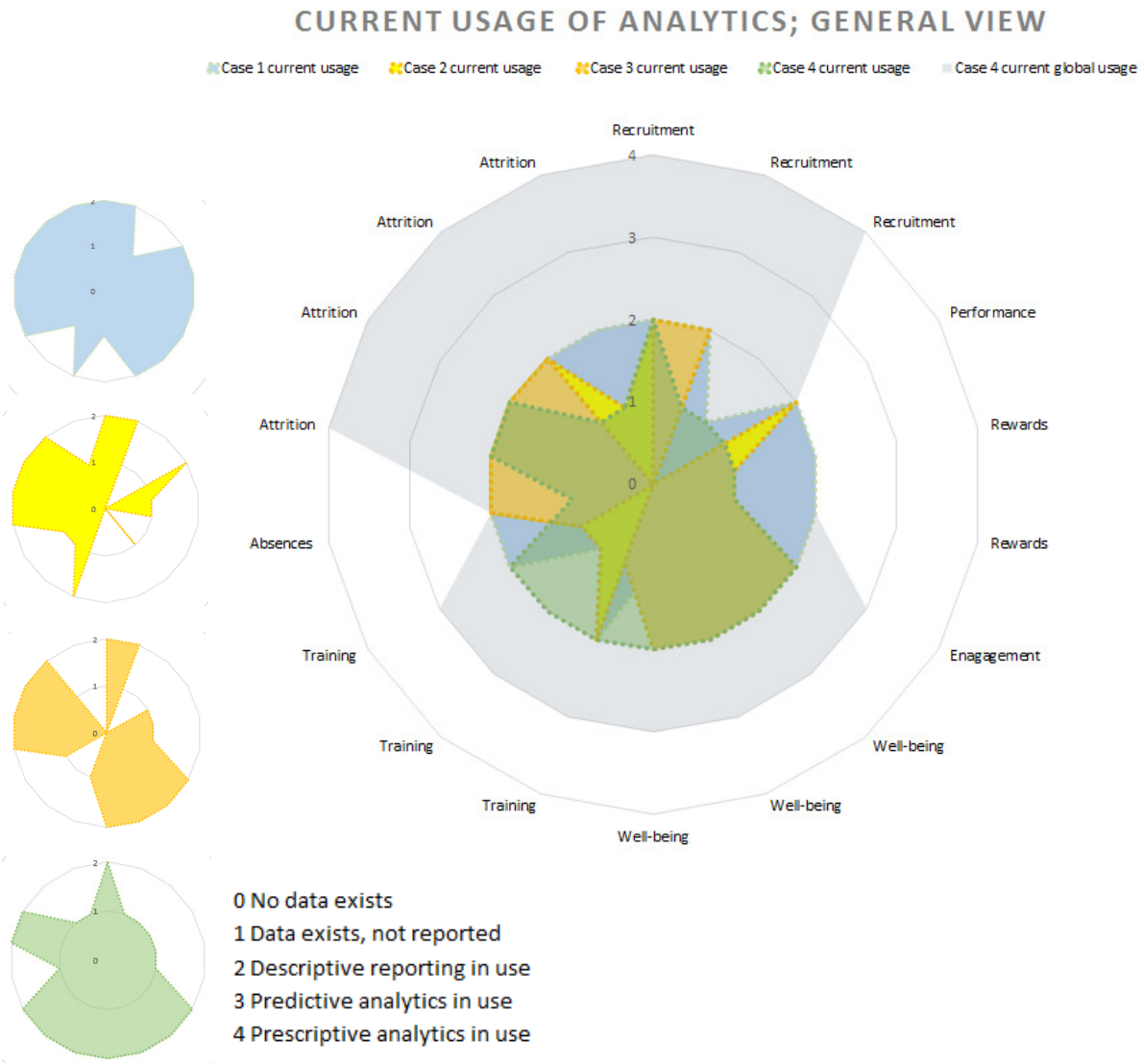


Figure 13. Current usage of analytics per process areas

When looking at the process area level in Figure 13, where one uses the same analytics maturity scale from 1 to 4 as above, the globally operating company is offering analytics services strongly in the attrition and recruitment related areas, whereas absences, performance and rewards are not being analyzed and reported as actively by the case companies. All the four case companies in Finland are active in descriptive reporting, the case company 2 seemingly the least active, whereas case company 1 is the most active in the descriptive reporting area. Case company 4 seems to be using the analytics capabilities with the widest range at global level, but locally in Finland it is equal to other case companies.

All in all, each company has its own emphasis on the analytics usage. Descriptive reporting is in use in all the functions, at least by some of the companies. A cautious generalization could be drawn. It seems that the gaps in usage are in the areas of recruitment, rewards and training. This statement cannot be generalized too much due to the small number of interviewed companies. However, what is interesting that the company performing predictive and prescriptive analytics is performing it the most in the attrition, wellbeing, recruitment and training areas. As described in the case description earlier, they had received positive business benefits in those areas. These could be considered as benchmark areas when planning the company specific initiatives.

6.4 Perceived business value of HR predictive analytics

In the earlier section we covered what is the current usage of the analytics in the case companies. This section extends the topic by clarifying what would be the case companies' perception on the business value of using predictive analytics in HR.

The case companies estimated, what would be the business value from their point of view on each of the identified predictive analytics processes. Each company has given scores to all of the processes. This is illustrated in Figure 14 below. The total score varies from 30 to 35 when one summarizes the points of all the processes together per a case company. This results in an average value of 1.7-1.9 per defined process. Thus one could conclude, that all the interviewees seem to think there is on average "moderate" value in general in performing predicting analytics in the HR.

Process area	HR Predictive Analytics -processes	Case 1 perceived value of predictive analytics	Case 2 perceived value of predictive analytics	Case 3 perceived value of predictive analytics	Case 4 perceived value of predictive analytics	TOTAL SCORE
Area 1: Predictive employee recruitment						
Recruitment	Predict future recruitment needs in the company	2	2	4	3	11
Recruitment	Predict the best candidates for the open positions	3	3	2	2	10
Recruitment	Predict which skills are needed in the future	2	2	3	3	10
Performance	Predict who will be the future top performer i.e. predict employee performance	2	3	3	2	10
Area 2: Predictive employee management						
Rewards	Predict which rewards produce best performance	0	3	1	1	5
Rewards	Predict optimal amount of rewards to be offered	0	2	1	2	5
Enagagement	Predict best engagement package for top performers, (e.g.reward packages, trainings,	4	3	3	3	13
Well-being	Predict well-being activity needs on employee level (physical and mental health)	3	3	2	2	10
Well-being	Predict optimal amount of well-being activities to be offered	3	3	1	2	9
Well-being	Predict return on investment on well-being activities i.e. best performing activities	3	3	2	3	11
Training	Predict training needs on employee level	2	3	3	2	10
Training	Predict return on investment of trainings i.e. best performing trainings	1	2	2	2	7
Training	Predict optimal amount of trainings to be offered	1	2	1	3	7
Absences	Predict employee absences	2	2	2	1	7
Area 3: Predictive employee attrition						
Attrition	Predict resignations on organisational level (amount of resignations)	3	3	3	3	12
Attrition	Predict resignations on employee level	4	2	3	3	12
Attrition	Predict how employee resignations can be prevented	3	2	3	2	10
Attrition	Predict which skills will be lost and when	3	2	3	3	11
	TOTAL SCORE	**32**	**35**	**30**	**32**	

Perceived value of predictive analytics	
0	0 No value identified
1	1 Low value
2	2 Moderate value
3	3 High value
4	4 Very high value

Figure 14. Perceived value of using predictive analytics processes

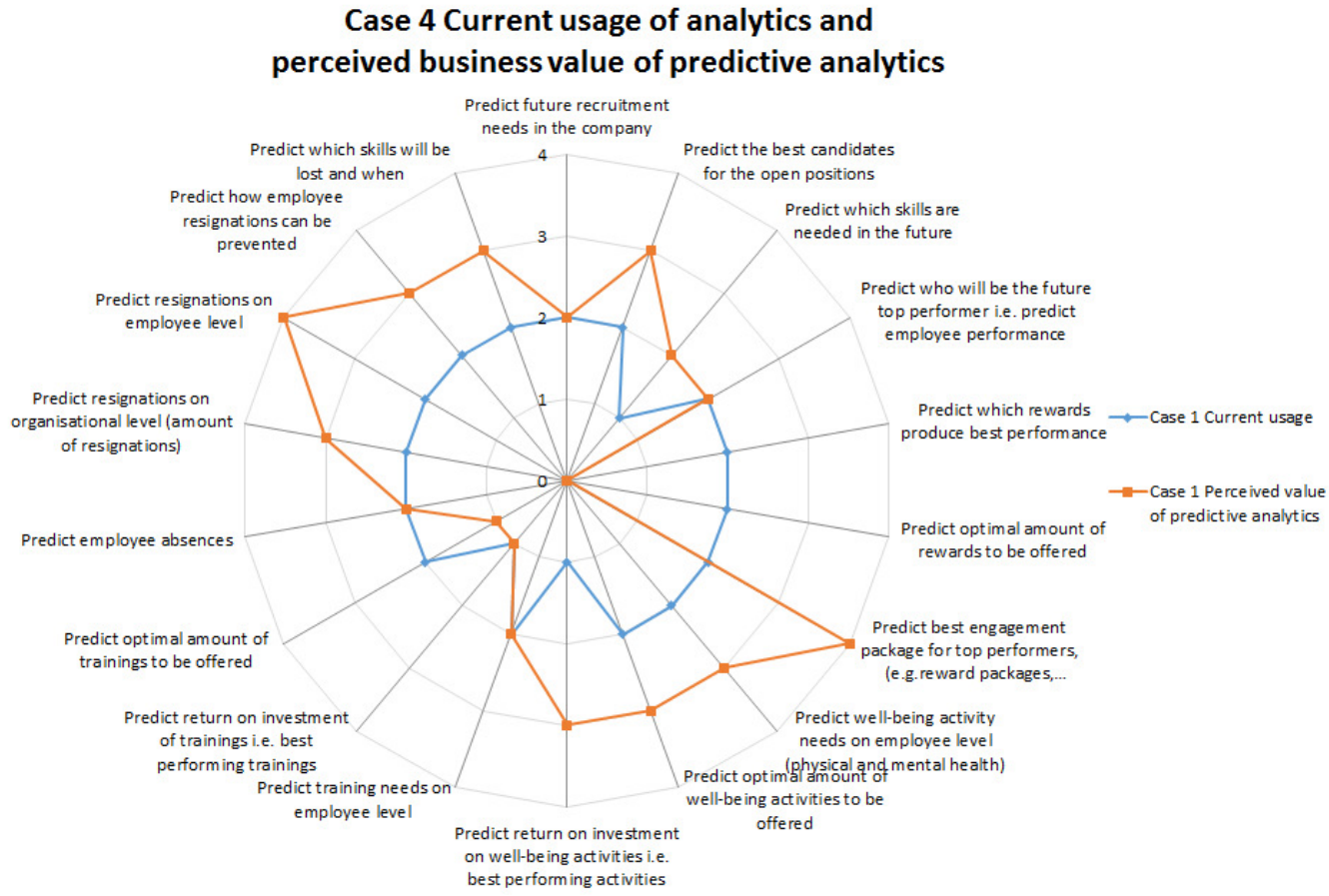
When observing the horizontal rows, one can see the total score per each HR predictive analytics process. The process "Predict best engagement package for top performers, (e.g. reward packages, trainings, career planning)" has received the highest summarized score (13 points) from all the companies. The rewards related processes "Predict which rewards produce best performance" and "Predict optimal amount of rewards to be offered" have both received the lowest total score, only five points. The reason why the rewards area was not seen as a valuable target for predictive analytics, was often due to a fact that companies stated they had a standard rewards system in use, which they were not going to change anyway in the near future. Thus the result of rewards predictions would be useless, if one cannot anyway react and change anything in the current situation. Part of the training predictions were neither seen as valuable. The modification of the training offering merely targets to create cost savings. Thus it was seen more as a cost controlling activity, instead of a new value generating function.

Overall the employee recruitment, employee attrition, wellbeing, performance and engagement area predictions have received high values, above 10 each, which would result to an average of 2,5 (from moderate to high value) at least per process. The case companies 3 and 4 seem to value employee recruitment area predictions higher than the other companies. Case company 1 has valuated the prediction of the employee engagement with the highest score, and all the other companies agree that there is at least "very high" value in the engagement predictions. Case company 1 has also rated the employee attrition prediction very high, especially on employee level, instead of just on summary level in different parts of the organizations. Other companies have valuated the employee attrition prediction also high, with the exception of the case company 2, which only valuates the organizational level summary attrition predictions to have high value.

All in all, there is again some dispersion in the answers, but some generalization can be summarized. The employee attrition and retention were indicated to be important. The reasons varied why these were seen as important; case company 3 wanted to be able to do workforce planning better, to have employees available to match the market need. The case company 1 needed to target the people in key positions or key people, such as people with long careers in the company, and make sure they have a chance to react to their plans of leaving. Then again all the companies see employee engagement predictions valuable. One could summarize, that all the companies have recognized the value of keeping employees engaged.

6.4.1 Perceived value per case company

As the evaluations vary between the companies quite a bit, the following sections analyze the results case specifically. The current usage of analytics and perceived value of analytics are combined into the spider graphs (Figures 15-18). These graphs aim to demonstrate for each company the gap between where they are currently at, and what they see as a desirable target state. This could work as motivation for the companies to take action and try predictive analytics in the identified application areas.



Current usage	Perceived value of predictive analytics
0 No data exists	0 No value identified
1 Data exists, not reported	1 Low value
2 Descriptive reporting in use	2 Moderate value
3 Predictive analytics in use	3 High value
4 Prescriptive analytics in use	4 Very high value

Figure 15. Case 1 comparison of current usage and perceived value

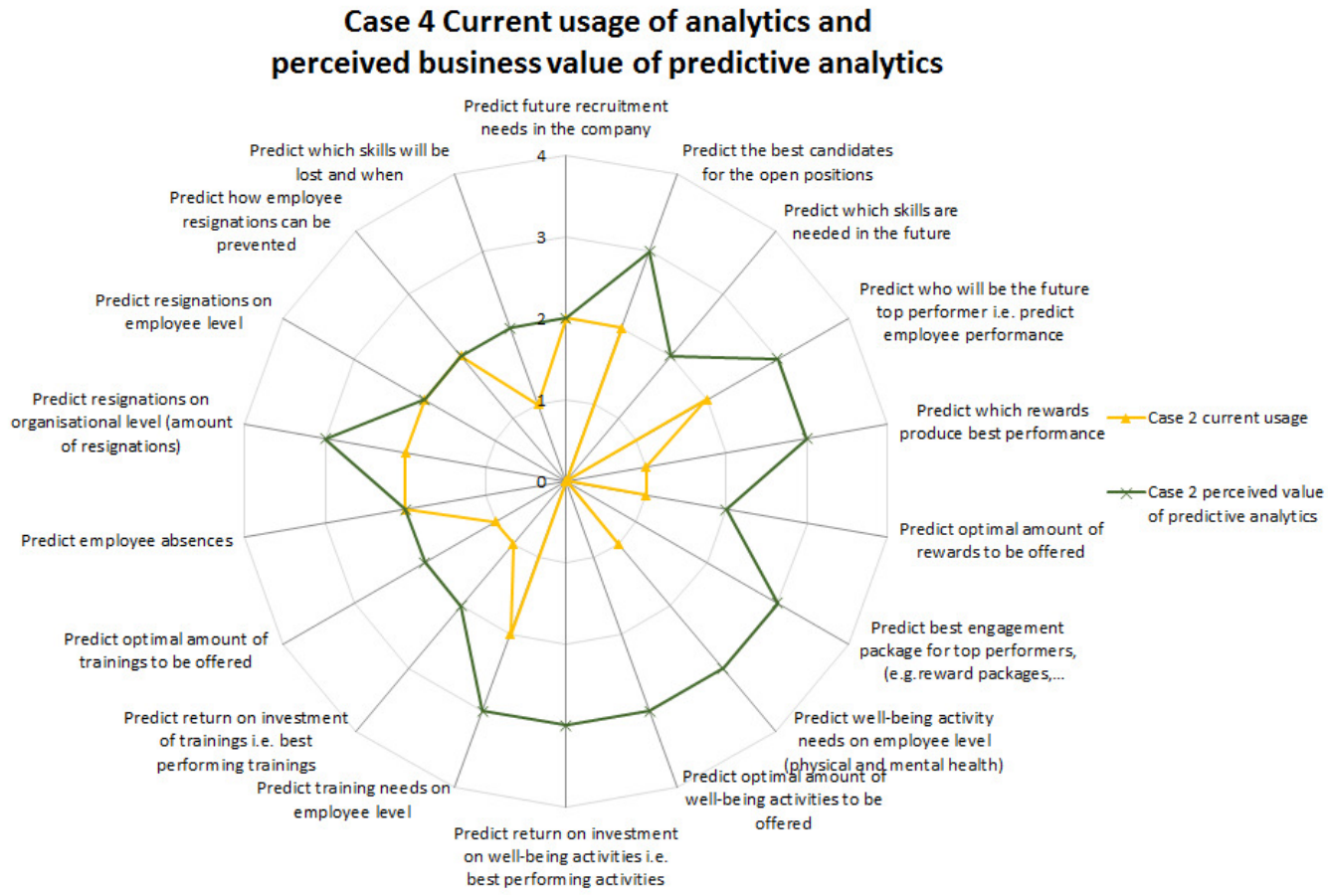
Figure 15 shows, that the case company 1 is currently using only descriptive analytics. There is no reporting in use yet in the future needs on skill prediction area, in measuring training

profitability and wellbeing activity profitability. The perceived value and the interest to perform predictive analytics was the lowest on the rewards and training areas.

The perceived value is quite high on the predictions of resignation on employee level, and also on the other predictions related employee resignation predictions. According to the interviewee this need comes through their company's age structure; one wants to keep the qualified but aging people in the company as long as possible, or at least be able to control the resignations. This applies also to some high profile positions, which are more difficult to replace than employees in standard positions. This would be significant for controlling the recruiting costs and cost of losing the key employee.

The interest is also high in the employee engagement and wellbeing areas. In the wellbeing area the interviewee reasons that they would want to predict how the employee ability to work can be maintained, especially concentrating to the aging workforce. In the employee engagement area the benefit would be the same; to reduce unwanted attrition due disengagement that would be costly to the company.

Additionally, there are areas where there is no interest into the predictive analytics, such as rewards and recognition. The interviewee explained, that the company has a standard reward system in use. A fixed reward model was in use especially in the factories. There has not been a business need to change that and thus predictions would add to her no value into the current processes.



Current usage	Perceived value of predictive analytics
0 No data exists	0 No value identified
1 Data exists, not reported	1 Low value
2 Descriptive reporting in use	2 Moderate value
3 Predictive analytics in use	3 High value
4 Prescriptive analytics in use	4 Very high value

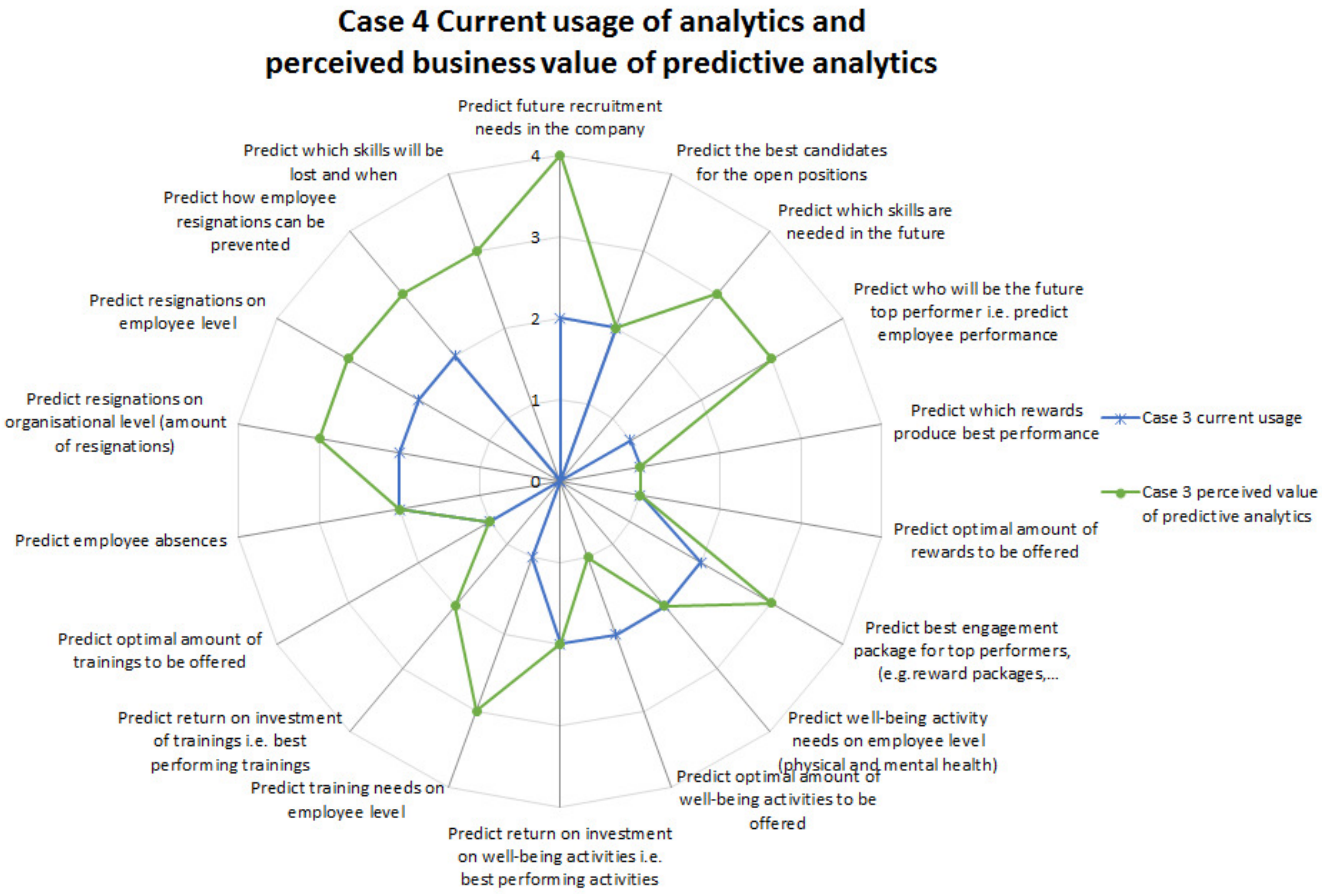
Figure 16. Case 2 comparison of current usage and perceived value

Figure 16 illustrates, that the case company 2 is also currently using only descriptive analytics, but a lot less than case company 1. Most of the current reporting is done in the areas of resignations and recruitments, some on trainings and employee performance. Then again the interviewee was not able to identify if some of the areas would be only with low or no value.

The interviewee sees highest business value in being able to predict the organizational level resignations, predict the best candidates for open positions, predict the performance, engagement and wellbeing of the employees. Being able to keep the recruiting costs down is one of the benefits the interviewee describes. Especially in their customer service positions the employee turnover could be preferably lower. Predicting the training needs on employee level were estimated to be significant, for productivity of each employee.

The interest to the predictions of the well-being activities comes strongly through the company's latest development on offering well-being analytics as a service. The value here comes through the chain of events as described by the interviewee; first measure the employee well-being related data, identify the employees in need for services, make intervention, and through improved employee health and increase in wellbeing realize the positive outcomes of cost savings and performance improvements.

All in all, the maturity level of practicing analytics seems to be on the lower side, but there is interest in developing the analytics further. Wellbeing area has some emphasis, but otherwise there are no high peaks in the interest, but more of a general interest on most of the areas. Thus, for this company it might be beneficial to have quick trials in the interest areas and in this way determine, in which area the work should be continued.



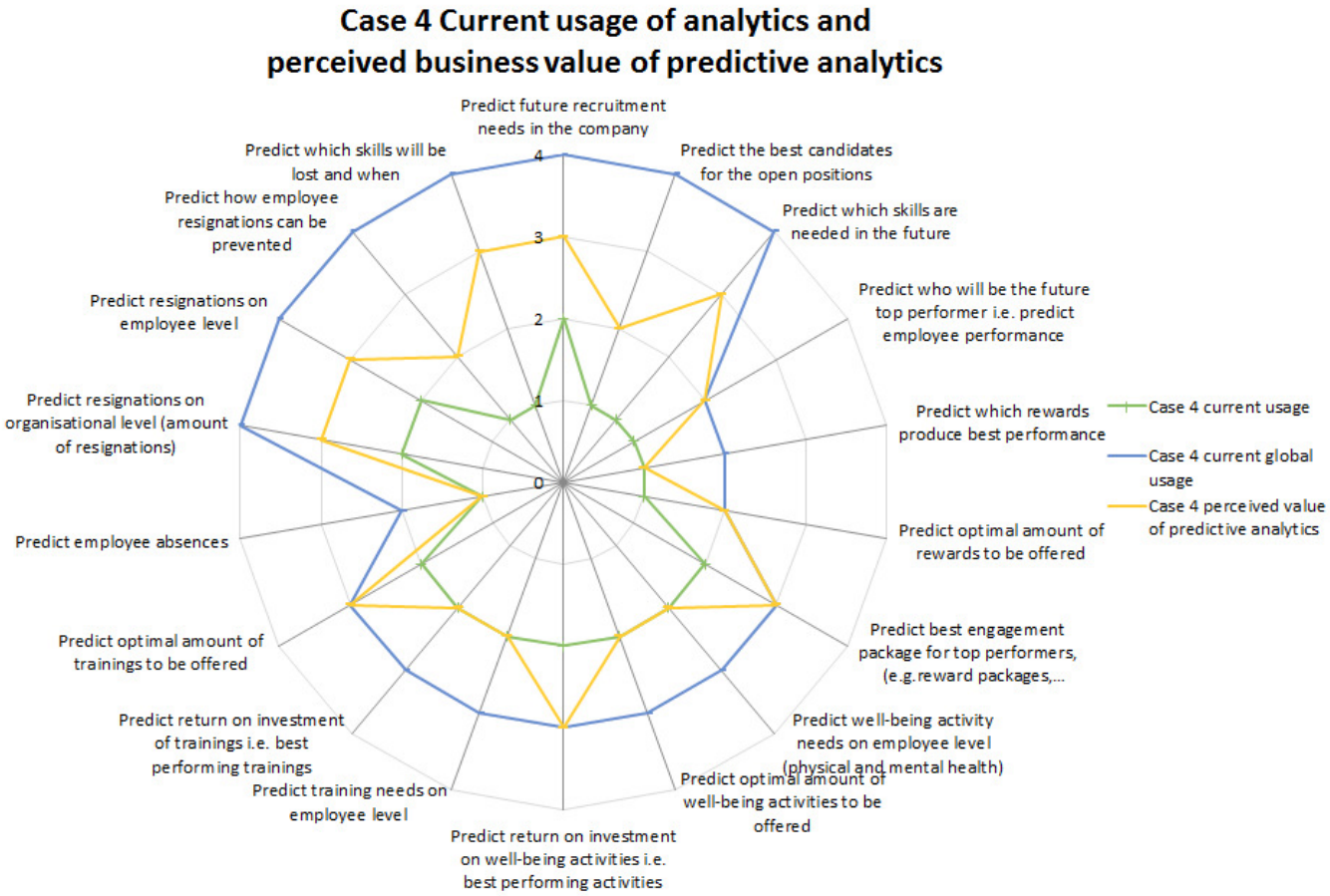
Current usage	Perceived value of predictive analytics
0 No data exists	0 No value identified
1 Data exists, not reported	1 Low value
2 Descriptive reporting in use	2 Moderate value
3 Predictive analytics in use	3 High value
4 Prescriptive analytics in use	4 Very high value

Figure 17. Case 3 comparison of current usage and perceived value

The case company 3 is also currently using only descriptive analytics, but not in all the HR areas as shown in the Figure 17. There are some significant gaps in what the interviewee sees as valuable and where they are currently in the analytics maturity levels. This comes partially through the fact that at the moment the data collection in HR is very limited, due to the old technologies in use.

Areas where the company has currently no data and no reporting in use, but would been seen as highly valuable are; predictions on which skills are lost and when and predictions on what skills are needed in the future. Overall the predictions on preventing resignations and recruitment needs are seen as highly valuable. In their company the employee turnover is quite big, especially in the low-wage jobs of the cleaning and real estate services. Predicting the

future recruitment needs on company level are seen as the most valuable, mainly to optimize the cost efficiency and be able to recruit optimal amount compared to the need of the workforce. All in all, the benefits in the recruitment, resignation and employee performance areas are created according to the interviewee through possibility to operate as costs efficiently as possible and through optimizing the performance of the employees.



Current usage	Perceived value of predictive analytics
0 No data exists	0 No value identified
1 Data exists, not reported	1 Low value
2 Descriptive reporting in use	2 Moderate value
3 Predictive analytics in use	3 High value
4 Prescriptive analytics in use	4 Very high value

Figure 18. Case 4 comparison of current usage and perceived value

Figure 18 illustrates, that the case company 4 is currently using only descriptive analytics locally in Finland, even though predictive and prescriptive analytics capabilities are available in the global level. This is included in to the same picture for comparison purposes. The interviewee tells that reporting is not used in the rewards area too widely, as the company a

standard reward model for all the employees, creating no specific need on reward reporting. Reports are also not generated on skill level, which skills are disappearing from the company or what would be needed in the future. The interviewee sees high value in many of the prediction processes listed, with the exceptions of rewards analytics and employee absences. The business value was identified to be similar as by the other interviewees; the cost reductions, the enhanced targeting of HR services and the improved decision making ability by the management.

What is significant in this setting, is that locally the company is still in the lower end of analytics maturity levels, whereas globally there would be predictive and prescriptive analytics capabilities available. The predictive analytics are offered in all the other areas than employee absences, some rewards areas and employee performance. Thus the global team offering covers all the possible needs the local team might have, and additionally the global team stated that they are all the time developing their offering further.

An area that would need attention according to the interviewee, in addition to what was covered in the questionnaire, would be the current hot topic of women leadership. The company is highly interested in data analytics and predictions on how to attract women leaders to higher positions, and how to keep them stay in the company, especially in these higher positions. Currently the interviewee states that the company is working on this area, and advanced analytics such as predictive analytics would be a useful aid.

6.5 Challenges of the analytics in HR

This section describes the identified challenges, what are hindering the companies from taking action with the predictive analytics. The biggest challenges identified by the interviewees are listed below per analytics building blocks. All the companies mentioned one challenge; lack of people who would understand both predictive analytics but also HR business processes. This skillset would have been highly valuated by the interviewees. Other common challenges were the lack of technology for data management in general but also missing tools for the predictive analytics. Also having data scattered around the organizations due to historical business related reasons or just due to technological reasons were seen widely as problematic. The list of identified main challenges is as follows:

1. Infrastructure
    a. Missing data warehousing capabilities
    b. Missing predictive analytics tools and technologies
2. Data management
    a. Lacking data quality and need for harmonization
    b. Data disorganization around the company and around different HR areas
3. Governance
    a. Missing centralized data governance initiatives and organization
4. Organization
    a. Very few people in the companies who would understand both HR business and predictive analytics
    b. Lacking leadership interest
5. Analytics
    a. Currently few facts available on the actual positive effects of using predictive analytics, as HR predictive analytics is not widely used yet, if at all in Finland
    b. Lacking business interest
    c. Lacking understanding on the analytics and predictive analytics capabilities among the stakeholders

Each of the challenges can be resolved and overcome. The technological reasons are solvable as described earlier in this study, via cloud solutions, data integration possibilities and new opportunities on the predictive analytics toolsets. People from universities are graduating with analytics skillsets to fulfill the gap in analytics skills. Then again, people need to

collaborate efficiently between IT and business, to deliver optimal outcomes. What comes to the proving of predictive analytics effects, most interviewees mentioned that if one sees the benefits, the buy in to continue in the analytics path would increase. Thus it could be recommended to try out with a light and simple initiative the effects of using predictive analytics in decision making. All the capabilities do not need to be adopted at once, but one can have a trial with some of the areas identified as valuable.

As a summary, all these challenges vary between the case companies. Thus one could recommend for each of the companies to make their own detailed situation analysis on their current state, what are their current problems, and target the identified challenges based on their needs and strategic goals.

7 Conclusions

7.1 The main findings and implications to practice

The research covered the analytics building blocks, how the value is measured in HR and if and how the predictive analytics can add to the HR value. A set of predictive analytics implementation areas in HR were identified and valued by the case companies. Also the challenges hindering the progress with HR predictive analytics were discussed. To summarize the findings, let's repeat the key research questions and see how the study covered those. The research questions of this study were defined in the beginning and they are the following;

1. How is the value of leveraging predictive analytics in HR perceived?
2. What are the main building blocks needed in implementing predictive analytics in HR?
3. What are the main challenges preventing predictive analytics adoption in HR?

To answer to the question how the value of predictive analytics is seen in HR, one needs to define how HR in general is valued. Thus let us have a look at how HR is currently and should be valued, to understand what the additional value is, that predictive analytics can produce.

Traditionally, the HR has been seen as a cost center instead of a value creating function. This has partially been the effect of not having standard tangible HR measurements in place in the HR area, such as there are for example in the finance area. The Center for talent reporting (2015) presents a set of standardized measures that is gaining popularity among the companies. A set of recommendations on how to start demonstrating the value can be generated as a result of the study, through which the HR can prove its usefulness to the company.

To start with, the HR people should define in detail with the leadership, what actually needs to be measured, to receive the wanted leadership attention and further commitment. Fitz-enz and Mattox (2014) recommend, and this study supports it, that the companies should start to concentrate more on measuring and reporting the profitability and effects on the company outcomes, instead of following up the HR functions' internal measures only. Currently only the case company 4's global team performing predictive analytics was tying the results into financial measures. Preferably one would use financial metrics to communicate the HR function to deliver the message to leadership most effectively. Thus, one could conclude that the HR analytics specialists in the companies need to re-evaluate their current activities, whether they are measuring the right things. It is difficult but not impossible to tie the HR metrics to financial

outcomes, through analyzing data and specifically the effects of the HR actions to the financial outcomes. The leadership commitment to HR development activities would also be gained through connecting the HR targets to personal performance incentives. These are the ways how HR function proves its profitability and usefulness to the company.

Then again what is the actual HR value, what does it comprise? The employee and company level factors, which have an effect on the outcomes, were described in this research, such as employee commitment to the company or amount of wellbeing activities to the employee engagement. A summary of benefits and values, which HR can produce to the company, are described in Figure 19. Not all of the listed benefits in the study or directly monetary, but they can be connected with financial outcomes by analyzing the relations.

The HR action such as rewards, wellbeing, performance or learning initiatives generate employee level affection, commitment, and increased ability to perform overall. This turns into personal level improvements in performance, increased engagement, commitment and creativity. This personal level improvement then again translates into company level performance increase, increased customer satisfaction, sales increase, positive return on equity and cost savings. Or as the interviewed wellbeing provider states, the employees can turn their wellbeing and energy into actual outputs, be more productive and effective at work, when they have reached an optimal overall vitality. All the other case companies tended to agree on a general level with Paauwe et al. (2013), Miranda (2015) and Fitz-enz and Mattox (2014), which are the values HR can support to produce. However, this was not quantified in financial outcomes in the case companies, thus the case interviews did not produce additional empirical evidence in this area.

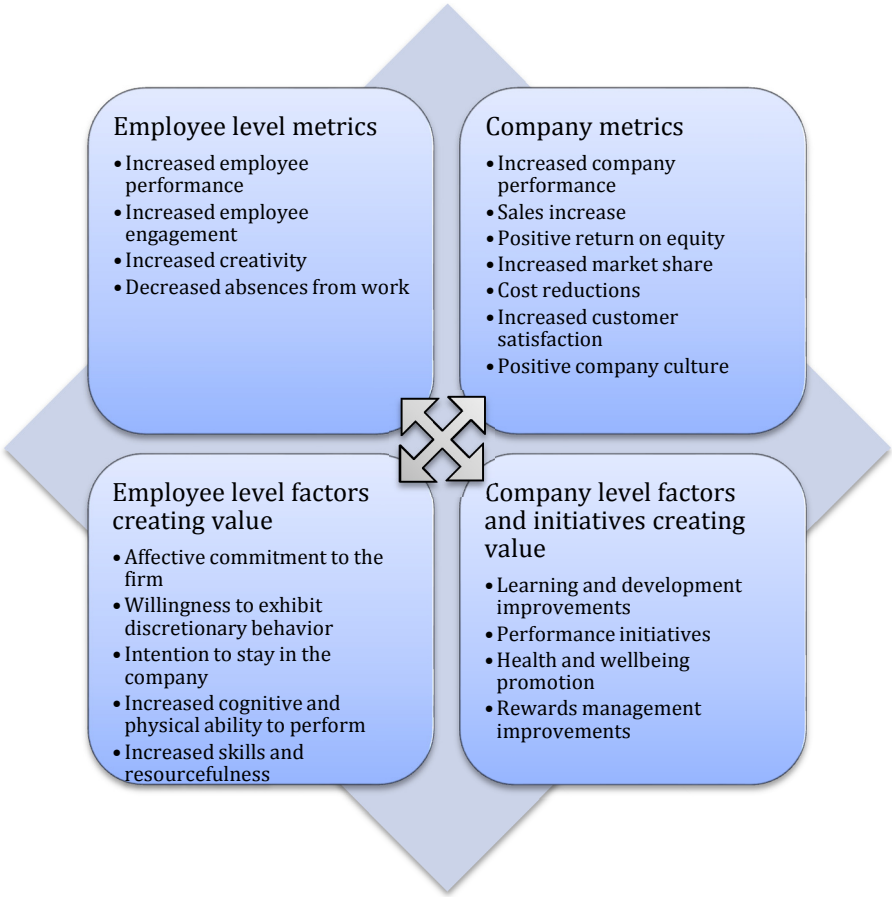


Figure 19. HR business benefits. Modified from Paauwe et al. (2013), Miranda (2015), Fitz-enz and Mattox (2014)

What is the value then of leveraging predictive analytics in HR perceived? As predictive analytics is a tool for supporting HR business leaders towards optimal outcomes, the above stated HR business outcomes would apply to the question "what is the value that predictive analytics can produce to HR". Predictive analytics is a tool to support HR practitioners' daily work in planning and decision making.

Predictive analytics would thus just extend the view and optimize and increase the listed positive outcomes. The processes could be done more effectively with enhanced decision making ability and clear indications of financial correlations. As noted before, in the interviews it was discovered that none of the companies were currently tying the HR measures to financial metrics or to company performance. The reasons ranged from the lack of capable analytic people, lack of technologies, the perception of difficulty in measurements to the lack of motivation from the business side to demand the information. An exception to this is the global team of the case company 4, who were already executing predictive analytics at an advanced level, and were also following up the monetary benefits. All the results they had measured were

positive, resulting in significant cost savings and profit increases for the company. Thus, this research still supports the view from Paauwe et al. (2013), Miranda (2015), Fitz-enz and Mattox (2014) that HR can create actual positive financial business outcomes.

How is the value then of leveraging predictive analytics in HR perceived by the companies? To answer this, one needed to identify what are the exact prediction areas where analytics can be used. This research extends the current studies in the HR predictive analytics area by collecting several possible implementation areas in HR together. The list of predictive analytics processes in Table 10 was collected based on the studies from Naasz and Nadel (2015), Fitz-enz and Mattox (2014), Oehler and Falletta (2015), Cappelli (2009), Anschober et al. (2010), Bhattacharya et.al (2005), Baron (2012), Brown (2014), Barron (2012), Ivancevich (1985) and Shaw (2011) and were modified into their final format in the case companies' expert interviews. It was soon discovered that each of the companies saw at least some value in all the listed predictive analytics process areas.

Table 10: HR predictive analytics process area; highlights

Area 1: Predictive employee recruitment	
Recruit	Predict future recruitment needs in the company
Recruit	Predict the best candidates for the open positions
Recruit	Predict which skills are needed in the future
Area 2: Predictive employee "maintenance"; development, rewards and well-being	
Rewards	Predict who will be the future top performer i.e. predict employee performance
Rewards	Predict which rewards produce best performance
Rewards	Predict optimal amount of rewards to be offered
Enagagement	Predict best engagement package (holistic view which factors affect) for top performers; reward packages+trainings+career path
Well-being	Predict well-being activity needs on employee level (physical and mental health)
Well-being	Predict optimal amount of well-being activities to be offered
Well-being	Predict return on investment on well-being activities i.e. best performing
Training	Predict training needs on employee level
Training	Predict return on investment of trainings i.e. best performing trainings
Training	Predict optimal amount of trainings to be offered
Absences	Predict employee absences
Area 3: Predictive employee attrition	
Attrition	Predict resignations on organisational level (amount of resignations)
Attrition	Predict resignations on employee level
Attrition	Predict how employee resignations can be prevented
Attrition	Predict which skills will be lost and when

Each of the case companies values the HD predictive analytics process areas differently, and tends to emphasize the value in those areas, which are important from their business point of view. To get actual trends visible better, one would benefit from a significantly greater sample set of interviewees. In other words, one cannot draw too many general conclusions on which process area for example creates the biggest value, but the companies valued the processes from their individual perspectives.

However, there were some cautious indications on trends and similar views on the value in certain HR predictive analytics areas. The processes getting higher than average rating for the business value are highlighted in Table 10 in green. These areas comprise the predictions of the employee recruitment from different perspectives, and predictions on employee attrition. Also, predicting the employee the well-being and employee engagement, and affecting the length of employment were seen as valuable by all the interviewees. Again, the reasons why the companies valued each process were very company specific; some wanted to take care of the wellbeing of the aged workforce whereas others had wellbeing as a core strategic initiative. Earlier researches have not identified the exact value of the processes, thus this research extends the view by identifying areas where companies could start the analytics work.

The main benefits of the predictive capabilities listed by the interviewees were cost savings in employee recruitment costs, cost saving with lower employee turnover and thus with longer employment relationships. Also ability to optimize operations and target the budgets more effectively in trainings, wellbeing and workforce planning were seen as the most important benefits. The existing research on business benefits in HR area by Naasz and Nadel (2015), Fitz-enz and Mattox (2014), Oehler and Falletta (2015), Cappelli (2009), Anschober et al. (2010), Bhattacharya et.al (2005), Baron (2012), Brown (2014), Barron (2012), Ivancevich (1985) and Shaw (2011) support these views. Each company saw the biggest value in those analytics areas, which were strategically important for their core business. The case company 1 for example wanted to keep employees as long as possible and predict that area, whereas the case company 3 needs to predict the future workforce needs in the high employee turnover business area. Thus, each company should define individually what makes sense and is the most valuable predictive analytics action in their case.

Based on the interviews the companies, who are not working with advanced analytics and predictive analytics, are not connecting the HR activities with the positive business outcomes very effectively. The listed benefits concentrated mainly on cost savings, whereas the existing researches such as Ashton et al. (2004) proved that the positive outcomes could be seen also

for example as an increase in performance and profits, increased customer satisfaction and increased sales as stated before.

As next, the research answered the question; what are the main building blocks, which are needed in implementing the predictive analytics in HR? The analytics building blocks by TDWI (2015) are the organization, technology, data management, governance and analytics itself. Some companies had already advanced analytics technology, but not in active use through missing competence in HR analytics area. There was also indication that one wants to build the analytics capabilities gradually. The views are opposing in the literature e.g. by Fitz-enz and Mattox (2014) and Bose (2009) on how gradually one needs to build the capabilities, or could one alternatively get quick wins easily in this area? This study supports the view that one needs to build leadership's and employees' awareness and understanding gradually about analytics. Then again, the technology should not be an obstacle in the analytics path, with the current offering on flexible and easily accessible solutions. It is recommended that some sort of data storing solution is in place from where the data can be retrieved, but one single data store is not mandatory with current technologies able to solve complex integrations problems.

Currently many of the companies stated that the motivation to move further with HR predictive analytics should come from business. There is interest but not huge demand among the leadership to trial with analytics capabilities in the HR area. Another alternative which the interviewees suggested, on how the HR predictive analytics would be able to move forward was a quick win on some of the areas. If one demonstrated with one trial the benefits in practice, one would get more buy-in to continue in the same route.

What are the main challenges preventing predictive analytics adoption in HR? The biggest challenges on adopting predictive analytics into HR were also company specific, ranging from technological challenges to awareness and understanding. The common problem was the lack of talent, who could combine the predictive analytics understanding to the HR business knowledge. Each company had their own technological challenges, one did not have any historical data in use in HR area due old technologies, one did not know how to operate the existing data mining tools most effectively and the other had data on silos and disorganized. Need for data harmonization was here again a common nominator among the other companies, than the one where global data team owns the area and takes care the standards are followed and data stays in good quality. Another recommendation of this study is to manage the data harmonization efforts as a centralized effort, as well as the analytics efforts conducted from the data.

A valuable next step and a recommendation for each company would be to continue the internal development in the analytics path, especially in those areas that they see valuable. Before taking an action, the case companies could take a closer look into their analytics maturity, for example with the help of the TDWI (2015) analytics maturity assessment tool, which they offer online, or with any other similar service.

All in all, every company needs to do their own case specific analysis on where to start with HR predictive analytics capabilities, to generate value for the company. However, the start can be very light and target initially for instance just a specific area, as also Bose (2009) suggests, to see if there is any benefit on continuing analysis. The technology is widely available and the company does not have to have a complete analytics portfolio in use to be able to take the first steps. Some basic elements are still needed, such as capable people, available data and tools and an idea where to start.

7.2 Assessment of the study, limitations and further research

In this study both the positive business value of the HR measurement in general and the positive value of the predictive analytics were discovered to exist, but there is also room for further research on this area. Theoretically and from the case companies' point of view the value exists, and thus the next recommended logical step would be to continue with more targeted empirical study on the identified most valuable HR prediction areas, such as the employee engagement, recruitment or employee retention. As stated by Koch (2015) one should aim at quick wins with small efforts to experience the benefits and thus gain more leverage for the further trials with predictive analytics. All in all this study extends the existing research by summarizing the HR area prediction possibilities from several studies such as Naasz and Nadel (2015), Fitz-enz and Mattox (2014), Oehler and Falletta (2015), Cappelli (2009), Anschober et al. (2010), Bhattacharya et.al (2005), Baron (2012), Brown (2014), Barron (2012), Ivancevich (1985) and Shaw (2011), and giving an indication on which areas one could try to proceed with further empirical analysis. The list of the identified predictive analytics processes for instance could work as a reference for a further study.

This study described the results for each case company separately, but also some generalization and conclusions could be drawn on their joint view, on the values and on the challenges in the HR predictive analytics area. Additionally this research demonstrated the level of HR predictive analytics in Finland being still quite immature. However, due to the small number of interviewees, the summary of the results could look different should the interviewee

group be bigger or different. In other words, the results are not definitive, even though in this study some trends could be seen. This study is still a good starting point for further analysis, from which one can take input to further empirical studies.

There are also some limitations in this study. The small sample set was deliberate for this study, to get in depth interviews and expert opinions to answer complicated research questions. However, should one want to see definitive trends and credibility to specific questions, one would need a bigger sample. Also, as the companies were quite immature in their analytics maturity, the views came from that perspective, whereas evaluation for different processes could be different from professionals actually using predictive analytics in the HR areas. This is not seen as a major deficit for this research, as the aim was to find out how the interviewed HR and analytics professionals perceive the different predictive analytics implementation areas.

As another future research area, one could also consider the effect and significance of the unstructured big data sources to the HR prediction models, instead of only concentrating on company's internal data sources. The external big data sources were not directly scoped out from this study, but the interviewees did not highlight them specifically during the interviews.

Additionally, one could investigate the HR predictive modeling from the technological point of view. The technological aspects were not at the core of the research in this study, only the existence of the vast amount of modern possibilities was acknowledged, which enable the predictive analytics. The technological point could be extended to include the next steps in the analytics maturity ladders; prescriptive analytics. More specifically, how the decision making can be automated based on the received predictions and where this functionality could be applied to.

From the financial and mathematical perspective, there are also numerous research possibilities directly related to this study; from the chaos theory to the company valuation theories. One could argue, that especially in HR where human actions are the core of the business, actions are relatively random. As the chaos theory states, in random actions one can find surprising patterns and structure. Statistical modelling is the tool for finding those patterns and the employee behavior would be one study option for the interested mathematicians. Another area would be the financial perspective; how to value the intangible assets in HR and how to value the non-monetary improvements such as an increase in employee engagement or an improvement in employee well-being. Predictive modeling can support in this area, by combining financial outcomes to the effects of the HR actions taken, one just needs to start experimenting; collect the data, do the modelling work and find out the results.

Appendix A: Questionnaires

Table A1: Questionnaire to case companies;open questions

General	
	What is your position and responsibilities in the company?
	How long have you worked in the reporting/analytics/HR analytics area? How long in the current company?
Main building blocks: HR & reporting	
HR Operations as-is	What are the operational areas of HR in your company? Employee recruitment, development, well-being, training, compensation&benefits, other?
Measurement	What are the key performance indicators of these functions in HR?
Main building blocks: HR analytics	
IT Landscape	What are the systems and technologies used in the HR reporting in your company? What about in HR predictive analytics area? Do you have any challenges in this technology area? If yes what?
Analytics personnel	How is the current reporting work and possible/current advanced analytics (incl.predictive analytics) -work organised in your company? What type of expertise do you need to leverage HR predictive analytics? Do you have any challenges in this area? If yes, what?
Data quality	How are you monitoring your HR data quality? Do you have any challenges with HR data quality? If yes, what?
Motivations	What would be the main motivators for your company to start predictive analytics initiatives in HR area?
Strategy/Sponsorsip	What kind of management support do you have for these kind of initiatives?
Analytics processes	**Pls. See the next sheet**
Final questions	
Business Challenges	What are in general the biggest HR business challenges at the moment? How could predictive analytics help in those areas?
Visions	Are you planning any HR predictive analytics initiatives currently? What kind of initiatives?

Table A2: Questionnaire to case companies; closed questions

Questionnaire on HR analytics

27.9.2015

Evaluation chart for different predictive analytics processes in HR

Process area	Current use (please elaborate what, how)	HR Predictive Analytics -processes	Perceived business value of Prediction - capability (please elaborate why)	Actual realized business value (monetary or non-montary)
Example	*Reporting in use*	*Predict future recruitment needs in the company*	*2 Moderate value*	*Costs of project delays reduced by x amount last year.*
Area 1: Predictive employee recruitment				
Recruit	0 No data exists	Predict future recruitment needs in the company	0 No value identified	
Recruit	0 No data exists	Predict the best candidates for the open positions	0 No value identified	
Recruit	0 No data exists	Predict which skills are needed in the future	0 No value identified	
Area 2: Predictive employee management				
Performance	0 No data exists	Predict who will be the future top performer i.e. predict employee	0 No value identified	
Rewards	0 No data exists	Predict which rewards produce best performance	0 No value identified	
Rewards	0 No data exists	Predict optimal amount of rewards to be offered	0 No value identified	
Enagagement	0 No data exists	Predict best engagement package (holistic view which factors affect) for top performers; reward packages+trainings+career path	0 No value identified	
Well-being	0 No data exists	Predict well-being activity needs on employee level (physical and	0 No value identified	
Well-being	0 No data exists	Predict optimal amount of well-being activities to be offered	0 No value identified	
Well-being	0 No data exists	Predict return on investment on well-being activities i.e. best	0 No value identified	
Training	0 No data exists	Predict training needs on employee level	0 No value identified	
Training	0 No data exists	Predict return on investment of trainings i.e. best performing trainings	0 No value identified	
Training	0 No data exists	Predict optimal amount of trainings to be offered	0 No value identified	
Absences	0 No data exists	Predict employee absences	0 No value identified	
Area 3: Predictive employee attrition				
Attrition	0 No data exists	Predict resignations on organisational level (amount of resignations)	0 No value identified	
Attrition	0 No data exists	Predict resignations on employee level	0 No value identified	
Attrition	0 No data exists	Predict how employee resignations can be prevented	0 No value identified	
Attrition	0 No data exists	Predict which skills will be lost and when	0 No value identified	

Current use	Perceived value
0 No data exists	0 No value identified
1 Data exists, not reported	1 Low value
2 Descriptive reporting in use	2 Moderate value
3 Predictive analytics in use	3 High value
4 Prescriptive analytics in use	4 Very high value

Table A3: Questionnaire to subject matter experts; wellbeing providor –company

Wellbeing provider specialist interview

General information

- What is your current position and what are your main responsibilities?
- How long have you worked in the well-being area?

Employee well-being

- What are the current trends on employee well-being analytics -area according to your view?
  - *What about specifically in employee well-being predictive analytics?*
- Are you planning any well-being analytics or predictive analytics initiatives currently? What kind of initiatives?
- How do you see the readiness of current clients to take action with predictive analytics?
  - What are the biggest challenges in leveraging analytics and predictive analytics in employee well-being data?

Aalto University
School of Business

Questionnaire on HR analytics

27.9.2015

Evaluation chart for different predictive analytics processes in HR

Process area	Current use (please elaborate what, how)	HR Predictive Analytics -processes	Perceived business value of Prediction - capability (please elaborate why)	Actual realized business value (monetary or non-montary)
Example	*Reporting in use*	*Predict future recruitment needs in the company*	*2 Moderate value*	*Costs of project delays reduced by x amount last year.*
Area 2: Predictive employee management				
Performance	0 No data exists	Predict who will be the future top performer i.e. predict employee performance	0 No value identified	
Rewards	0 No data exists	Predict which rewards produce best performance	0 No value identified	
Rewards	0 No data exists	Predict optimal amount of rewards to be offered	0 No value identified	
Enagagement	0 No data exists	Predict best engagement package (holistic view which factors affect) for top performers; reward packages+trainings+career path	0 No value identified	
Well-being	0 No data exists	Predict well-being activity needs on employee level (physical and mental health)	0 No value identified	
Well-being	0 No data exists	Predict optimal amount of well-being activities to be offered	0 No value identified	
Well-being	0 No data exists	Predict return on investment on well-being activities i.e. best performing activities	0 No value identified	
Training	0 No data exists	Predict training needs on employee level	0 No value identified	
Training	0 No data exists	Predict return on investment of trainings i.e. best performing trainings	0 No value identified	
Training	0 No data exists	Predict optimal amount of trainings to be offered	0 No value identified	
Absences	0 No data exists	Predict employee absences	0 No value identified	

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