# HR Analytics:
# A case study on the internal employee mobility in a large multinational

*Analyze the internal employee mobility and career paths using employee data to find useful insights for the succession planning of an organization.*

**Student**: Roel van Etten (1275984)

**Supervisor**: Marinus Verhagen

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## Preface

Wow, it really was an adventures and wild ride with many ups and downs. Regardless of all effort and brain cracking moments, I enjoyed every single moment writing this master thesis. I was, and still am, very passionate about HR analytics and I am ready to discover even more of this fantastic field of expertise.

By this way I want to thank my closest friends and family for their encouragement and support. I would like to thank my thesis supervisor Marinus Verhagen for the endless help and feedback and I also would like to thank my colleagues Bastiaan, Mitchel & Sjoerd for their great ideas and technical support with Excel and Python.

At last, a big shout out to my inspirational mentor, colleague and founder of Crunchr, Dirk Jonker who provided me the opportunity to conduct this study. I really appreciated your time, your positive energy and motivational words that kept me on the road. Thanks for everything!

I hope you will enjoy this study as much as I did.

Roel van Etten, January 2018

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## Abstract

This is a case study that applies HR analytics methods and procedures to a specific problem in the domain of employee mobility (succession and career management). For the purpose of this research a large multination offered the opportunity to study a large employee data set. In this study, the employee data of 2015, 2016 and 2017 with more than 8000 employees is analyzed. First a literature review explored the movements or transitions that employees can make internally. The most important theories and mathematical approaches used in this study are based on studies by Rosenbaum (1979; 1984) who studied internal employee mobility and career paths. First, based on a literature study about internal employee mobility a model is created that help organizations to indicate job transitions in an employee dataset. Second, a method is created to discover how vacancies get filled in the organization, based on the vacancy chain model. Third, a method is created to analyze career paths in the organization. Finally the hypothesis studies the effect of high and low performance ratings on promotion, which is partially supported.



Key words: HR analytics, internal employee mobility, career paths, succession, employee data

# 1 Introduction

Human Resources (HR) practitioners, including all business units and partners involved in the HR process, make decisions about one of the most valuable resource of an organization, namely the employee including their knowledge, skills and abilities. Recently, this decision making process has changed to a more systematic approach, based on more evidence based management and decision making (Hota & Ghosh, 2013). Edwards and Edwards (2016) describe the systematic approach as HR analytics and they define it as: “The systematic application of predictive modelling using inferential statistics to existing HR people-related data in order to inform judgements about possible casual factors driving key HR-related performance indicators” (p.2) .

Until recently, the availability of organizational employee data was not easily accessible, obtainable and approachable for many (HR) practitioners, which can be explained by two different reasons. The first reason is the rise and introduction of HR information systems (HRIS) in the 1980’s and 1990’s, following by electronic HRM software (e-HRM) around the year 2000. These technological improvements and systems made it possible to record and work with employee data (van den Heuvel & Bondarouk, 2016). Secondly, organizations were, and still are, very reluctant in sharing confidential (sensitive) business information and data, as for instance employee data, with (HR) researchers. For the reason that the misuse of this information could lead to competitive threats (Wong, 2012).

Similarly, the scientific research area of HR analytics has not yet been explored comprehensively (Gal, Jensen & Stein, 2017; Marler & Boudreau, 2016), to illustrate a search on Google Scholar with the term “HR analytics” or "People analytics" only gives less than 1000 hits worldwide. This result is significant different in comparison with a search on terms as "data analytics" (+115.000 hits) or "marketing analytics" (+4500 hits). Although, HR analytics is for many (HR) practitioners an uncharted territory and many researchers think that HR is on the verge of a turning point. Van der Laken (2017) analyzed worldwide google search behaviors between 2004-2017 on terms as “HR analytics” and “People analytics” and found that the popularity on these terms increased. Furthermore, researchers state that in a few years HR analytics will be a leading phenomenon and the basis of many organizational (HR) decisions and strategies (Cascio & Boudreau, 2011; Edwards & Edwards, 2014; Ulrich & Dulebohn, 2015; van den Heuvel & Bondarouk, 2016). This relatively new rise of HR analytics has become part of the strategic (HR) decision making process of many (international) organizations and becomes more important and advanced in the next few years. Huselid (2014)

stated that analytics present the opportunity to help organizations understand what they do not yet know. By identifying trends and patterns HR practitioners and management teams can make better strategic decisions about future workforce challenges that may arise. HR analytics could offer the opportunity to help model and analyze employee data and examine patterns in order to help understand causal factors. To sum, the mentioned researchers all agree on the potential that the application of HR analytics could bring to business. Edwards and Edwards (2016) explain that HR analytics is about predictive modelling, methods or procedures which can be applied to specific cases or problems in HR domains as for instance, performance management, diversity management, recruitment and selection, strategic workforce planning or succession and career management. This study is a data-driven case study that applies methods and procedures to a specific problem in the domain of employee mobility (succession and career management).

Nowadays, organizations still have partial understanding of their current and future employee mobility and succession planning. Therefore, to make these strategic decisions is a challenge for many organizations. By the use of available organizational employee data it could be possible to analyze and understand internal employee mobility, including career paths in order to find useful insights for the succession planning of an organization. Therefore, the two main constructs central in this research are *internal employee mobility* and *succession planning*. The construct internal employee mobility is described by Hall (1996) and Sullivan (1999) as all the patterns of organizational transitions over the course of a person's work life. In the early 1980's the researchers Anderson, Milkovisch and Tsui (1981) proposed that the importance of understanding the internal employee mobility is necessary to ensure that the right number of the right employees will be at the right job at the right time in the future. The construct internal employee mobility can be viewed from different perspectives related to HR. From an organizational perspective internal employee mobility addresses topics as for instance, strategic workforce planning and career and succession management. Whereas, the economic perspective addresses topics as for instance, the make versus buy decision. The second important construct in this research is succession planning. Organizations need to identify and fulfil critical management positions for strategic application of leadership positions over time, in order to maintain organizational stability and continuation of performance (Rothwell, 2010).

As earlier mentioned, future research related to HR analytics is uprising and this research aims to contribute to the existing scientific knowledge about HR analytics methodology and the application of HR analytics in the domain of employee mobility. Edwards and Edwards (2016) state that "at present, most HR functions lack the capability to use the

available HR data to its full potential". Therefore, the use and aim of this research paper is to provide new HR analytics models, methods and approaches that can help organizations to better understand and analyze internal employee mobility and career paths. With the use of employee data it is possible to create new insights that help HR to maximize the utility and effectiveness of their succession planning. For organizations it is important to get the right employee, at the right time in the right place for economical purposes and sustainability of their competitive advantage.

This study is of an exploratory nature, because of the limited empirical research at the organizational level that is available about HR analytics case studies (Gal, Jensen & Stein, 2017; Marler & Boudreau, 2016). The research will be conducted within a large multinational and has three major phases. The first phase of this study is to understand internal employee mobility and transition movements in order to establish a model which helps organizations to determine internal employee mobility in the employee data. In the second phase of this research the model is centrally applied in order to validate and prepare the employee with the use of Excel. In the last phase several internal employee mobility theories will be tested with the data of the second phase.

Hence, the central research question that this research paper will answer is as following:

*"To what extent is it possible to find career paths in internal employee mobility and do these paths give insights in the succession of the employees in the organization".*

First the different theories related to this study will be explained. Then the research method will be explained and the results will be presented. Finally the discussion and conclusion of the study will be described.

# 2 Theoretical framework

The central topic in this research is internal employee mobility and in this part of the paper the theoretical background will be described. Other related theories as for instance, job transition movements, succession planning and the Markov model will be explained.

## *2.1 Internal employee mobility*

Employees *move* in an organization and this flow of workforce is influenced by several

individual, environmental and organizational factors (Anderson et al., 1981). Employees enter and leave the organization and can *move* in the organization itself. Employee mobility or job mobility is defined as all the patterns of intra- and inter-organizational transitions over the course of a person's work life (Hall, 1996; Sullivan, 1999). Several researchers (Anderson et al. 1981; Campion, Cheraskin, Stevens 1994; Hall 2002) state that intra-organizational job transitions are an important way to provide employees with new work experiences and opportunities for skill acquirement. Employee mobility is by various other researchers explained as the construct *career mobility* to "include everything from changing jobs to changing organization to changing occupations" (p. 351, Ng, Sorensen, Eby & Feldman, 2007). Furthermore, Ng et al. (2007) defined the construct *job changing* as "any substantial changes in work responsibilities, hierarchical levels, or titles within an organization" (p. 325) which includes internal promotions, transfers and demotions. Nicholson and West (1988) state there are three main mobility dimensions to distinguish: Status (upwards, lateral or downwards), function (same or changed) and employer (internal and external). Since this research is about the *internal* employee mobility and the internal career paths, the external mobility of employees that continue their career outside of the organization will not be included in this study.

### *2.2 Types of internal job transitions*

As earlier named in the introduction, inter-organizational transitions or job transitions are part of the definition of internal employee mobility. Ng et al. (2007) describes three different types of internal job mobility in an organization. The employee could internally move upwards (promotion), downwards (demotion) and lateral (lateral mobility). In addition, employees also enter organizations (entry) or leave organizations (termination).

#### *2.2.1 Promotion, demotion, lateral mobility*

The first movement, a promotion is traditionally the most desired type of job mobility because a promotion is associated with an upward transfer with increased responsibility and/or status, higher rewards and compensations, (Baker, Gibbs & Holmstrom, 1994; Forbes, 1987; Gutteridge, 1973; Rosenbaum, 1984; Rothwell, 2010; Tharenou, 1997). In addition, Turner (1960) suggests that employees promote because of their job performance.

The second movement is a *demotion*, which is the opposite of a promotion since it is a downward movement. A demotion is associated with a movement to a less important or lower position or occupational status in the organization (More, 1962). Mostly, a demotion is seen as a negative development in someone's career. According to Rothwell (2010) this assumption is

not utterly correct. In a situation where a business unit is disbanded through business or economic decisions, the most effective performers, from that business unit, could fill vacancies in other parts of the organization (temporary) to retain their high performance and possible (leadership) talent or improve their long-term career expectations.

The third movement is *lateral transfer* or inplacement, which is a cross movement through the organization. A lateral transfer is related to job rotations on temporary or permanent basis where an employee moves from one position to another as an element of organizational and personal development (Carruthers and Pinder, 1983; Heizer, 1976). Transferring employees across the organization has become a more common method when organizations downsize (Rothwell, 2010). In 1979 the researchers Pinder and Das viewed these transfers as "a more compassionate alternative to layoffs". Hall (2002) described lateral job transfers as valid alternatives for career paths that focus on climbing the organizational ladder.

### *2.2.2 New entries*

New employees that move into the organization are part of the recruitment and selection process of HR. In order to find successors for the new positions, HR needs to recruit and select the best possible candidates. However, hiring new employees from outside to fulfil positions in the organization could be a gamble, since the track records of these new hires are difficult to verify. Another reason could be that these new employees face difficulties in working harmoniously in the new corporate culture (Rothwell, 2010). Since these new employees have to adjust to the new organization, they can experience high levels of uncertainty about their job or various other uncertainties about organizational norms and culture (Morrison, 1995).

### *2.2.3 Termination*

Employees that leave the organization is described as *termination*, which is associated with layoffs, downsizing, reduction of workforce, firings, attrition. Furthermore, employees could also reach the age of retirement or, in a worst case scenario, become unable to work through mental or physical disorders due to illness and injury. The general perspective on termination is seen as a negative phenomenon, since people lose their jobs which creates a financial state of uncertainty. However, termination can be an effective tool to remove poor performers from their positions in order to open up opportunities for other employees who are seen as good performers or high potentials (Rothwell, 2010).

### *2.3 Features of job transitions in the employee data*

The assumption that employees move in an organization, would result in changes in the employee data. Based on several changes the employee dataset, it is possible to determine features that indicate whether an employee made a job transition. First a transition is recognizable by the most obvious change, namely a changed position title. However, a changed job title is in itself an empty concept, since it does not refer to a definable or demonstrable job transition. Nonetheless a changed position title gives an indication that something has changed, because some organizations use job evaluation systems and grading levels linked to position titles (Van Sliedregt, Voskuijl & Thierry, 2010). Thus, a changed position title would indicate a job transition. If this information is not available, it is important to define other features that could indicate a job transition. Ng et al. (2007) stated that a job transition result in changed grade levels, hierarchical levels, reporting layers or titles. Thus, in the employee data these changes could be visible. The following features are divided as subjective and objective. Object features are stand-alone features that determine a job transition and do not require a double check. Subjective features are features that require a double check, since a change in this feature could have underlying explanations. The features are explained below.

#### *2.3.1 Dates*

Officially an employee has a contract of employment linked to a (start/end) date. As part of the HR administration, organizations keep track of these dates. Three examples of dates that could be stored in the employee data are: Contract start and end date, start date current position and start date new contract type. In short, if an employee has a new position or contract, this will be shown in the data and is used as an objective indicator for a job transition.

#### *2.3.2 Position grades based on a job evaluation system*

Organizations use objective, systematic methods to distinguish jobs or positions based on levels of responsibilities and rewards. Organizations use these methods to establish a rational pay structure, in order to measure the value of jobs to one another and set the basic wage level for jobs. The measurement is based on job analysis and job evaluation systems (Van Sliedregt, Voskuijl & Thierry, 2010). Job evaluation systems consist of different scales that are related to general characteristics and job specific characteristics. The general characteristics are for instance knowledge, problem solving and responsibility. Job specific characteristics refer to supervision and working conditions (Van Sliedregt et al., 2010). In the study by Van Sliedregt et al. (2010) two widely used job evaluation systems are discussed, namely the *Hay*

*Guide Chart System* (Hay) and the *Integral Functional Analysis System* (IFA). The Hay system uses three main characteristics (knowhow, problem solving and accountability) and the IFA system has four main characteristics (knowledge and skills, independence, responsibility and working conditions). Thus, when organizations use these systems (or any other related job evaluation systems) changes in the characteristics and grades are traceable from the personnel records or employee data under the condition that these organizations track such records. Thus the objective indicator *grade* is used.

### *2.3.3 Hierarchical layer or reporting layer*

Organizations have different hierarchical management layers, also known as reporting layers, in their organizational structure. Employees work in certain job positions in a specific layer and have to report to a supervisor. Ng et al. (2007) defined that a job change includes substantial changes in for instance hierarchical levels. Furthermore Baker, Gibbs and Holmstrom (1994) also used the hierarchical layer in their study as an indicator to study transition. Therefore, a changed job with another hierarchical/reporting layer indicates a transition and will be shown in the data. This feature is a subjective indicator, since it could be possible that hierarchical layers can shift due to reorganizations (downsizing or layoffs) and therefore this needs to be investigated more precisely.

### *2.3.4 Direct and indirect span of control*

In addition to the hierarchical layers, employees could experience changes in their span of control. For instance when an employee makes a promotion and the responsibilities grow the employee could became responsible for leading a bigger team. A bigger team would result in a higher span of control. If organizations keep track of such records, this will be shown in the data and therefore this is used as an objective indicator.

### *2.3.5 Functional area/business unit or department*

It could be possible that an employee changes from functional area, business unit or department, which could indicate that the employee has a different job with other responsibilities. This occurs for instance when an employee experience a lateral movement to another job with the same hierarchical level (Ng. et al, 2007). Therefore, if available in the data, this could be used as an objective indicator for a job transition.

Given these features it enables researchers and organizations to determine job transitions in the

employee data. Eventually, these features are used to create a model that detects job transitions in the employee data. In the method section of this study, a detailed explanation about the usage of this model is described.

### *2.4 A deeper understanding of employee mobility*

The importance of understanding employee mobility of an organization is early in the 1970's and 1980's discussed by several researchers (Doeringer & Piore, 1971; Miner & Miner, 1973; Anderson et al, 1981). The mobility of employees is a major facet of the HR planning to make sure that the organization achieves its goal to get the right (number of) employees, at the right place in the right time in the future, capable of doing the things that are necessary (Miner & Miner, 1973). Doeringer and Piore (1971) state that future decisions are made to allocate HR to these so called 'right places', so that they need to take into account mobility rates for various subgroups, as for instance leadership positions or *career paths* for different groups that include administrative policies, rules and procedures that monitor movement. In several studies by Rosenbaum (1979; 1984) about internal employee mobility these career paths and patterns within the organization are investigated. In his studies he developed an employee mobility model named *the tournament model*.

The basic idea of the tournament model is that employees' career paths and patterns within organizations are the result of a competition process, which Rosenbaum (1984) defines as career tournaments. The tournament approach is built on the vacancy chain model which focuses on promotion chances and higher positions in hierarchically structured organizations. These positions are described as "rare". Several employees are candidates for these rare positions, and only a few which are called "the winners" fulfil these positions. On the other hand, this career tournament or promotion process leaves numerous "losers" behind. The essence of the tournament model is that employees compete for a promotion, which leads to the existence of a vacancy chain: A new vacancy is filled, results in the fact that the previous job of this employee becomes vacant. Internal movements are influenced by vacancy chains, since employees can only move(up) in the organization if there is a position vacant *under the condition that the organization did not create a new or different position within the organization*.

The vacancy chain theory is explained by Rosenfeld (1992) based on previous studies from White (1970). The mobility movements depend on the available positions in the organization and are interdependent on the filling of jobs. An employee moves to a new position or moves out the organization (termination), which creates an open job position that

could be filled. Another employee within the organization, moves into this job, which leaves his or her previous job vacant and so on. Eventually a vacancy chain will end, when a person outside of the organization (new entry) fulfils the vacant job. To summarize, jobs can be created or destroyed, but "they exist independently of particular incumbents" (p. 42). The first proposition in this research concerns the vacancy chain theory. If an employee makes a promotion, this means that the previous job will become vacant. This 'gap' can be filled by another employee in order to sustain continuity of the organizational performance. This reasoning, results in the first proposition:

*P1: The vacancy chain model exists in the organization where upward job transitions result in former job positions becoming vacant which are filled in by other employees.*

Rosenbaum (1979) discusses also another method to analyze historical effects by the use of a simple transition matrix, which is based on the Markov chain theory. The Markov chain theory could be used to define, predict and control employee mobility. Markov models show the probabilities of moving from each time one position to each time two by using transition matrices, in order that inferences can be made about the consequences of transition matrices based on assumptions. Rosenbaum (1979) explains the basic principle of Markov models by a quote from Mayer (1972) who refers to the *principle of path independence*. Mayer (1972) explains the *principle of path independence* as follows: Two people have different status histories, however their status levels at the time recorded are identical to another, for instance when they enter the same position in the organization. A transition matrix would create identical future predictions about their mobility and therefore, their position in the organization. In order to analyze the internal employee mobility with a transition matrix, historical employee data needs to be available. This study analyses the career paths of employees. The application of these analyses and matrices are further explained in the method section of this research paper.

There is another important field of expertise which could be linked to HR analytics, namely *supply chain management* (SCM). For organizations it is necessary to create a balanced workforce by bringing the labor supply and the organizational demand together. SCM is explained by Mentzer et al. (2001) as "the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes to improve the long-term

performance of the individual companies and the supply chain as a whole" (p. 18). In short, the essence of SCM is to bring the supply and demand together by optimized processes to prevent possible waste in order to create competitive advantage for the organization (Mentzer et al., 2010). In HR this theory or process is applied and known as strategic human resource planning (SHRP) or strategic workforce planning. Ulferts, Wirtz and Peterson (2009) explain the process of SHRP in four different steps. The first step is to assess the current human resource capacity. The second step is forecast the human resource requirements. After the forecast, HR can make a gap analysis and check if there is a disbalance between the labor supply and the organizational demand. The last step is to create an HR strategy that works towards creating a balanced workforce. Hence, if an organization understands the internal employee mobility and transitions, this would contribute to new insights to create a balanced workforce.

Since organizations want to understand how to get the right employee, at the right time in the right place in the organization, it is important to understand the internal employee mobility. The core of this study is to find career paths based on path dependency. The term "paths" is a metaphor that sees a career as a journey (Inkson, 2004). This metaphor includes two different facets of a career, namely time (which is shown as the history of someone's career) and directions that refer to the job transitions (Adamson, Doherty & Viney, 1998; Inkson, 2004). A series of career movements would indicate a career path with the assumption that every career move, in combination with the competition process of the tournament model, depends on the previous move. Therefore, these career paths are not based on a random process. To investigate the path dependency in careers results in the second proposition of this study:

*P2: Career paths in organizations and are based on path dependency*

Career paths imply a route which one is following and have a direction that links the successive positions over time (Adamson et al., 1998). However, it is no longer apparent that career paths can be logical and purposeful, because career moves can be diverse as for instance upwards, downwards or cross movements (Baruch, 2004; Inkson, 2004). Thus, employees can move internally from one functional area to another. In short, career paths do not have internal limits. This results in the third proposition:

*P3: Career paths do not solely exist in one functional area*

### *2.5 Succession, succession planning and high performing successors*

Succession is described as the order in which one employee after another succeeds to a title. An organization can ensure their employee succession to plan for successor to assume key leadership or backup positions. By planning succession, the organization ensures that there is stability of the tenure of personnel for the continuation of the effective performance of an organization and, for instance strategic application of leadership positions over time. Succession planning is described as "identifying critical management positions, starting at levels of project managers and supervisors and extending up to the highest position in the organization" (Rothwell, 2010). Besides succession planning, organizations need to manage the succession. Succession management focuses on continuing, daily efforts to build successors within the organization. Thus, succession planning and succession management are important within an organization to meet current or future needs of the organization.

The identification of these critical positions is the first step, while the fulfilment of these positions is the second step, which is described by Collings and Mellahi (2009) as part of the process of strategic talent management. In addition, Collings and Mellahi (2009) mention in their study that it is important that high potential or high performing employees fulfil these roles. The relation between performance and promotion is in early sixties studied by Turner (1960) who suggests that employees promote because of their job performance. More recently, the relationship between performance career progressions is also been studied by Carmeli, Shalom, and Weisberg (2007) and they conclude that job performance is the only major predictor of promotion. Therefore, Employees marked with a high performance rating are more likely to be seen successors in the organization. Thus, it is likely that these employees get promoted more often than employees with a low performance rating, which results in the following hypothesis:

*H1: Employees with a high performance rating get promoted more often than employees with a low performance rating*

In the next section of this study, the research method will be explained.

# 3 Methods

In this section the research methodology will be explained. First, the research design and the sample will be discussed. After the sample, the research procedure, methods and analyses will be discussed.

## *3.1 Research design and research sample*

A large multinational, active in the global information services industry, was willing to provide their data for this study, which created a unique opportunity to carry out a case study among employees employed in the United States. The research design of this study is of quantitative nature, since it studied personnel records. The employee data covers three different years, namely 2015, 2016, and 2017. Therefore, this research is a longitudinal study. The data contains personnel records from more than 8.000 employees including the employee IDs, gender types, hire dates, employee grades, position titles, performance ratings and functional areas from the past three years. In total three different measurements, namely t0 (2015), t1 (2016) and t2 (2017) have been done. In the preliminary phase, the data quality was validated and cleaned. To ensure anonymity of the employees, names and other personal information were deleted. To ensure anonymity of the organization, position titles and functional areas were anonymized. An overview of the data characteristics can be found below in Table 1.

| ***Year*** | ***2015*** | *Period 1 (2015-2016)* | ***2016*** | *Period 2 (2016-2017)* | ***2017*** |
|---|---|---|---|---|---|
| Headcount | 8029 | | 8665 | | 8820 |
| Gender (male) | 49.2% | | 48.4% | | 50.2% |
| Mean organizational tenure (years) | 9.47 | | 9.21 | | 9.32 |
| s.d. organizational tenure (years) | 8.63 | | 8.71 | | 8.81 |
| New hires | | 1773 | | 1271 | |
| Leavers | | 1137 | | 1116 | |

*Table 1. General data information*

### *3.1.1 Headcount, new hires and leavers*

The headcount is based on a count of the employee ID's in the dataset. Every year employees enter and leave the organization. With the use of a function in Excel it is possible to detect new hires and calculate the number of leavers between different time slices, which is described in the table as a period. This function works as follows. If the employee ID in the

second time slice does not occur in the first time slice, this means that the employee is a new hire. The opposite approach works to detect leavers. If the employee ID in the first time slice does not occur in the second time slice, this means that the employee left in the period between the time slices. Hence, the first time slice is compared with the next and so on. In 2015 the headcount was 8029 employees. Between 2015 and 2016 (Period 1), 1137 employees left the organization and 1773 employees entered the organization. In total the headcount increased with 665 employees, with result that the organization had 8665 employees in 2016. Between 2016 and 2017 (Period 2), 1116 employees left and 1271 entered the organization with the result that the headcount increased with 155 employees to 8820 employees in 2017.

### *3.1.2 Gender distribution and organization tenure*

The gender distribution was evenly distributed. In 2015 the organization had 49.2% male employees. In 2016 this was 48.4% and in 2017 there were 50.2% male employees. On average the employees had an organizational tenure of 9.47 (SD = 8.63) years in 2015 which slightly decreased to 9.21 (SD = 8.71) years in 2016. In 2017 the organization tenure increased to 9.32 (SD = 8.81) years.

## *3.2 Procedures and methods and analyses*

This research contains three different phases. The first phase in this research focused on what features determine a job transition, which were described earlier in the theoretical background of this research (part 2.3). Based on these features a model (a flowchart) was created (Appendix 1). This flowchart is designed in such way that it works most efficient as possible. The reason why the position grade is taken as the first feature, is because this is the least complex feature that can be checked. In addition, this model is optimized during the entire study period. The reason to use this model was to distinguish employees that made a job transition from the employees that made no job transition. This model works as follows: Every employee is linked to an unique identifier (employee ID), therefore the employee ID is used as the starting point to track individual changes over time. Every step in the flowchart contains a feature, as for instance the *position grade,* and when this feature changes it gives an indication that the employee made a job transition. The model questions, as it were, the given features. An example as such question was: *"Is there a change in the position grade"?* If the question was answered with a "yes" then the employee possible made a job transition, if the answer was a "no" then the employee was checked with the next indicator. In the case that there was no changed value or state, it assumed that the employee made no job transition. Subsequently, the

model can be computerized into a software tool with VBA (Visual Basics for applications) or Python[I] so that this model, in combination with for instance Excel, can be used to analyze employee data.

The second phase, which was an important preliminary phase to the data analyses, was the data preparation phase. In this phase, different data tables were created in Excel with the VLOOKUP (vertical lookup) and COUNTIF function based on the features described in the model (Appendix 1). The features that were available in the data were *position grade levels, functional areas and position titles*. In the first step, the VLOOKUP function was used to track the employees' state per time slice, so that the state between the time slices could be compared. As an illustration this function can be explained as follows (note: in this example the state that will be checked is the employees' position grade level). An employee fulfils a position title assigned with grade level five. In the next time slice, this employee got promoted to another job with grade level six. In the next step, the transitions were counted with the COUNTIF function. The COUNTIF function can be applied to count the number of cells that meet a single criterion. If the cell met the criterion, Excel returned this as value "1"; if the cell did not meet the criterion Excel returned this value as "0". An example of the criterion that was used: *"Did the grade of the employee change?* The answer to this question was *yes* which meets the criterion and returns the value "1". The same procedure was also used to identify other feature changes. With the results from the VLOOKUP and the COUNTIF functions, it was possible to create multiple data tables based on grade levels, functional areas and changed position titles between the different time slices. Based on these data tables, it was possible to create transition matrices. A transition matrix is used to describe the transition that employees move from 'X' to 'Y' (or the opposite). The idea behind the transition matrix is straightforward and can be explained by the following example with ten employees: Five employees moved from position "A" to position "B" in a certain time period. However, five other employees moved from position "A" to position "C". This means that five out of ten employees (50%) moved from position "A" to "B" and the other 50% moved from position "A" to "C". In short, by computing all outcomes, it was possible to compute transitions for all possible state changes, which was used as input for the analyses of the propositions.

In the last phase of this research the propositions and the hypothesis were investigated. Each proposition covered a different topic and requires different transition matrices. Apart from the use of these tables and matrices, each proposition had a detailed analysis.

[I] *An object-oriented, high-level programming language which can be used for processing scientific data*

### *3.2.1 Analysis proposition one*

The first proposition investigated the vacancy chain model, which focused on the positions that became vacant due to internal employee mobility. In the analysis of this proposition the several mathematical calculations were carried out on both data matrices which are found in appendix 2a and 2b.

In the first step, all the vacant positions that are filled were calculated. The vacant positions were filled in three different ways, namely by promotion, demotion or new hires. To count these positions, a sum is taken of the headcount of all employees that moved into a specific grade level (y). This number includes all new entries that entered a specific layer (a), the sum of employees that demoted to a specific layer (b) and the sum of employees that promoted to a specific layer (c):

$$a + b + c = y$$

The next step is to understand how these vacancies get filled and the following calculations were carried out. First the percentage of vacancies that filled by new hires was calculated by the sum of all new entries that entered a specific layer (a) divided by the total headcount of all employees that moved into a specific layer (y):

$$\frac{a}{y}$$

Second, the percentage of vacancies that filled by demotion was calculated by the total of employees that demoted to a specific layer (b) divided by the total of headcount of all employees that moved into a specific layer (y):

$$\frac{b}{y}$$

Third, the percentage of vacancies that filled by promotion was calculated by the total of employees that promoted to a specific layer (b) divided by the total of headcount of all employees that moved into a specific layer (y):

$$\frac{c}{y}$$

Eventually, based on the outcomes of these calculations, an average was calculated over the periods 1 and 2 which can be found in the results section of this study.

### *3.2.2 Analysis proposition two*

The second proposition is a career path analysis with the use of a simple transition matrix. In the first step of this analysis, a data overview of every position title movement between 2015- 2016 (Period 1) and 2016- 2017 (Period 2) was created. Based on this analysis

there were 1563 different position title movements found. However, some position moves occurred more frequently, since more employees experienced the same movement. In the second step, the most common movement was selected as starting point in this career path analysis. The reason why the most common movement is picked, was because it would be too complex to analyze all movements and all possible paths manually and it would take weeks of software development to create a tool that could do this. A draft for such tool can be found in appendix 5, which will be elaborated in the end of this paper. Hence, to study this proposition the focus solely lay on the career path of the most common position title movement.

### *3.2.3 Analysis proposition three*

The last proposition is about the movements between functional areas. For the analysis two transition matrices were created in the second phase of this research. Both transition matrices can be found in appendix 3. The average internal employee mobility in the functional areas in the period 2015 - 2017 is shown in the result section of this study.

### *3.2.4 Analysis hypothesis one*

With the use of SPSS the one-way repeated measures analysis of variance (ANOVA) was applied to test whether the outcome of the analysis was significant. In the hypothesis, the relation between the performance rating and the experienced promotions of employees were studied. The sample that was selected for this hypothesis was based on employees that were present between 2015 and 2017. In total 5047 employees got included in this selection. For this measurement the performance ratings of $t^0$ (2015) and $t^1$ (2016) were included. The reason why the performance ratings of $T^2$ (2017) is excluded, is because this is linked to the *possible* promotions of the period 2017-2018, and this data was not available. The analysis of this hypothesis is further explained in the result section of this study.

In the next section the results of this study are discussed.

# 4 Results

The results of the study are shown in this section. In the first part the results of the propositions will be explained. In the last part, the analysis of the hypothesis will be described.

## *4.1 Proposition one*

The first proposition investigates the vacancy chain model and assumes that upward job transitions result in former job positions becoming vacant and eventually filled in by another employee. Since our data provided the *position grade* of employees, which is described in the model (Appendix 1) as a possible data indicator, this feature is used to analyze possible upward and downward job transitions the data. To investigate this proposition, two transition matrices between the periods 2015-2016 and 2016-2017 are created (appendix 2a and 2b). These two matrices show the employee mobility between the levels of the position grades. Thus, if employees move to an upward position (promote) this means that they move into a higher grade level, which creates a vacant position in their former grade level.

With the transition matrices, it is possible to measure the percentage of the filled vacancies. The calculation that is used, is described in the method section of this study. The result of the analysis shows that vacancies are filled in by new hires and internally by promotion and demotion. The results of the calculations of both matrices are taken together as an average and are shown below (Table 2).

| Grade level | Vacancy filled in by new hires (external inflow) | Vacancy filled in by demotion (internal) | Vacancy filled in by promotion (internal) | Total employees per grade level on average |
|---|---|---|---|---|
| **1** | 90.16% | 9.84% | 0.00% | 173 |
| **2** | 80.56% | 9.28% | 10.17% | 552 |
| **3** | 55.20% | 20.23% | 24.57% | 866 |
| **4** | 62.32% | 11.99% | 25.69% | 643 |
| **5** | 67.70% | 9.37% | 22.93% | 971 |
| **6** | 67.40% | 7.33% | 25.26% | 1465 |
| **7** | 60.65% | 5.31% | 34.04% | 1404 |
| **8** | 64.70% | 2.11% | 33.19% | 534 |
| **9** | 57.81% | 1.03% | 41.16% | 388 |
| **10** | 49.37% | 2.98% | 47.65% | 150 |
| **11** | 82.35% | 0.00% | 17.65% | 53 |
| **12** | 62.50% | 0.00% | 37.50% | 17 |

| | | | | |
|---|---|---|---|---|
| **13** | 100% | 0.00% | 0.00% | 6 |
| **14** | n/a | n/a | n/a | 2 |

*Table 2. Average of filled vacancies in period 2015-2017*

In general, the external inflow of employees is in every level the most dominant way of filling in vacancies. The table shows that the lowest percentage (49.37%) of new hires is in level 10, which means that more than half of all vacancies were filled in by newly hired employees. Furthermore the higher grade level, the more vacancies were filled in by promotion and the fewer vacancies were filled in by demotion (apart from outliers). A detailed analysis shows that the first grade level, which is the lowest grade level in the organization, has almost the highest percentage of new hires. Since it is not possible to have employees promoted to the first grade level, the promotion percentage is zero. However, there are some employees that demote from higher levels back to the first grade level. The third grade level has the highest percentage of demotion and the most employees that experience a demotion to the third grade level come from grade level four (appendix 2). The demotion of the third grade is exceptionally high compared to other demotion percentages in this analysis. Thus, this outcome is firm-specific and can be seen as an outlier. The ninth grade level has the least demotion. The tenth grade level has the highest percentage of promotion and the employees that experience a promotion, come from grade level seven, eight and nine. Remarkably, vacancies in the 13$^{th}$ level are solely filled by new hires. At last, there is no mobility at all in the highest grade level (level 14).

Admittedly, it is complicated to test the vacancy chain model properly due to organizational growth and newly created positions. The vacancies were not solely filled in by promotions but also by demotion and even the most dominant way of filling vacancies is by new hired employees. The vacancy chain model exists when an employee makes a promotion, which means that the previous job will become vacant and this ‘gap’ can be filled by another employee. However, a vacancy chain will end when a person outside of the organization (new hire) fulfils the vacant job, which occurs frequently (half of vacancies are filled by new hires). Therefore, this proposition is barely supported.

### *4.2 Proposition two*

The second proposition analyzes all career path movements in the organization in 2015, 2016 and 2017. Career movements could indicate a career path in the organization with the assumption that a career move depends on the previous move. To test this proposition, the most

frequent position title movement is selected as starting point in this analysis. In terms of organizational confidentiality, the official position titles will be left out in this study. Therefore the starting position in this analysis is described as position 'A' which continues in alphabetical order to describe a career path. Furthermore, position A is rated with grade level two and is a staffing position. In total there are 58 employees employed in position A. The career path starting from position A ends after six steps in position G (a senior top management position) and these employees do not move to other positions.

In total, 96.6% of all employees that work in position A, move to position B. This is the most dominant movement to a single position. A small group of employees (1.7%) that start in position A move to one other position which is an upward promotion. The remaining employees (1.7%) move to one other position with the same grade level. The career moves of employees that start in position A are visualized in figure 1a.

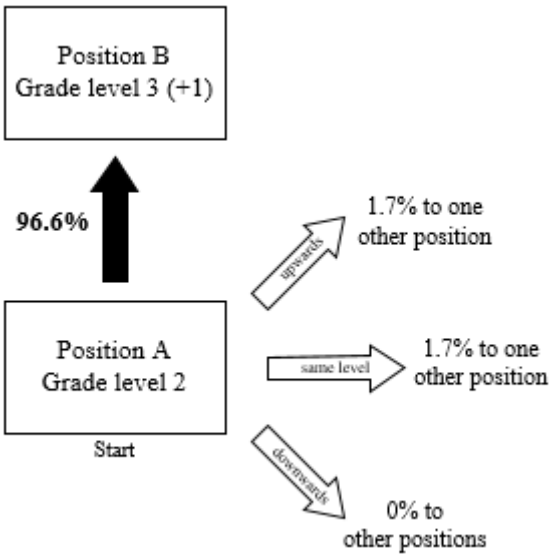



*Figure 1a. Career path possibilities from position A.*

The analysis continues with position B. The most dominant movement to a single position is experienced by 65.9% of the employees that move upwards to position C. Other employees (31.7%) move upwards to eight different positions. The remaining employees (2.4%) demote to one other position. The career moves of employees in position B are visualized in figure 1b.

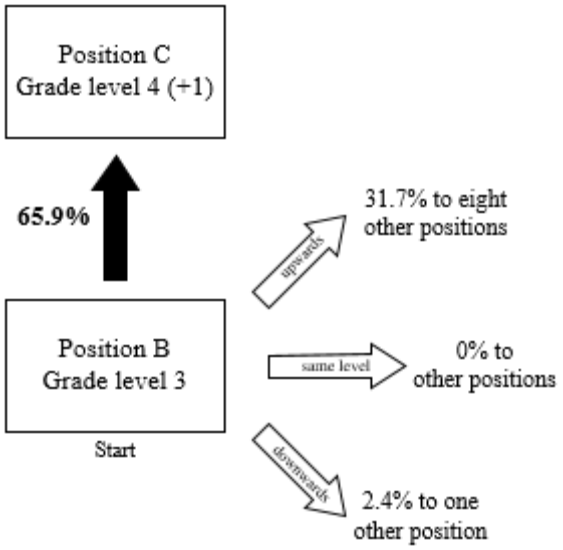



*Figure 1b. Career path possibilities from position B.*

The analysis continues with position C. The most dominant movement to a single position is experienced by 23.8% of the employees that move upwards to position D. Other employees (61.9 %) move upwards to eight different positions. There is also a group of employees (9.5%) that move to two different positions with the same grade level as they were. The remaining employees (4.8%) move downwards to one other position. The career moves of employees in position C are visualized in figure 1c.

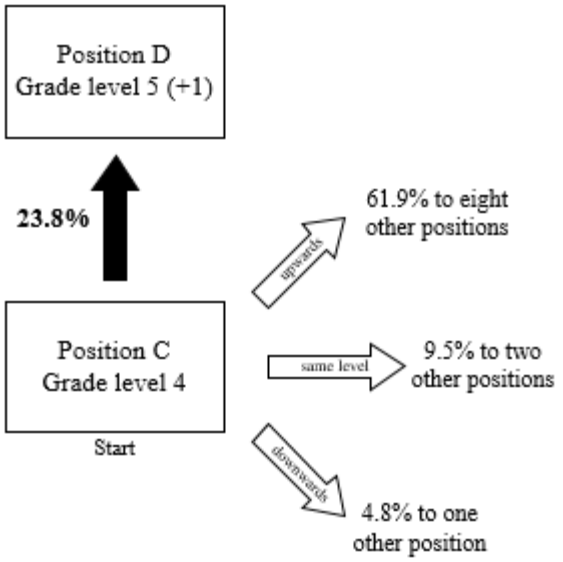



*Figure 1c. Career path possibilities from position C.*

The analysis continues with position D. The most dominant movement to a single position is experienced by 62.5% of the employees that move upwards to position E. Another group of employees (25%) move upwards to two different positions. The remaining group of employees (12.5%) move downwards to one other position. The career moves of employees in position D are visualized in figure 1d.

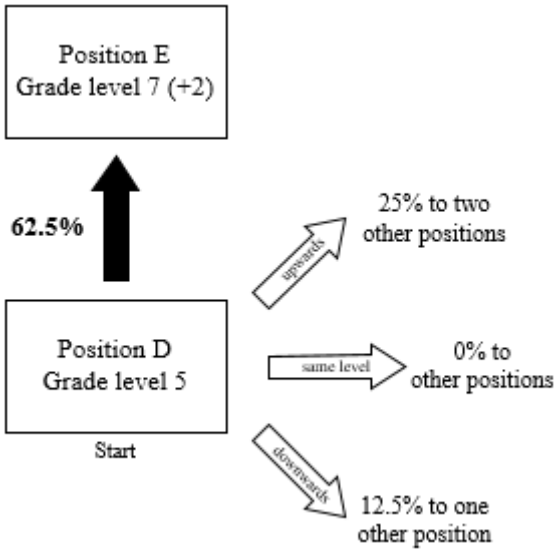



*Figure 1d. Career path possibilities from position D.*

The analysis continues with position E. The most dominant movement to a single position is experienced by 23.8% of the employees that move upwards to position F. One third of the employees (33.3%) move to seven other positions with the same grade level and 42.9% of the employees experience a demotion and move downwards to six other positions. The career moves of employees in position E are visualized in figure 1e.

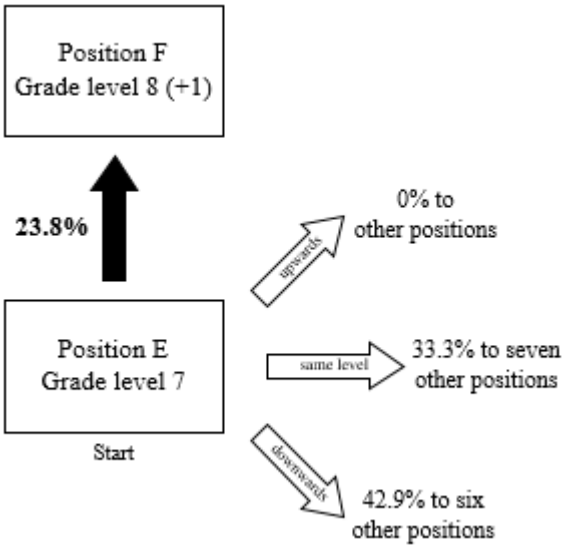



*Figure 1e. Career path possibilities from position E.*

The last position movement in this career path analysis starts with position F. The most dominant movement to a single position is an upward movement to position G, which is experienced by 50% of the employees. The remaining employees (50%) move to two other positions, which are downward movements. The career moves of employees in position F are visualized in figure 1f.

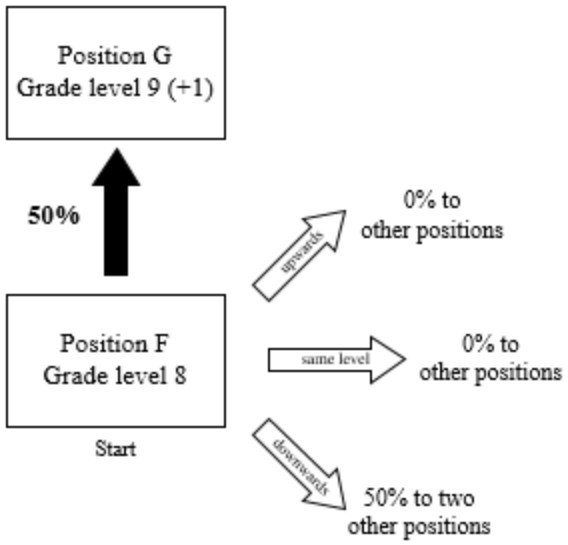



*Figure 1f. Career path possibilities from position F.*

As result of the career path analysis where a specific start position is selected, is it possible to create a career path based on the most dominant movements to a single position. This career path is an upward path, which starts in grade level 3 and ends in grade level 9. The path is shown below in figure 2.

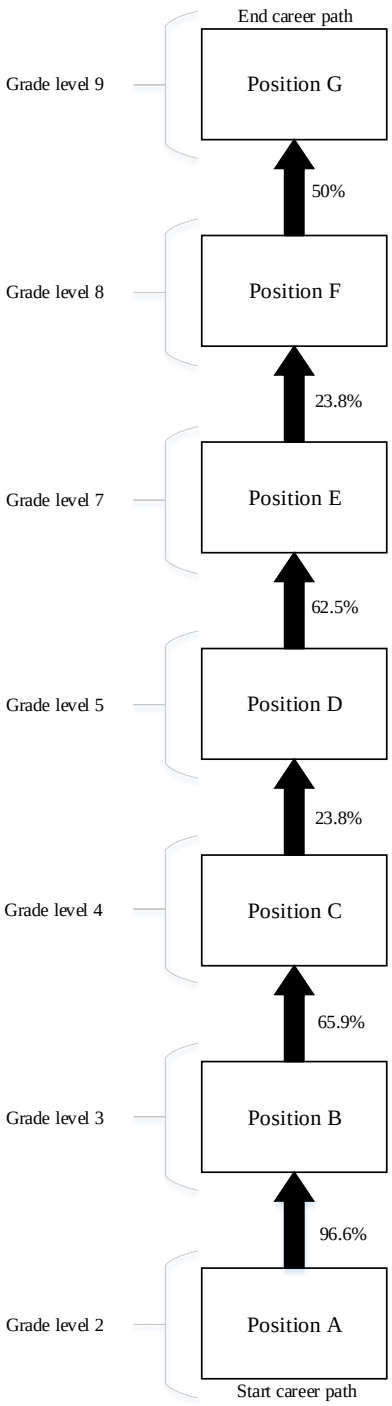



*Figure 2. Organizational career path based on the most common transitions starting in position A*

Hence, these results indicate that a career path exist which is based on a specific sequence of most dominant career movements to a single position. Therefore, this specific case supports the assumption that series of career movements can depend on previous movements.

### *4.3 Proposition three*

The third proposition investigates if employees move between functional areas. The proposition assumes that career paths do not have internal limits and that employees do not solely have a career in their own functional area. The mobility between the functional areas can be found in appendix 3. The average internal employee mobility in the functional areas in the period 2015 - 2017 is shown in the transition matrix below (Table 3).

| **Functional area** | **to** | | | | |
|---|---|---|---|---|---|
| **from** | **A** | **B** | **C** | **D** | **E** |
| **A** | 94.67% | 3.43% | 0.21% | 1.69% | 0.00% |
| **B** | 2.05% | 94.05% | 1.15% | 2.75% | 0.00% |
| **C** | 0.00% | 2.19% | 95.51% | 2.16% | 0.14% |
| **D** | 0.37% | 3.58% | 0.79% | 94.09% | 1.16% |
| **E** | 0.00% | 0.00% | 0.00% | 0.57% | 99.43% |

*Table 3. Average internal employee mobility between functional areas 2015-2017*

The organization has five different functional areas to distinguish. Employees that for instance work in functional area 'A' stay in area 'A' or move to other areas. Table 3 shows that 94.67% of the employees that work in area 'A' stay in the same area between period 2015 and 2017. In total 5.33% of the employees that work in area 'A' move to other areas. Remarkably, none of the employees that work in area 'A' move to area 'E'. Similar to area 'A', 94.05% of the employees that work in area 'B' stay in their own area and do not move to area 'E'. Almost six percent (5.95%) of the employees that move from 'B' to other areas. In area 'C' 95.51% of the employees stay in their own area. Only 4.49% of the employees that work in area 'C' move to other areas, remarkably there is no movement to area 'A'. The most employees in area 'D' stay in their own area (94.09%). The total of employees in area 'D' that move to other areas is 5.91%. In addition, employees in this area move to all possible areas. The last functional area 'E' has the least movements. The most employees (99.43%) in this area stay in their own area and solely move to area 'D'.

To summarize, most employees stay in their own functional area. However, a small group of employees move between functional areas which shows that employees do not solely stay in their own functional area. More precisely, a detailed analysis of one individual career path supports this outcome: Employee 'EMP_ID0001' worked in area 'A' (grade 3) and one year later this employee got promoted to a position in area 'B' (grade 4).

Hence, these outcomes support the assumption that career paths do not solely exist in one functional area, because employees move between the functional areas. Therefore, the careers of employees are not limited to solely one functional area.

### *4.4 Hypothesis one*

In this hypothesis, the performance rating of the employees is analyzed. The performance ratings which are used in this analyses are linked to the annual employee performance review ratings. This hypothesis assumes that employees with a high performance rating get more often promoted than employees with a low performance rating. In the data there are five different performance ratings to distinguish starting from one till five, where one is the lowest and five is the highest performance rating. The sample that is selected for this hypothesis is based on employees that were present in all time slices. In addition, the performance rating that is selected for this analysis is the performance rating that the employees had in t0 and t1. In total 5047 employees were included in this selection. Since there are two different periods points used in this study (2015-2016, 2016-2017) employees could experience a maximum of two promotions. In total 4137 employees experienced no promotion and they have an average performance rating of 3.298 (SD = .008). In total 880 employees experienced one promotion with an average performance rating of 3.453 (SD = .017). The last group of employees had two promotions which is experienced by a small group of 30 employees with an average performance rating of 3.433 (SD = .090)d dfg…aksdflkj) To study the effect of the performance rating on promotions a one-way repeated measures analysis of variance (ANOVA) was applied to test whether the outcome of the analysis was significant. In general, the results show that the performance ratings differs significantly ($F=36.263$, $p<0.001$) of the three promotion levels. However, a Post Doc test (Tukey) only shows significant ($p<0.001$) differences between none and one experienced promotions. There are no significant ($p>0.10$) differences found between the employees that experienced none or two promotions or the one or two promotions. Furthermore, the results show that the perceived performance rating changes are not significantly over time ($F= 0.046$, $p>0.05$). In addition, the results show that there is no linear effect of performance ratings on promotions between t0 and t1 ($F=1.459$, $p>0.05$). The SPSS output can be found in Appendix 4.

To conclude, the results of the analysis of variance show that the hypothesis [employees with a high performance score get more often promoted than employees with a low performance score] is partially supported. In general employees that experienced none promotions have lower levels of performance ratings compared to employees that experience

one promotion. Employees that experience two promotions have a slight lower average on their performance rating than employees that experience one promotion. However, the performance ratings of 2015 and 2016 changed and were not related to another, which makes it not possible to discover significant results between performance ratings and promotions over time.

# 5 Discussion and conclusion

In the last part of this research the results will be discussed. In the first part, the theoretical contribution and major findings are explained. In the second part, the research limitations of this research are discussed. In the last part, the final recommendations for future research and practical use of this research are described.

## *5.1 Theoretical contribution and major findings*

Edwards and Edwards (2016) state that most HR functions lack the capability to use the available HR data to its full potential. However, researchers in the field of HR analytics all agree on the potential that the application of HR analytics could bring to business (Cascio & Boudreau, 2011; Edwards & Edwards, 2016; Ulrich & Dulebohn, 2015; van den Heuvel & Bondarouk, 2016). This research contributes to the field of HR analytics by testing and finding new HR analytics models, methods or procedures in order to 'shorten' the gap described by Edwards and Edwards (2016). Furthermore, this research contributes to the field of research in HR analytics applied in the domain of employee mobility. Since employees (including their KSA) are one of the most valuable resource of an organization, it is important to understand how they move inside an organization so that HR can make deliberated strategic decisions about the workforce and succession. In order to contribute to the field HR analytics in the domain of employee mobility, this research focused on the following research question: "To what extent is it possible to find career paths in internal employee mobility and do these paths give insights in the succession of the employees in the organization". For the purpose of the investigation of this study, a multinational offered the opportunity to study a large employee data set. In this explorative case study, the employee data of 2015, 2016 and 2017 with more than 8000 employees is analyzed.

Firstly, a model is created which helps organizations understand how employees move in an organization. With this model (appendix 1) organizations can detect possible job transitions in their data. Second, a method is created to discover how vacancies get filled in the organization, based on promotion, demotion and by external inflow of new hires. Third, a

method is created to analyze career paths in the organization, based on the literature study on employee mobility. In addition, the possible practical application of this analysis is explained later in this study which elaborates on an idea for an HR analytics tool for organizations. Lastly, HR analytics has not yet been explored comprehensively (Gal, Jensen & Stein, 2017; Marler & Boudreau, 2016). Therefore, this research contributes to scientific research area of HR analytics, applied in the field of employee mobility due to empirical findings by studying historical employee data from a large multinational with a sample of 8000 employees.

### *5.1.1 Proposition one*

The first proposition investigates the vacancy chain model. The results show that this proposition is barely supported. The higher the grade level, the more vacancies are filled by promotion and the fewer vacancies are filled by demotion. However, (new) vacancies are also filled by new hires which is the most dominant way of filling vacancies in all levels. The results of the vacancy chain model analysis can be clarified by the three transitions (new hires, demotions and promotions). The most dominant transition is the inflow of employees that enter the organization (new hires) which occurs in every grade level except for the highest level. The results show that the lowest percentage of new hires is not lower than 49.37%, which means that roughly more than half of all vacancies in all levels (excluding the highest level) were filled in by newly hired employees. In the highest grade levels (11, 12 and 13) the external inflow is even more than 50%. A vacancy chain will end when a person outside of the organization (new hire) fulfils the vacant job, which occurs frequently (half of vacancies are filled by new hires). Therefore, this proposition is barely supported.

The explanation why the organization hired new employees can be explained by two different reasons. The main reason is that the organization grew between 2015 and 2017. This growth is visible in the general data information (table 1). In total the headcount of the organization increased with 636 employees in the first year and 155 in the second year. Therefore the organization created new or different positions in every grade level, which resulted in hiring new employees. Another reason why an organization hires new employees is, because the organization could need particular human capital which is not available in the current workforce. Lepak and Snell (1999) describe that organizations utilize different approaches to allocate human capital. They state that organizations ‘make’ or ‘buy’ their human capital, which refers to internally develop employees (to create the required capital) or acquire employees from outside of the organization. Thus, the high external inflow in the organization could indicate that the organization encounters difficulties with developing the right employee

internally to fulfil the (top) positions in the organization which suggest probably some issues.

The second transition is the internal movement of employees that make a promotion. Opposite to demotion, a promotion associated with high or good performance (Fairburn & Malcomson, 2001; Rothwell, 2010). As described in the literature review of this study, the vacancy chain model is based on the tournament approach and both models focus on promotion chances and higher positions in organizations, which is linked to succession (Rosenfeld, 1992). The results show that the higher the grade level, the more employees make a promotion. The explanation for this result is that the higher grade positions are seen as the 'rare' positions in the organization and employees are successors for these positions. Organizations ensure their succession to plan for talent or high performers to assume key leadership positions in higher grades by letting employees promote upwards, which is shown in this analysis. The last transition is the downward movement of employees that demote based on their grade level. A reason for demotion is explained by Van Dalen and Henkens (2016) who state that demotion is associated with poor performance and productivity. Organizations see demotion as a solution when employees do not perform according to the terms of their contract, however in practice it is a complex decision to demote employees. In addition, demotion could bring negative side effects. Josten and Schalk (2010) found that demotion leads to demotivation of the employee and that demotion is negatively related to employee satisfaction

### *5.1.2 Proposition two*

The second proposition is the career path analysis. The outcome of this analysis supports the assumption that career paths could be based on path dependency where employees experience a specific sequence of career movements starting from a specific position in the organization. The explanation for this could be that HR is engaged with the career and succession planning of their employees. One of the key tasks of HR is to ensure by investing in their human capital so that employees move in such way that the organization has the right employee, at the right time in the right place in the organization. Organizations invest in their employees which Lepak and Snell (1999) Collings and Mellahi (2009) link to the development of human capital. In short, organizations plan this to happen so that their employees do not randomly move across the organization (Anderson, Milkovich & Tsui, 1981).

To continue on the results of the career path analysis, the data shows that employees make several transitions. As earlier stated, the employees do not solely promote, but also demote and make lateral movements. The promotion is earlier in this study associated with succession, which in this analysis shows an organization career path where employees move

upwards. The career path analysis also shows events of demotion where employees possibly get replaced to their previous position. An explanation for this could be that a previous promotion to the employees' current position did not result in the desired outcome for both employee and employer, with result that employees experience a demotion to their previous position. In a study by the Canadian psychologist Peter in 1969 this phenomenon is called the Peters principle: Employees will climb the hierarchal ladder until they reach the maximum level of incompetence. The last transition that is visible in the career path analysis, is the lateral movement of employees, which is almost non-existing. However, these employees do not promote or demote, but get a different position in the organization with the same grade level. An explanation for this is that organizations move their personnel in such way that they have to rotate jobs on temporary or permanent basis for organizational and personal development (Carruthers and Pinder, 1983; Heizer, 1976). Furthermore, Hall (2002) described lateral job mobility as valid alternative for career paths that focus on climbing the organizational ladder. In addition, it could be that the organization develops these employees, who experienced a lateral movement, in such way that it is part of their personal development in order to get the right human capital at the right time in the right position in the organizations.

### *5.1.3 Proposition three*

The last proposition investigates if employees move between functional areas, or in other words if employees have career paths outside their own functional area. The results show that employees do not solely move in the functional area where they started, which supports the third proposition. This result is in line with findings of other researchers (Baruch, 2004; Inkson, 2004; Cappellen & Janssens, 2005). As earlier described in the theoretical section of this study, employees could move through the organization and experience job rotation which is described as a lateral transfer. The importance of job rotation is studied by many researchers and they found that it has positive effects for the employee as well as for the organization. When employees experience different jobs in different functional areas they will be more satisfied, involved, experienced and committed which is positively related to (organizational) performance and productivity (Campion, Cheraskin & Stevens 1994).

### *5.1.4 Hypothesis*

The hypothesis focused on the relation between performance ratings and promotions. The results of the analysis on the hypothesis partially supported that employees with a high performance rating experience more promotions than employees with a low performance

rating. However, it was not possible to find significant results between performance ratings and experienced promotions over time. The performance ratings are based on annual performance reviews and it could be that employees get rated inaccurate or unfair by their supervisor, since a performance evaluation systems can be based on subjective human judgement (Kim & Rubianty, 2011). Further, the explanation why more employees promote with a high performance rating than employees with a low performance rating, is based on the basic idea of the tournament model (Rosenbaum, 1984). Promotions within an organization are the result of a competition process; employees compete for positions upwards in the hierarchical ladder and only the best employees (the winners) fulfil these positions. Furthermore, a promotion is associated with high or good performance as stated earlier (Carmeli, Shalom, & Weisberg, 2007; Fairburn & Malcomson, 2001; Rothwell, 2010).

### *5.2 Limitations*

The first limitation concerns the lack of prior research studies on in the field of HR analytics (Gal, Jensen & Stein, 2017; Marler & Boudreau, 2016). The scientific research area of HR analytics has not yet been explored comprehensively, therefore it is challenging to find comparable empirical studies where HR analytics is applied in the domain of employee mobility studies. Due to the lack of comparable studies that made use of large employee data sets, this study provides the opportunity to develop new models and approaches in the field of HR analytics.

The second limitation concerns the use of historical data. In this study only three measure points are used (t0, t1 & t2). Although the data was rich and extensive, it would be better to have personnel records from more years. The rule is simple, the more historical data, the more possible (internal) employee mobility and career paths could be found. In addition, with more data it is possible to refine the used models and appraroches, as for instance the model from appendix 1, the vacancy chain model or the career path analyses.

The third limitation concerns the organizational confidentiality and the anonymized dataset. Hence, full anonymity will minimalize possible competitive risks. Besides organizational anonymity, every position title and functional area is anonymized. With result that, to conduct a study under these circumstances, it is a bit complicated to describe and explain the results of the analyses without losing leverage or impact.

The fourth limitation concerns the lack of internal organizational knowledge. Without the possibility to have knowledge about the organization concerned or discuss with the HR departments involved in this topic, it is complicated to verify and explain outcomes. To

illustrate an example: The results of the first proposition show that the third layer has deviate levels of demotion and, due to the fact that it is not possible to discuss this with the organization, this outlier cannot be explained.

The last limitation concerns the complexity to test the vacancy chain model during organizational growth. The results show that the organizational headcount increased over the years, which can be related to organizational growth due to higher market needs or increased revenue and profits. The model explicit states that it solely can be tested under the condition that the organization did not create new or different positions. Therefore, it was not possible to test the first proposition properly.

### *5.3 Recommendations for future research*

Recommendations for future research can be made. First of all it is important that HR practitioners and researchers focuses more on data and analytics (Edwards & Edwards, 2016). In general, employee data contains a lot of information which is currently not analyzed or used for reasons that they (a) don't have the expertise or (b) cannot access the data easily. In figurative language, employee data is comparable with a rough diamond: *It needs to be cut and refined to discover its brilliance.*

The second recommendation concerns the use of new employee data from the same organization in the next two or three years. As earlier mentioned, it is possible to refine the used models and approaches with more employee data. The models and analyses are designed in such way that it is possible to increase the scalability and reliability, by adding new employee data. However, this only applies when the new employee data is validated and cleaned in the same way as the previous used data.

The third recommendation is based on the characteristics of internal employee mobility. It would be interesting to study the characteristics of the employees as for instance age, gender, organizational tenure or performance ratings that could predict internal mobility. Findings of a study on these characteristics can be used to detect specific characteristics or groups of employees that move internally. As an illustration, a gender diversity topic about the promotion ratio of woman in the top of organization can be further investigated.

The fourth recommendation concerns the employee mobility in general. The results show that the organization has a dynamic headcount where employees enter and leave the organization. It would be interesting to investigate the group of leavers to find the possible explanations why these employees leave the organization. It could be, for example, that employees leave the organization for the reason that they cannot further promote to higher

grade levels, because vacancies in the top are only filled in by external inflow. Furthermore, an interesting case is to study the stability index. This index gives an indication of the percentage of employees who have stayed longer than 12 months in the organization. A low stability index means that a lot of people who recently joined the organization left, which is costly in terms of hire and training costs. A high stability index means that the organization is in the need of new employees in order to get fresh perspectives and ideas. In other words, when the stability index is low this could mean that employees identified as successors for key positions, leave too early with as result that the organization needs to hire external employees. The reason why the stability index is not incorporated in this study, is because this research focuses mainly on internal employee mobility instead of turnover (characteristics).

The fifth recommendation concerns the relation between performance rating and promotion. Besides the frequency of upward mobility by high performers, it would be interesting to study the upwards growth rate of employees to identify differences between low and high performers. An example how this can be tested, is with the use of the feature *date in position* in combination with performance ratings. In short, the date in position can be longer or shorter for employees with different performance ratings and this relation can be tested. The idea behind this research recommendation is also explained as an tool in the practical implication section.

The last recommendation concerns the collection of employee data. The advice for every organization is to store and collect all employee data, with taking into account the intellectual privacy legislation and the General Data Protection Regulation Act. This data could be used for future research, which provides the opportunity for HR to change to evidence based management and decision making.

### *5.4 Practical implications*

In the first phase of this study a model is created to identify job transitions in employee data. In essence, this model can generally be applied to any employee data set under the condition that the data includes the given features which are described in the theoretical part of this study. The insights derived from this study could help organizations to identify bottlenecks in their current internal employee mobility. The study offers a various set of methods which can help to (a) create an overview of how vacancies get filled internally in order to detect for instance exceptionally high external inflow, high levels of demotion or inadequate promotion and (b) test a career path analysis to understand the career paths of employees.

An interesting practical use for HR lies in the field of expectation and position

management. Based on several employee data analyses, as for instance the career path analysis, HR could manage the career perspectives of employees. When HR understands how employees move, including how many steps/years it would take to grow into position in the top layers of the organization, they can communicate this to the employees in order to manage their future career growth expectations. Similarly, it is possible to manage the expectations of job applicants. In an interview, the employer can be transparent about the career perspectives that new employees could expect, because the organization understands how employees move internally. With this intention, the model which is created in the first phase of this study can be computerized with the use of Python.

As a matter of fact a group of software engineers of the organization Crunchr (an online solution for workforce reporting and people analytics) refined the model so that it is aligned with the software infrastructure of Crunchr. The model that eventually is used by these software engineers can be found in Appendix 5. This model is data driven and the software developers can adjust the model, based on demands of the client. In addition, this model includes the feature *'solid line'* which refers to information about employees reporting to a specific manager. This data was not available, therefore this refined model could not be used in this study. With the use of this model, a tool is developed in Crunchr which enables HR to get insights in the career paths of the employees.

Based on the model from Appendix 1, a new idea is derived which is based on the career path analysis. The name of this tool is the *´Career Roadmap Identifier (CRI)'* which is currently a draft version for an online tool. The *CRI* exists out of four steps that help the employee and the (HR) manager to find future career possibilities. In general the *CRI* analyses all career paths that employees *walked* in the organization, based on the historical employee data. The idea behind this tool is that it answers three main questions that employees or (HR) managers could have about career (path) possibilities, namely: '*What are the career possibilities of any chosen position in the organization*?', '*How to get to that position (based on the current position)?'* and *'What will be the estimated time to reach a certain position (based on the current position)?'* The concept version of the *CRI* tool is elaborated and visualized in Appendix 6. It can be very helpful for an organization to understand how employees move internally and which paths they walk. It could be the case that an organization developed a succession plan, and yet the opposite happens in reality (which becomes visible when the employee data is analyzed). In addition it would be possible to predict the workforce planning and establish the succession planning by using such tools.

As a final point, the practical application of HR analytics is immense. New insights

could be translated into new tools that help organizations understand their employees with the use of data. Generally speaking, organizations and (HR) practitioners should create more awareness among the use of HR analytics and the willingness to explore more possibilities with employee data. It is not without good reason that Crunchr and competitors in this area use the words in their slogan: "*HR analytics made easy"!*

# Appendices


Appendix 1 Process model IEM

Appendix 2a Employee mobility between employee grade levels 2015-2016

Appendix 2b Employee mobility between employee grade levels 2016-2017

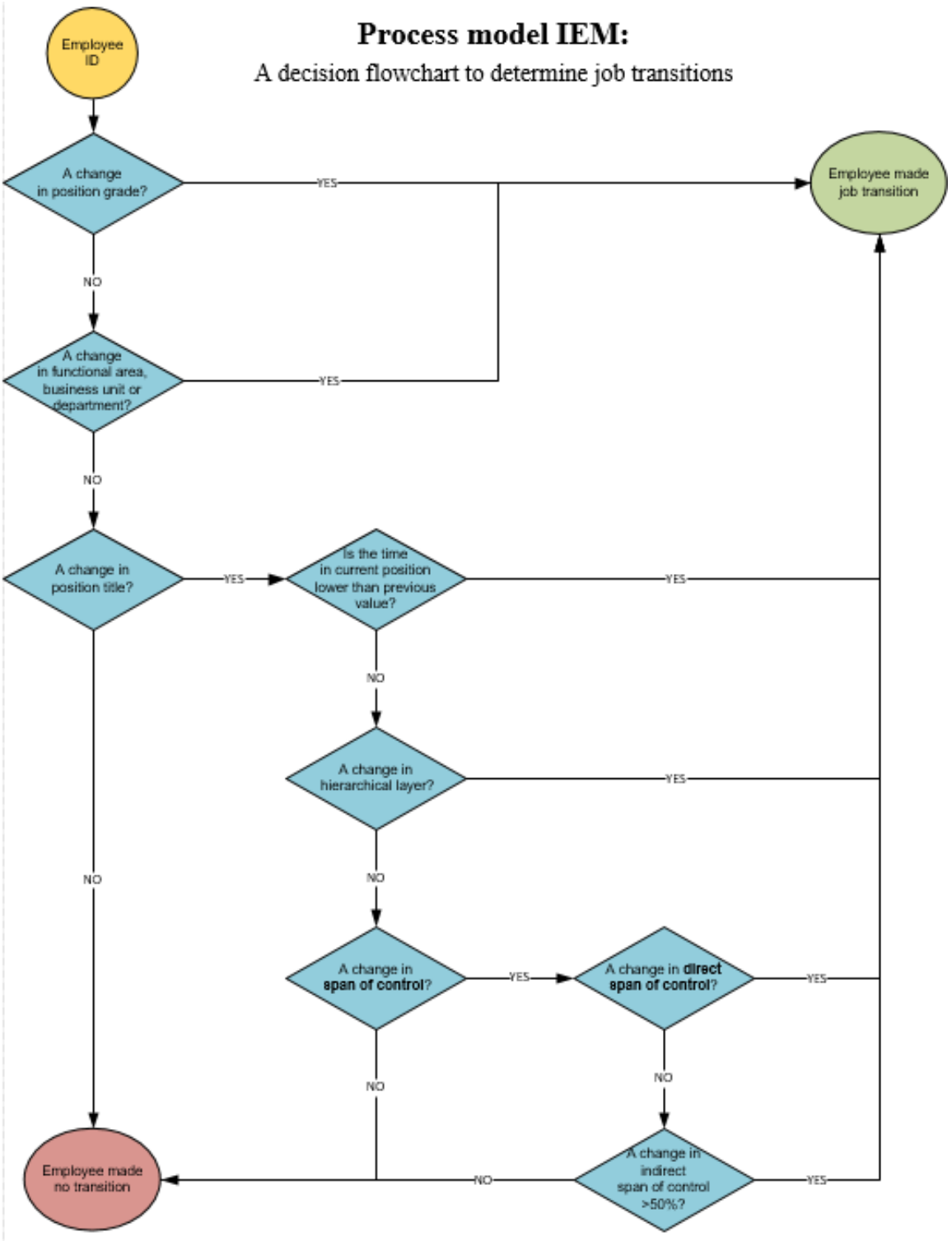
Appendix 3 Internal employee mobility between functional areas

Appendix 4 SPSS Output Hypothesis 1

Appendix 5 Data model for the career path analysis in Crunchr

Appendix 6 Career Roadmap Identifier

Appendix 1 Process model IEM



Appendix 2a Employee mobility between employee grade levels 2015-2016

| **Employee grade level** | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **to** | | | | | | | | | | | | | | | |
| **from** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **Total** | **Leaver** |
| **1** | 123 | 31 | 14 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 170 | 64 |
| **2** | 1 | 400 | 121 | 24 | 11 | 3 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 563 | 109 |
| **3** | 1 | 21 | 686 | 47 | 31 | 21 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 813 | 132 |
| **4** | 1 | 2 | 30 | 501 | 42 | 36 | 9 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 622 | 79 |
| **5** | 0 | 0 | 7 | 15 | 783 | 94 | 26 | 8 | 1 | 0 | 0 | 0 | 0 | 0 | 934 | 126 |
| **6** | 0 | 0 | 6 | 11 | 23 | 1209 | 107 | 11 | 7 | 0 | 0 | 0 | 0 | 0 | 1374 | 246 |
| **7** | 0 | 0 | 1 | 3 | 12 | 42 | 1209 | 53 | 34 | 4 | 0 | 0 | 0 | 0 | 1358 | 174 |
| **8** | 0 | 0 | 0 | 1 | 0 | 3 | 27 | 421 | 31 | 10 | 0 | 0 | 0 | 0 | 493 | 90 |
| **9** | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 330 | 9 | 1 | 0 | 0 | 0 | 348 | 70 |
| **10** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 140 | 5 | 0 | 0 | 0 | 147 | 24 |
| **11** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 44 | 3 | 0 | 0 | 48 | 14 |
| **12** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 0 | 0 | 15 | 7 |
| **13** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 5 | 2 |
| **14** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 |
| **New hires** | 89 | 189 | 195 | 148 | 244 | 385 | 267 | 135 | 89 | 19 | 11 | 1 | 1 | 0 | - | - |

*Employee mobility between grade levels period 2015-2016*

Appendix 2b Employee mobility between employee grade levels 2016-2017

| **Employee grade level** | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **to** | | | | | | | | | | | | | | | |
| **from** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **Total** | **Leaver** |
| **1** | 161 | 10 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 175 | 40 |
| **2** | 7 | 476 | 27 | 16 | 4 | 9 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 540 | 103 |
| **3** | 3 | 10 | 853 | 33 | 7 | 9 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 919 | 141 |
| **4** | 1 | 0 | 43 | 554 | 49 | 13 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 663 | 88 |
| **5** | 0 | 2 | 17 | 14 | 891 | 61 | 19 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 1008 | 138 |
| **6** | 0 | 0 | 6 | 11 | 19 | 1436 | 74 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 1555 | 239 |
| **7** | 0 | 0 | 0 | 1 | 5 | 22 | 1376 | 31 | 15 | 0 | 0 | 0 | 0 | 0 | 1450 | 204 |
| **8** | 0 | 0 | 0 | 0 | 0 | 5 | 11 | 522 | 30 | 7 | 0 | 0 | 0 | 0 | 575 | 62 |
| **9** | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 408 | 16 | 0 | 0 | 0 | 0 | 427 | 67 |
| **10** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 152 | 0 | 0 | 0 | 0 | 153 | 30 |
| **11** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 55 | 0 | 0 | 0 | 57 | 4 |
| **12** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 0 | 0 | 19 | 0 |
| **13** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 6 | 0 |
| **14** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 |
| **New hires** | 56 | 110 | 134 | 142 | 180 | 267 | 179 | 93 | 73 | 30 | 4 | 2 | 1 | 0 | - | - |

*Employee mobility between grade levels period 2016-2017*

Appendix 3 Internal employee mobility between functional areas

| **Functional area** | **to** | | | | |
|---|---|---|---|---|---|
| **from** | **A** | **B** | **C** | **D** | **E** |
| **A** | 1770 | 76 | 4 | 44 | 0 |
| **B** | 34 | 2470 | 48 | 86 | 0 |
| **C** | 0 | 26 | 981 | 31 | 2 |
| **D** | 5 | 47 | 12 | 1072 | 10 |
| **E** | 0 | 0 | 0 | 2 | 172 |

*Employee mobility between functional areas 2015-2016*

| **Functional area** | **to** | | | | |
|---|---|---|---|---|---|
| **from** | **A** | **B** | **C** | **D** | **E** |
| **A** | 1915 | 57 | 4 | 21 | 0 |
| **B** | 83 | 2782 | 14 | 66 | 0 |
| **C** | 0 | 21 | 1082 | 15 | 1 |
| **D** | 4 | 40 | 7 | 1234 | 19 |
| **E** | 0 | 0 | 0 | 0 | 184 |

*Employee mobility between functional areas 2016-2017*

Appendix 4 SPSS Output hypothesis 1

**Within-Subjects Factors**

Measure: MEASURE_1

| factor1 | Dependent Variable |
|---|---|
| 1 | performance_2015 |
| 2 | performance_2016 |

**Between-Subjects Factors**

| | | N |
|---|---|---|
| promotions | 0 | 4137 |
| | 1 | 880 |
| | 2 | 30 |

**Multivariate Tests[a]**

| Effect | | Value | F | Hypothesis df | Error df | Sig. |
|---|---|---|---|---|---|---|
| factor1 | Pillai's Trace | ,000 | ,046[b] | 1,000 | 5044,000 | ,830 |
| | Wilks' Lambda | 1,000 | ,046[b] | 1,000 | 5044,000 | ,830 |
| | Hotelling's Trace | ,000 | ,046[b] | 1,000 | 5044,000 | ,830 |
| | Roy's Largest Root | ,000 | ,046[b] | 1,000 | 5044,000 | ,830 |
| factor1 * promotions | Pillai's Trace | ,001 | 1,459[b] | 2,000 | 5044,000 | ,233 |
| | Wilks' Lambda | ,999 | 1,459[b] | 2,000 | 5044,000 | ,233 |
| | Hotelling's Trace | ,001 | 1,459[b] | 2,000 | 5044,000 | ,233 |
| | Roy's Largest Root | ,001 | 1,459[b] | 2,000 | 5044,000 | ,233 |

a. Design: Intercept + promotions

Within Subjects Design: factor1

b. Exact statistic

**Tests of Within-Subjects Effects**

Measure: MEASURE_1

| Source | | Type ■ Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| factor1 | Sphericity Assumed | ,009 | 1 | ,009 | ,046 | ,830 |
| | Greenhouse-Geisser | ,009 | 1,000 | ,009 | ,046 | ,830 |
| | Huynh-Feldt | ,009 | 1,000 | ,009 | ,046 | ,830 |
| | Lower-bound | ,009 | 1,000 | ,009 | ,046 | ,830 |
| factor1 * promotions | Sphericity Assumed | ,594 | 2 | ,297 | 1,459 | ,233 |
| | Greenhouse-Geisser | ,594 | 2,000 | ,297 | 1,459 | ,233 |
| | Huynh-Feldt | ,594 | 2,000 | ,297 | 1,459 | ,233 |
| | Lower-bound | ,594 | 2,000 | ,297 | 1,459 | ,233 |
| Error(factor1) | Sphericity Assumed | 1026,406 | 5044 | ,203 | | |
| | Greenhouse-Geisser | 1026,406 | 5044,000 | ,203 | | |
| | Huynh-Feldt | 1026,406 | 5044,000 | ,203 | | |
| | Lower-bound | 1026,406 | 5044,000 | ,203 | | |

**Tests of Within-Subjects Contrasts**

Measure: MEASURE_1

| Source | factor1 | Type ■ Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| factor1 | Linear | ,009 | 1 | ,009 | ,046 | ,830 |
| factor1 * promotions | Linear | ,594 | 2 | ,297 | 1,459 | ,233 |
| Error(factor1) | Linear | 1026,406 | 5044 | ,203 | | |

**Tests of Between-Subjects Effects**

Measure: MEASURE_1

Transformed Variable: Average

| Source | Type ■ Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Intercept | 5976,173 | 1 | 5976,173 | 12237,411 | ,000 |
| promotions | 35,419 | 2 | 17,709 | 36,263 | ,000 |
| Error | 2463,251 | 5044 | ,488 | | |

## Estimated Marginal Means

**1. promotions**

Measure: MEASURE_1

| promotions | Mean | Std. Error | 95% Confidence Interval | |
|---|---|---|---|---|
| | | | Lower Bound | Upper Bound |
| 0 | 3,298 | ,008 | 3,283 | 3,313 |
| 1 | 3,453 | ,017 | 3,420 | 3,485 |
| 2 | 3,433 | ,090 | 3,256 | 3,610 |

**2. factor1**

Measure: MEASURE_1

| factor1 | Mean | Std. Error | 95% Confidence Interval | |
|---|---|---|---|---|
| | | | Lower Bound | Upper Bound |
| 1 | 3,391 | ,037 | 3,318 | 3,463 |
| 2 | 3,399 | ,036 | 3,328 | 3,470 |

**3. promotions * factor1**

Measure: MEASURE_1

| promotions | factor1 | Mean | Std. Error | 95% Confidence Interval | |
|---|---|---|---|---|---|
| | | | | Lower Bound | Upper Bound |
| 0 | 1 | 3,302 | ,009 | 3,284 | 3,320 |
| | 2 | 3,294 | ,009 | 3,277 | 3,312 |
| 1 | 1 | 3,436 | ,020 | 3,397 | 3,476 |
| | 2 | 3,469 | ,020 | 3,431 | 3,508 |
| 2 | 1 | 3,433 | ,108 | 3,221 | 3,646 |
| | 2 | 3,433 | ,106 | 3,225 | 3,642 |

## Post Hoc Tests

**Multiple Comparisons**

Measure: MEASURE_1

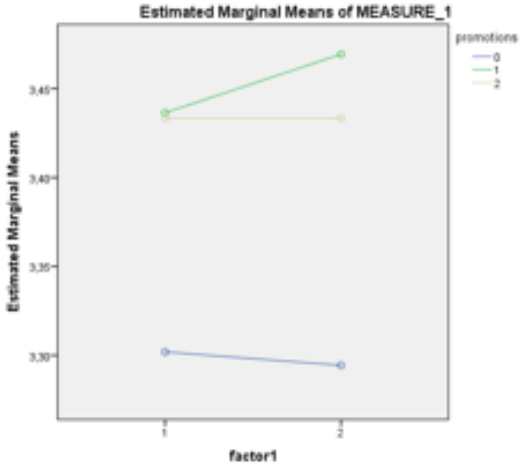
| | (I) promotions | (J) promotions | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower Bound | Upper Bound |
| Tukey HSD | 0 | 1 | -,15* | ,018 | ,000 | -,20 | -,11 |
| | | 2 | -,14 | ,091 | ,294 | -,35 | ,08 |
| | 1 | 0 | ,15* | ,018 | ,000 | ,11 | ,20 |
| | | 2 | ,02 | ,092 | ,975 | -,20 | ,23 |
| | 2 | 0 | ,14 | ,091 | ,294 | -,08 | ,35 |
| | | 1 | -,02 | ,092 | ,975 | -,23 | ,20 |

Based on observed means.

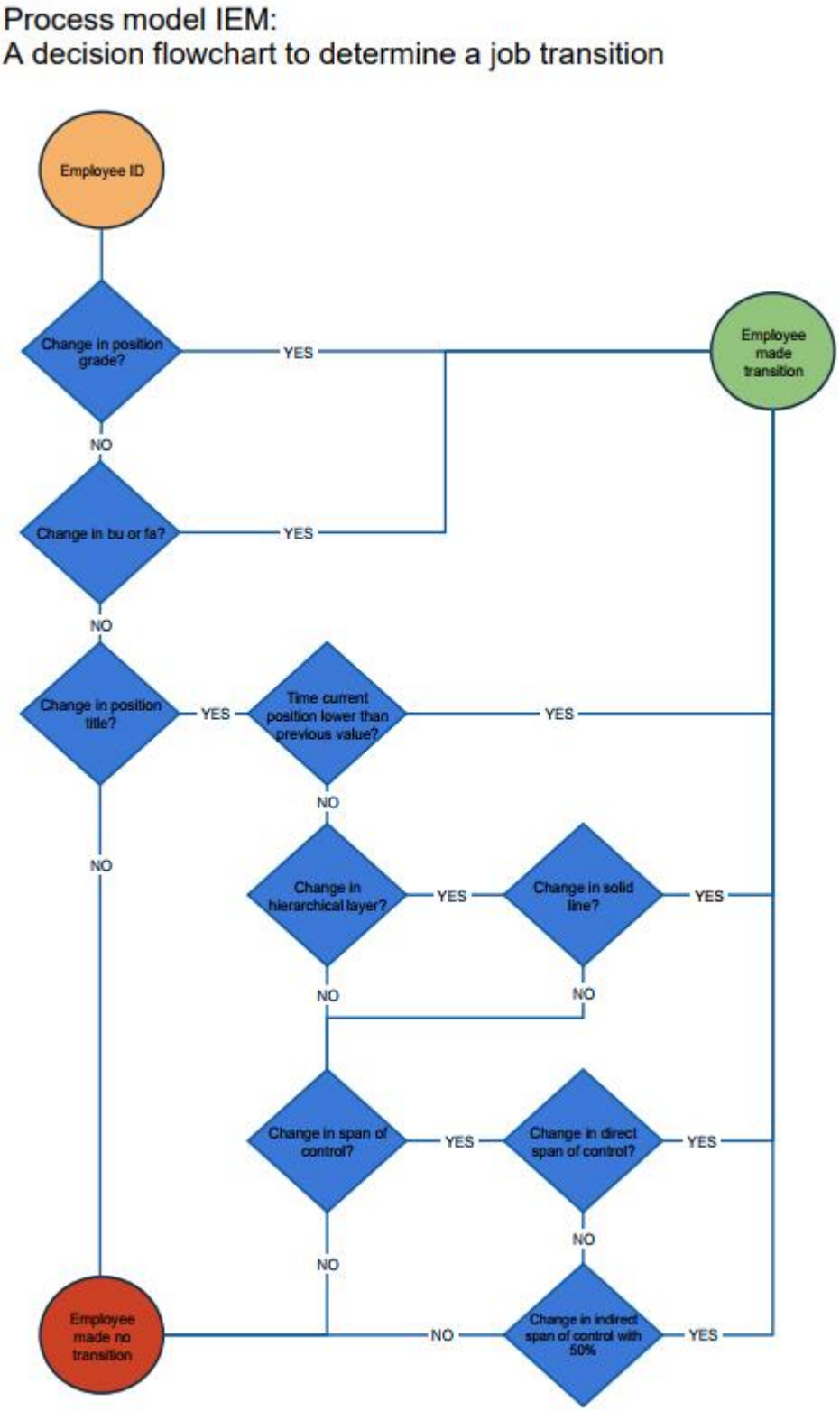
The error term is Mean Square(Error) = ,244.

*. The mean difference is significant at the ,05 level.

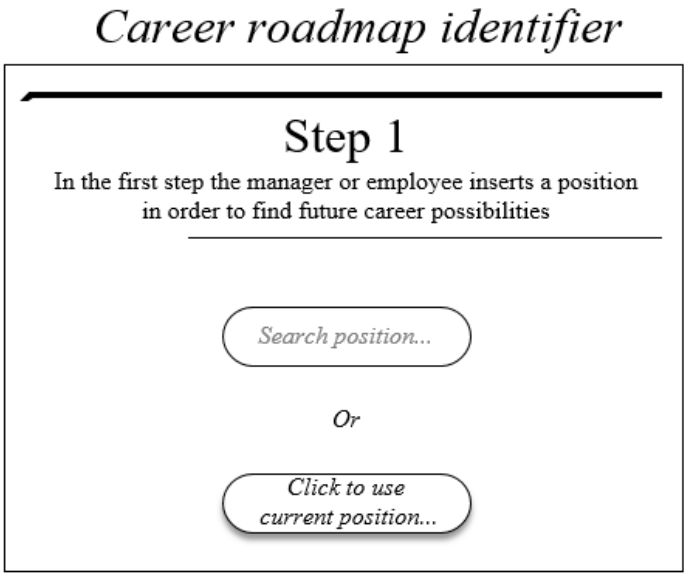
## Profile Plots

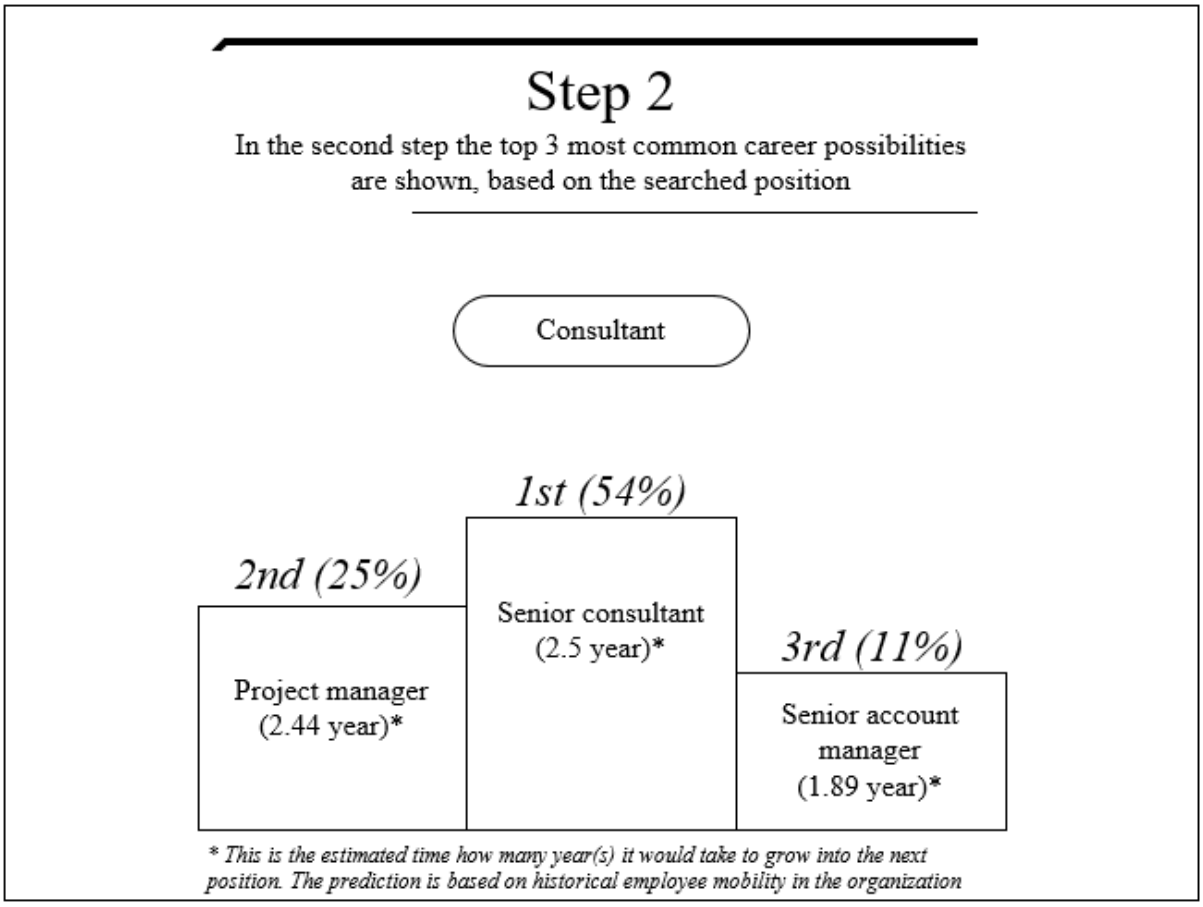


Appendix 5 Data model for the career path analysis in Crunchr



Appendix 6 Career Roadmap Identifier



# Step 3

In the third step an overview is displayed with information about the chosen position

*Previous position* ← Senior Consultant → *Next position*

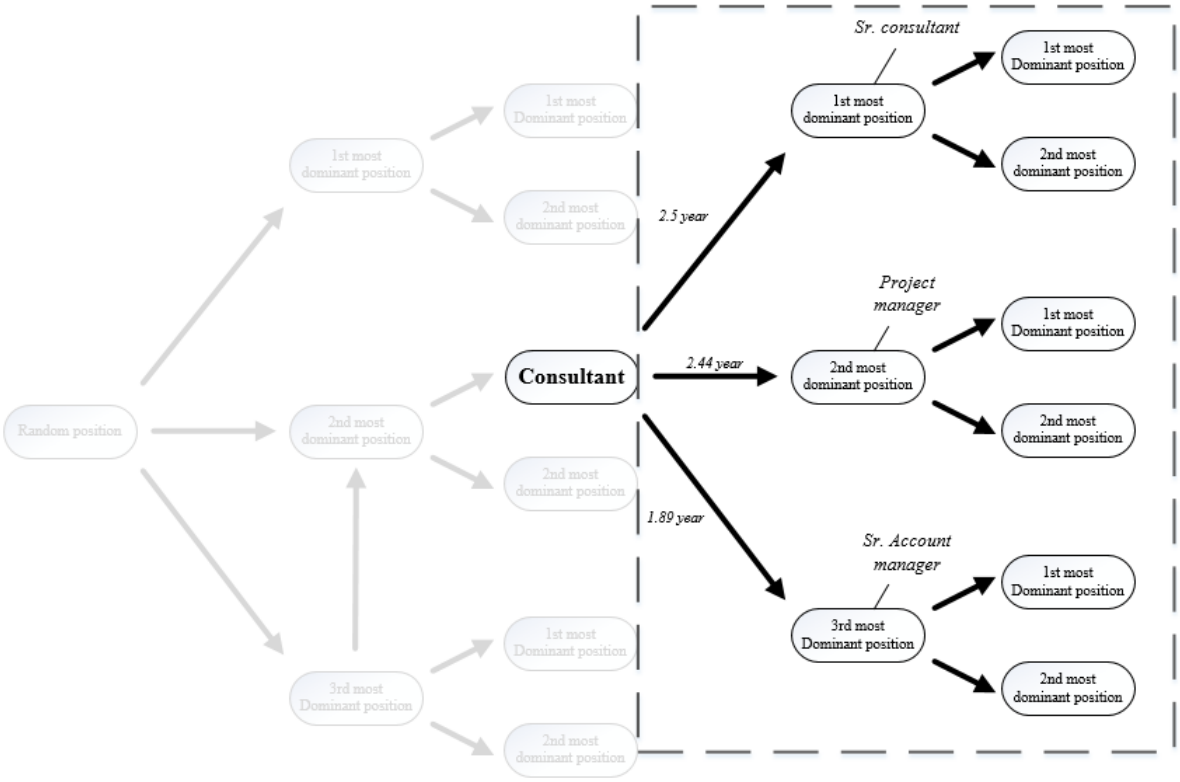
*1st (54%)*

Salary scale: ....
Average teamsize: ....
Average time in position: ....
Average organizational tenure: ....
Average age: ....
Percentage male / female: ....% / ....%
Important competencies: ....
Average direct span of control*: ....

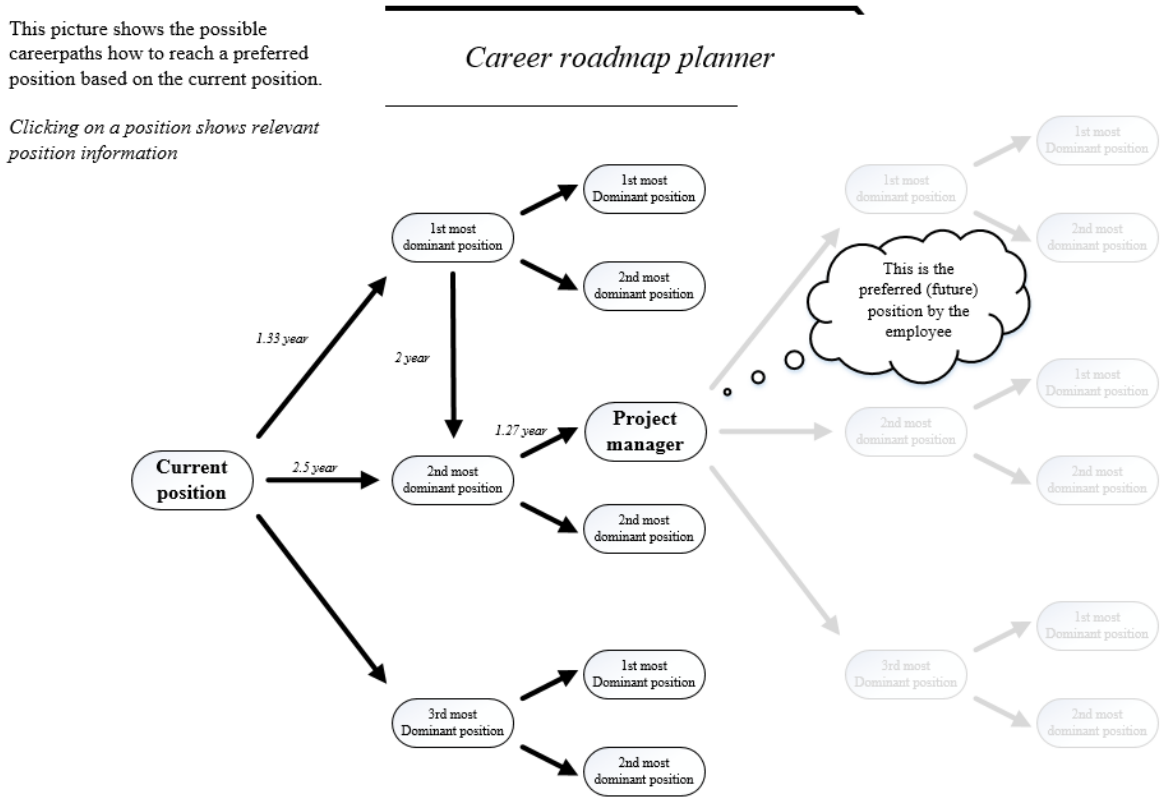
**only applicable for people management positions*

# Step 4

In the fourth step a careerpath roadmap is displayed based on chosen position



This is an extra step in the CRI. In step one till four it is clear where the employee could go, but it is also possible to use the tool in the opposite direction, which answers the question how to get to a *preferred* position, based on the current position.



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