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**Master's Thesis of Business Administration**

**Employee mobility and Performance  
in Formula 1**

Formula 1 의 직원 인동성 및 성과

**August 2021**

**Graduate School of Business  
Seoul National University  
Strategy and International Management**

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# **Employee Mobility and Performance in Formula 1**

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**Submission of master's thesis of  
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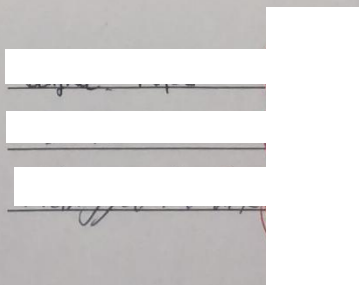
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# **Abstract**

## **Employee mobility and Performance in Formula 1**

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Employee mobility has been studied at both the individual and the collective level – executive team, star performers, knowledge workers; in sports – coaches and players. Because this effect of the different types of employees is studied separately, this leaves one important question unanswered - Does the mobility of employees at different organizational layers affect performance equally?

Using panel data from Formula 1 for the period 2014 – 2019, I invoke knowledge-based view and human and social capital arguments to compare the variance in the mobility effect between different employee groups in Formula 1 teams based on their functional roles and knowledge pools. The analysis is conducted using a negative binomial regression model with fixed

effects. In this study, I hypothesize that the influence of employee mobility varies across the different organizational layers and that this variance is largely dependent on the functional role of the employees. Additionally, I argue that the mobility of knowledge workers, such as engineers, has a stronger influence on team performance than that of other employees.

The findings are in line with the hypotheses, suggesting that the influence of employee mobility effect on performance is directly related to the functional knowledge of the employees. The most significant finding suggests that knowledge workers' mobility influences team performance the most. Interestingly, I find that mobility of team leadership, even though having a significant effect on performance, does not moderate the relationship between firm leadership and performance.

This study extends the theory to find that the value of workers is dependent also on the functional role they hold within the organization, not only their skills or firm-specific factors. The study sheds light on the issue of functional diversity, which has not been extensively examined in the mobility literature.

Keywords: employee mobility, performance, Formula 1, human capital, knowledge-based view, functional diversity

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## Chapter 1. Introduction

*“Change is what drives our sport..(Changes)..in drivers, in regulations, in races, in almost everything.” (Eric Boullier)*

To survive and successfully adapt to change one has to be creative, but the creative process is neither linear nor clear (Rouse, 2020). One constant change experienced throughout all organizations is employee mobility- a mechanism for transferring knowledge across organizations (Mawdsley and Somaya, 2016), that can have an effect on performance through the gain and loss of competitive advantage (Kogut and Zander, 1992; Phillips, 2002).

Mobility has been studied through the lens of the positive (Song, Almeida and Wu, 2003; Rosenkpf and Almeida, 2003) and negative effects it can have on organizations (Phillips, 2002). Literature has studied the mobility effects of executive teams (Drazin and Rao 1999) and their members (Finkelstein and Hambrick, 1990; Nath and Mahajan, 2015). There are also studies on the mobility effects of key employees especially in knowledge-based industries (Groysberg, 2008, Song, Almeida, & Wu, 2003). Studies in sports have also explored the mobility effects of managers (Aime et al. 2010; Trequattrini et al, 2019) and players (Eitzen & Yetman, 1972, Brown, 1982).

All studies have shown that the mobility of employees may or may not affect performance depending on different factors such as previous experience (Pfeffer and Davis-Blake, 1986, Bas ter Weel, 2011, D’Addona and Kind, 2014) or industry regulations (Shen and Cho, 2005) among other

factors. What these studies do not show is whether the mobility of the different employees - with or without managerial status, knowledge workers, star performers, etc. affects organizational performance equally or not. While studies reported effects of mobility ranging from positive to negative or absence of any effect, literature does not provide answers whether an executive member's mobility effect is equal to that of a manager's mobility effect. Talking about sports – does a change of manager matter more than players' changes? Who matters more and if so why? This study raises the question of whether employee mobility at different organizational layers affects team performance equally?

In this paper, I argue that employee mobility effects on performance vary across the organization and such variance is related to the functional role and knowledge of the employees. Moreover, I hypothesize that the mobility of knowledge workers such as engineers influences performance to a greater extent than the mobility of non-engineers.

The hypotheses are tested in the setting of Formula 1 – the most technologically advanced sport in the world for the period 2014-2019. I chose this setting because previous studies have shown that professional sports are an effective setting for studying organizational phenomena (Wolfe et al., 2005) and because in knowledge-based industries, mobility of personnel has been shown to have a significant effect on performance (Song, Almeida, & Wu, 2003). Moreover, research on Formula 1 is scarce and mainly focuses on the technological aspects of the sport (Jenkins, 2010, Bekker and Lotz 2009; Loiacono et al. 2010, Dominy and Dominy 1984, Alnaser et al. 2006). Very



few papers have examined the sport focusing on human capital (Bell et al, 2016; Jenkins and Tallman 2016) even though at the core of the teams and the sport lie the team members. As James Allison (*Chief Technical Officer, Mercedes-AMG Petronas Formula One Team as of July 2021*) famously said (James Allison, 2020): “*What people should be focusing on but don’t, is how good is a team at learning...it is the collective knowledge of the organization that determines whether the car is fast.*” and despite all teams emphasizing the importance of attracting the most skilled and talented engineers (Team Annual Reports) to my knowledge there are no studies that have examined employee mobility in this setting.

The data quality provides a unique setting where all team members have specific functional roles within the team and are interconnected to a high degree. Additionally, sports data allows for direct observation of performance – in the case of Formula 1- the points earned in head-to-head competition make it easier to see the direct effect of mobility.

This study seeks to shed more light on the complicated relationship between mobility and performance by examining the effects of mobility at different organizational levels. The results can help managers better understand at which organizational levels do firms lose, acquire, transfer and retain knowledge the most or the least. Understanding the collective impact of mobility of employees at different functional roles can help organizations manage their human capital successfully and extract maximum performance.

## Chapter 2. Setting Background

Formula One, widely considered as the pinnacle of motorsport, is the world's highest-class single-seater auto racing championship. The FIA (International Automobile Federation) is the governing body of the Formula One World Championship, among other motorsports, and promotes constant innovation in all aspects of the sport by enforcing technical, sporting, financial, safety, and other related rules and regulations (FIA Regulations). This makes the industry highly regulated, which implies that all organizations (teams) are faced with restrictions on managerial discretion and latitude of action (Shen and Cho, 2005) in terms of how to optimize their budgets and performance on the track, as the FIA carefully observes teams' corporate activities as well.

The Formula One World Championship has two different championships— Drivers' and Constructors' Championships. According to the FIA sporting regulations: "The Formula One World Championship driver's title will be awarded to the driver who has scored the highest number of points, taking into consideration all the results obtained during the Events which have taken place. The title of Formula One World Champion Constructor will be awarded to the Competitor which has scored the highest number of points, results from both cars being taken into account."<sup>1</sup> The span of the racing season typically is about 9 months starting in March. Throughout the racing

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<sup>1</sup> FIA Regulations (<https://www.fia.com/regulation/category/110>)

season, the teams compete in 20 races on average, on designated tracks all around the world. The current point system was adopted in 2010 by the FIA.<sup>2</sup>

Formula One teams are operated and managed by companies, which are responsible for designing, developing, manufacturing, and operating the Formula One car during testing and racing. The companies aim at performance maximization in both Championships – Drivers' and Constructors', with such maximization achieved through successful utilization of resources – human, financial, technological, etc. Team success is measured by the team's performance in both Championships, with Constructors' Championship being the more important one because the ranking in the Constructors' Championship at the end of each racing season determines the prize money the team will receive, which along with sponsorship money and the financial parameters determined by the shareholders of the firm, take up the biggest share of the team budget, with the rest of the money coming from other activities of the firm such as selling products and providing services to third parties.

Each organization follows a pyramidal structure. The governing body of each company is comprised of a Board of Directors who are responsible for the overall strategy of the firm, with some members having a hands-on approach in the management of the team. The C-suite is responsible for the day-to-day activities of the firm and reports directly to the Board of Directors. It is common for Board members to also be a part of the executive team. For

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<sup>2</sup> FIA Sporting Regulations, 2010, p3. (<http://fia.com>)

that reason in this study, I refer to the Board of Directors and C-suite collectively as *Firm Leadership*.

The race team also has a leadership team comprising of engineers responsible for the day-to-day activities of the race team and the important decisions, especially on track during race weekends. The typical structure of the team management has a Team Principal on top, who has the responsibility of managing the team and reports directly to the CEO of the firm. The rest of the team management is responsible for the team strategy, maximization of the on-track performance, and making sure the team does not break any of the regulations set by the FIA. Each team has a technical department that is responsible for the designing, developing and manufacturing, and performance of the Formula 1 cars. The Technical department is run by the Technical Director and/or Chief Technical Officer(CTO)<sup>3</sup>, who reports directly to the Team Principal. The rest of the technical department leadership is typically comprised of Chief Designer, Head of Aerodynamics, Chief Aerodynamicist, Performance and Engineering Directors reporting directly to the head of the technical department. The names of the positions vary from team to team and where some teams may have a position with the same name the responsibilities and duties of the employee can differ to a high degree.

In this analysis, the categorization of employees is done not by name of position but by the nature of responsibilities the employee bears as well as who the employee answers to directly. In this paper, the category Race Team

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<sup>3</sup> Depending on the team structure some CTOs are not directly involved with the design and development of the Formula 1 cars, and have overseeing duties.

Leadership is comprised of the employees responsible for the operation of the racing cars (Team Management) and the employees responsible for the design, development of the racing cars (Technical leadership) as all members work closely together and share functional roles as engineers with managerial status. Members of the Technical Leaderships of some teams often attend races, whereas other teams' Technical Leadership members do not, so for analysis simplification reasons I have merged the two groups Team Management and Technical Leadership to make it one – *Team Leadership*.

Sizes of teams vary depending on the budget of the firm with some teams having around 100 personnel and other established teams having over 1000 employees. The number of engineers involved with the development, design, and manufacturing of the Formula 1 cars is reflected in the team size, but during race weekends according to the sporting regulations set by the FIA “..each Competitor may not have more than a total of 60 team personnel who are associated in any way with the operation of the cars within the confines of the circuit.”<sup>4</sup>., out of which around 15 to 20 are engineers.<sup>5</sup>

### **Chapter 3: Theory**

The resource-based view and the knowledge-based view works of literature suggest that firms that perform better do so because of the organizational competitive advantage that lies within the tacit knowledge at

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<sup>4</sup> <https://www.fia.com/regulation/category/110>

<sup>5</sup> <https://www.mercedesamgf1.com/en/news/2018/11/insight-the-trackside-engineers/>.

the organizational core (Kogut and Zander, 1992) which is carried by the human assets making it an extremely valuable and inimitable firm resource (Barney,1991).

Mobility is one of the mechanisms for the transfer of human capital, such as tacit knowledge, across organizations (Mawdsley and Somaya, 2016). The mobility of employees especially in knowledge-intensive industries is directly linked to performance outcomes as firms can either benefit from hiring highly-skilled employees (Song, Almeida & Wu, 2003, Correidora and Rosenkopf,2010, Rao & Drazin, 2002) or experience negative effects following a loss of human capital (Batt, 2002; Huselid, 1995; Kacmar et al.2006; Philips, 2002; Shaw et al, 2005). This is a reason why organizations set their goals on hiring highly skilled personnel - to tap into the tacit knowledge the better performing firms presumably hold (Campbell, Coff, & Kryscynski, 2012).

The reciprocal effect does exist between mobility and performance but evidence shows the relationship is stronger than that of performance - mobility (Glebbeek & Bax, 2004, Shaw, Gupta, & Delery, 2005). Evidence from sports and particularly Formula 1 shows that employees can move to a poorly performing team to take a more senior position (e.g. Simone Resta in 2019 -from Scuderia Ferrari to Alfa Romeo Racing Orlen, Rob Smedley in 2014, from Scuderia Ferrari to Williams Racing).

### **3.1 Mobility of Executives**

Research on top management is abundant with studies focusing separately on CEOs (Finkelstein and Hambrick, 1990, Haleblan and Finkelstein, 1993),

on other non-CEO executives (Nath and Mahajan, 2017, Feldmann et al. 2009), or top management team as a group of individuals (Drazin and Rao 1999; Jackson et al. 1991). Literature also exists with a focus on the mobility effects of top executives as a collective (Bermiss and Murmann, 2014, Kacmar et al. 2006) providing evidence of significant effects of executive turnover on firm performance, due to executive teams shaping the organizational culture through the values and routines they instill (Hambrick and Mason, 1984). Evidence from sports on the other hand shows support for the argument that executive turnover has no significant effect (Warner, Watts, and Wruck, 1988).

Management literature has also paid attention to existing constraints on the managers' decision-making process, which influence firm performance particularly the financial aspect of performance (Finkelstein & Boyd, 1998, Hambrick and Finkelstein 1987) and has introduced management discretion as an explanation of the variance in number and range of options executives can choose from when making strategic decisions. Evidence points to the fact that executive officers, when faced with environmental and firm-specific constraints, have fewer options in terms of strategic direction and objectives, and that it is likely for the executive team to not have a significant impact on firm performance. (Shen and Cho, 2005). Industry constraints are likely to play a significant role in diminishing the effect of executive mobility on performance, especially in highly regulated industries (Hadlock et al., 2002) such as motorsport.

### **3.2 Mobility in Sports**

Mobility literature in sports has focused on the effects of mobility of key personnel, managers, players (Pfeffer and Davis-Blake, 1986, Aime et al. 2010, Jenkins and Tallman, 2016, Trequattrini et al, 2019) but these studies have examined the effects separately (Berman, Down, and Hill, 2002, Eitzen & Yetman, 1972, Allen et al, 1979, Brown, 1982) and have reported mixed results of negative, positive or no effects of mobility on performance (Bas ter Weel, 2011, D'Addona and Kind, 2014, Madum, 2016), which can be interpreted as some functional roles within teams and the mobility of individuals employed at specific positions to have a stronger effect on performance than others.

Moreover, Huckman and Pisano (2006) report that cardiac surgeons do not perform at the same level at the new hospital as they have at the hospital they have left. If the results are generalizable this would suggest that in a high-tech industry the performance of employees with key specific functional roles such as drivers is likely to not affect overall performance due to firm-specific factors that do not allow for replicability of performance (Groysberg, 2008).

In knowledge-based industries, work is often done in teams, which requires collaboration between individual employees (Kordana, 1995) suggesting interconnectedness between functional roles within and between teams as colleagues rely upon one another for the exchange of expertise (Galbraith, 1977). Often observed is that after switching employers highly-skilled workers lose a big part of their tacit knowledge that was a result of their close collaboration with colleagues (Becker, 1976). Previous studies



have shown that depending on the nature of the functional role of the executive members the effect of their mobility on performance is differs. (Bermiss and Murmann, 2014) Following that logic, it can be suggested that the same theory will hold also for non-executive managerial and other highly specific functional roles within an organization.

Formula 1 as a team sport that develops and uses advanced technology, is expected to be sharing similar characteristics with other knowledge-intensive industries in terms of employee mobility effects, such that generally the loss of key personnel to another team would result in knowledge transfer to the acquiring team and loss of knowledge for the team who loses an employee. Studies on Formula 1 regarding team personnel (Bell et al, 2016, Phillips, 2014) have previously shown that some team members matter less than others when it comes to influencing team performance, leading to suggest that the mobility of team members may have a different influence on performance depending on the functional role and managerial status of the employees.

## **Chapter 4: Hypotheses**

The mobility of employees especially in knowledge-intensive industries is directly linked to performance (Phillips, 2002). Mobility literature on top executives as a collective (Bermiss and Murmann, 2014, Kacmar et al. 2006) shows that changes in the executive team affect performance, because the organizational culture and values, as well as

routines, are set up by the executive team (Hambrick and Mason, 1984). But when firms operate in regulated industries effects of executive turnover are shown to be non-significant. (Shen and Cho, 2005, Hadlock et al., 2002). The nature of Formula 1 as high-tech motorsport with a governing body imposing rules and regulations does not allow for Firm Leadership to have significant managerial discretion when it comes to choosing between different strategic options. This suggests that the mobility of Firm leadership members have little to no significant effect on performance.

Firms operating in knowledge-intensive industries often require work to be done in teams, which leads to knowledge transfer between individuals ( Kordana, 1995) and that after switching employers highly-skilled workers lose a big part of their tacit knowledge which they had access to through their collaboration with colleagues (Becker, 1976). Mobility literature in sports has shown results for different key personnel, managers, or all players or players at certain positions(Pfeffer and Davis-Blake,1986, Aime et al. 2010, Jenkins and Tallman, 2016, Trequattrini et al, 2019). and have reported mixed results (Bas ter Weel, 2011, D'Addona and Kind, 2014, Madum, 2016). What studies in sports have not yet examined or compared is the variance in effects on performance depending on the functional role (Berman, Down, and Hill, 2002, Eitzen & Yetman, 1972, Allen et al, 1979, Brown, 1982).

Studies on Formula 1 regarding team personnel (Bell et al, 2016, Phillips, 2014) have shown that some team members matter less than others when it comes to influencing team performance, leading to suggestions that the mobility of team members has a different influence on performance

depending on the functional role and managerial status of the employees, similarly to the different effects for different executive team members depending on their functional roles (Bermiss and Murmann, 2014) and that mobility of Firm Leadership members will have little to no effect on performance due to the extreme regulations in Formula 1:

*H1: The influence of employee mobility on performance is likely to vary across the different organizational levels.*

Studies in human capital theory have shown that inward mobility positively affects organizational performance in terms of innovation (Rao & Drazin, 2002), transfer of knowledge (Almeida & Kogut, 1999; Rosenkopf & Almeida, 2003) especially in knowledge-intensive industries where the effects are more visible and strong. Studies have also shown that outward mobility is negatively related to organizational performance (e.g., Batt, 2002; Huselid, 1995; Osterman, 1987; Phillips, 2002; Staw, 1980). These effects are likely to be particularly strong if the human capital that is lost is strongly firm-specific (Coff, 1997; Kacmar et al., 2006) which can also arguably be the case of sports where teams and organizations share similar structures and are regulated, yet some teams outperform others repeatedly.

To my knowledge, only two studies exist that have tried to end the ongoing debate of whether teams (engineers) or drivers matter in determining performance on track (Phillips, 2014, Bell et al, 2016). Bell et al, (2016) using longitudinal data (1950-2014) find that the effect of team is significantly more important for performance, and also that this effect tends to increase over time. The strong evidence suggests that for the observational period in this study

(2014-2019) the same trend is likely to continue, and team effects will be stronger than driver effects. Even though some experts have argued that only the most skilled drivers can make a difference (Allen, 2000), the overall driver effect is likely to be less important than the team effect. So we can argue that team mobility will have a stronger effect on performance than driver mobility.

Moreover, previous studies have found that in high-tech industries the mobility of engineers has a strong effect on firm performance (Song, Almeida, & Wu, 2003). This would suggest that in Formula 1 as a high-tech industry where employees' functional roles are very specific, the different effects of team and drivers could be explained through the difference between their functional roles – engineering and non-engineering. And because the team effect is significantly stronger than the driver effect (Bell et al, 2016) I argue that the mobility effect of engineers will be more significant compared to the effect of the mobility of non-engineers.

*H2a: The difference in mobility effect on performance is likely to depend on the functional role of the employees.*

*H2b: The mobility of employees in engineering positions (team) is likely to have a stronger effect than the mobility of employees in non-engineering positions (drivers).*

As explained above Firm leadership (Board of Directors and C-suite) is responsible for the decision-making regarding overall strategic direction (Hambrick and Mason, 1984) of the organizations, and the mobility of Firm leadership members having a minimal to no effect on performance due to having little managerial discretion, in a highly-regulated

industry (Hadlock et al., 2002). Whereas Team Leadership - as engineers are responsible for the decision-making regarding all racing activities due to the direct and strong influence engineers with managerial status have on performance, (Bell et al, 2016) and also their mobility (Song, Almeida, & Wu, 2003) particularly in Formula 1. Additionally, because Team Leadership reports directly to Firm Leadership, the mobility of members of team leadership should exert an effect on the relationship between mobility of Firm Leadership and performance, which leads to:

*H3: The Mobility effect of firm leadership on performance is likely to be moderated by the mobility effect of team leadership.*

## **Chapter 5: Data and Methods**

The dataset is constructed over six racing seasons from 2014 through 2019 on all 12 teams, that have at some point have been a participant in the Constructors' Championship. During those six racing seasons, a total of 120 races have taken place. The time period was decided based on the nature of technical regulations of the sport. As previous studies have found that major technical rule changes set by FIA have a significant negative effect on performance (Mastromarco & Runkel, 2009). To avoid that I used the time period following the last major technical changes set by the FIA. The examination period also called the "hybrid era" started in 2014. Additionally, I chose the latest period, because teams have only recently started disclosing

more information on employees other than Team Principal, Drivers, and Technical Director.

The panel data is acquired from public sources and cross-referenced (official websites of race teams and drivers, Formula1.com and autosport.com, motorsport.com, racefans.com as well as from official social media accounts), to create a dataset. The final sample consists of observations on 528 employees. Due to non-available information, there are missing values for some positions, which may affect the final results. For the employees' tenure – the career history of employees was collected and cross-referenced from official race team websites, formula1.com, autosport.com, motorsport.com, racefans.com as well as official accounts on LinkedIn and other motorsport related official websites. The sampling is on employees working trackside, key factory-based personnel, and senior management.

As explained above in the final sample employees are separated into different categories, based on their managerial status and functional role within the organization. This resulted in having three distinct categories within the race team– 1)Team Leadership (comprising of Race Team Leadership and Technical leadership), which are engineers with managerial status; 2) Engineers with no managerial status – Trackside engineers and Senior Mechanics, and 3) Drivers- non-engineers. The final category that is not part of the race team per se but a part of the organization is Firm leadership,

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## 5.1 Dependent Variable

Team performance – To measure performance previous studies set in Formula 1 have used different dependent variables finishing position (Eichenberger and Stadelmann (2009), or adjust points earned throughout the racing season (Phillips, 2014, Bell et al 2016) because throughout the history of the sports points system have changed many times.<sup>6</sup>

For this study as a more appropriate measure of performance, I chose points scored per race. The current scoring system was adopted in 2010 by the FIA<sup>7</sup> and has not changed since then. For only one race during the observation period, the scoring system was changed doubling the awarded points and I have not adjusted this one change in the scoring system for the regression. Despite this, the overall findings are not expected to change.

The choice of performance measurement was made because I am looking at the team-level performance, whereas previous studies have analyzed driver-level performance. Points scored is a more appropriate measure of team performance because using a ranking system does not allow to observe the real difference in performance between teams. For example, the team that finishes at second place at the end of the season may have over 100 points more than the team in the third position, but this will not be reflected in the ranking system, as the teams' ranking positions will simply be 2nd and 3rd respectively.

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<sup>6</sup> <https://www.formula1.com/en/results.html>

<sup>7</sup> FIA Sporting Regulations, 2010, p3. (<http://fia.com>)

## 5.2 Independent Variables

Employee Mobility is measured through mobility events, that is the number of times an employee has changed their job position within the organization or has moved to a different organization.

Each mobility event – across positions(promotions or change of positions in the case of restructuring) and/or teams equals 1. As employees move across and within teams also throughout the season the month and the year of the mobility event are both included in the career history. The mobility events were separated into two different categories: Turnover referring to a mobility event when an employee has left the position and moved to another position within the same team or to a different team. The second category is New Hires -this refers to any mobility events signifying a movement to a new position, as a result of a promotion, restructuring, and creating of a new position, or newly hired within the team. Both categories were later merged to represent all mobility events within and across teams.

Categories of Employees are described above. Initially, The Variable Employee mobility was separated into multiple categories to reflect the mobility at each level and key functional positions within the organizations and they were as follow: Board of Directors, CEO, C-level management (excluding CEO), Team Principal, Race Team Leadership, Technical Leadership, Drivers, Trackside engineers, and Senior Mechanics. For simplification reasons Board of Directors, CEO, and C-level management categories were merged into one – *Firm Leadership*, which includes all individuals directly responsible for the management of the organizations



operating the Formula 1 team. Next, the category Team Principal was merged with Race Team Leadership and Technical Leadership, to create a new category of High Seniority Status employees within the race team, which in the paper I refer to as *Team Leadership*. This category includes all engineers in senior managerial positions responsible for the design, development, and operation of the teams. Finally, the rest of the categories *Drivers*, *Trackside engineers*, and *Senior Mechanics* are not merged, because these categories refer to team members who attend races and are directly responsible for the operation of the race cars but have distinct functional roles which are very different from one another. Drivers are non-engineers, whereas Trackside engineers and Senior Mechanics are engineers without managerial status, but in senior positions relative to the rest of the engineers and mechanics who attend races and report and take orders directly from Team Leadership.

### **5.3 Control variables**

As control variables, I have included several variables that are known to influence the performance of Formula 1 teams.

Employee Tenure - Previous studies have shown that mobility's effect on performance depends on the employees' abilities and tenure (Pfeffer and Davis-Blake, 1986). To avoid confounding effects I control for tenure, which can be used as a reflection of abilities because to be employed by a Formula 1 team as an engineer or a driver one has to be extremely skilled. Longer tenure in the sport implies a strong skill set and abilities. Data on tenure was collected from public sources such as Formula1.com, motorsport.com, racefans.com, autosport.com, official team and driver websites, and official LinkedIn accounts, and other official motorsport websites and media accounts.

All data were cross-referenced. The exact dates for joining and leaving positions are not available for all employees. In case of an official statement, interview, or document was available with the exact date of beginning or end of tenure at a certain position I have used the dates. In cases where the only month of change in position or team was publicly disclosed, I have used approximations (Departure from team/position -last day of the month; Joining a new team or starting at a new position – the first day of the month) to indicate the end and beginning of tenure at different positions. The aggregate total tenure for each group of employees was calculated in Excel using the following formulas:

*Total Tenure in Days= Category Size+Total Tenure (at the position in the sport as of 16.03.2014-the first date of the observation period)*

For every following date I have used the formula:

*Total Tenure in Days= Number of Days between races x Category Size + Total Tenure (at the position in the sport as of the date of the previous race)*

In the Case of the Turnover event, the tenure of the employee was removed from the category Total Tenure in Days for the team the employee is leaving, and in the case of New Hires mobility events the Total Tenure in days up to the given date the tenure was added to the Total Tenure of the rest members in the category.

*The Average Tenure was calculated by dividing Total Tenure in Days by 365 and then by the Category Size.*

Race Retirement causes – Technical failure vs. Collision or Accident

To better understand the value and abilities of team members – engineers and drivers respectively I use the number of race retirements due to a technical/ mechanical issue which signifies the quality and reliability of the car – that is the product of engineers labor. For that of drivers, I use race retirement causes due to collision/ accident or collision damage. When a team has a low number of retirements due to a technical/mechanical failure we can consider this as an indication of a highly skilled engineering team. The same logic can be used for the link between driver skills and the number of retirements due to driver mistakes that have led to a collision or accidents. This control variable is an alternative for performance measurement.

Team Size and Team Budgets - factors such as budget and team size are directly linked to performance outcomes and can have a significant effect. Allowing teams with bigger budgets to hire a greater number of employees as well as more highly-skilled engineers and/or drivers. This also allows the teams to have access to better materials and technologies to develop, design, and produce the cars. For those reasons, I chose to control for team budget and team size.

In this paper as team budget, I have used data from the financial statements released by the firms. The exact team budgets are not disclosed for any team, so the numbers I used for proxy of the budget is the turnover or revenue (depending on the term the team has decided to use) listed in the financial statement. For each team, I read the definitions for the terminology they have adopted in their financial statements and used the number which represents the money received as prize money, sponsorship money,

shareholder funds, and other sources of revenue such as providing expert services and selling products to third parties.

For two of the teams I have used estimated team size and team budget data from publications as two of the teams do not release financial statements. In the case of Scuderia Ferrari, the team is managed and operated by the moto racing department of Ferrari N.V, namely, Gestione Sportiva, with Ferrari N.V. releasing only consolidated financial statements. The other team for which I used data from publications on team size and team budget is Alfa Romeo Racing Orlen (formerly Sauber F1 Team). This is due to the fact that the team is operated by Sauber Motorsport AG, a privately held Swiss firm, that does not release any financial statements.

Driver salaries – The official driver salaries are not disclosed because any information about the drivers' contracts is classified and only authorized team personnel and Formula 1 personnel have access to it. I have used data released from Business Book GP, which is an annual french magazine about the Business side of Formula 1, and release estimated driver salaries. Information from this magazine is cited across all media and is the most often cited source when it comes to the business activities of Formula 1 teams. Additionally, I have used data from Sportac.com an official sports website that releases calculated approximations of athletes' salaries and is considered a reliable source.

Engine Supplier – Directors are included as a separate category because engines play a massive role in the performance of the cars. There are usually 3 or 4 engine suppliers, which supply all racing teams. Trackside engineers

whose job is related to engine operations are employed by the Engine supplying companies and not the race teams, thus are not included in this study. That means that they are not eligible to be included in the same category as Trackside engineers or Technical Leadership members. But to account for the influence of engines the Engine Directors category is included and controlled to see how much influence does the mobility of the Managing Director of the engine supplying companies have on the performance of customer teams and if the switching of suppliers has a significant influence on the performance of the car. That is done by calculating the tenure of Engine directors and the mobility events for the observational within the category. By controlling for the relative influence of engines on performance the significance of mobility can be more accurately estimated.

I have not included weather conditions and designated tracks. Previous studies have found that whereas the weather conditions and specifications of different tracks may influence the performance of teams the effect is not significant for overall performance (Bell, et al, 2016) because it varies from team to team.

## **5.4 Model**

Previous studies in sports statistics using count data from association football, MLB, or NFL on scoring (Pollard, 1985, Baxter & Stevenson, 1988, Mosteller, 1997) have suggested that an appropriate model in sports studies using count data is the negative binomial regression model. Formula 1 data allows observing a series of points scoring events, for a total of 1207 events for all teams for the observational period. The point system adopted by the FIA in 2010 allows satisfying the overdispersion assumption of the negative

binomial regression because only 10 out of 20 drivers are awarded points and the points range from 25 to 0 per driver. As we are looking at team performance per race this means that a team can win up to 44 points per race and some teams can win 0 points. In addition, team performance can vary from race to race meaning that the mean can vary by large amounts, so a negative binomial regression fits the distribution better than a Poisson distribution. This study adopts a negative binomial regression with fixed effects, due to the dependent variable (points earned) being measured using count data and to account for overdispersion that I found evidence of in the dependent variable. The analysis was conducted using STATA. I use the year and firm fixed-effects specification to correct for dependence across years and teams (Greene 2003). To calculate mobility rate the mobility events are divided by the size of the employee category (Team Leadership, Trackside engineers, etc.) for each point of the observational period, that is for each race throughout the observational period.

## **Chapter 6: Results**

The descriptive statistics and the correlations matrix for all variables used in the model are shown in Table 1 in the Appendix. The Pearson correlation shown in Table 1 shows that there is no serious problem with multicollinearity between the variables.

The results from all models are shown in Table 2. The results from the control variables in the baseline model are as expected. The control

variables Team budget and Tenure of key personnel have a significant effect on performance.

The baseline model (Model 1) suggests that the team budget has a large influence on team performance about 2-fold ( $\beta=2.5$ ,  $p<0.001$ ), which is in line with expectations, given that one of the incentives for scoring more points during each race, as the final ranking at the end of the season determines the amount of prize money each team will receive and that this money is included in the budgets teams have for the designing and developing the race cars for the next season. The effect of tenure of key personnel is also significant which is in line with previous research reporting that when taken into account previous experience of employees does influence the effect of the mobility event on performance, especially in sports (Pfeffer & Davis-Blake, 1986).

Model 2 of Table 2 includes all independent and control variables. In this, we can find support for Hypothesis 1, regarding the different influences of the mobility rate at the different team layers. The coefficient for the mobility rate of Firm Leadership is positive and not significant ( $\beta = 0.167$ ,  $p > 0.05$ ), which is in line with the expected little to no effect of executive mobility on performance, given the significant regulations existing in the industry. The coefficient for High Seniority Status employees mobility (referring to Team Leadership) is negative with small significance ( $\beta = -1.079$ ,  $p < 0.05$ ) suggesting that the mobility rate of members of Team Leadership (engineers with senior managerial status) in this paper is 108% likely to negatively affect performance, meaning that increase in the mobility rate of

Team Leadership is likely to negatively affect team chances of earning points (team drivers to finish the race within the points awarding top 10 positions). The coefficient for Driver mobility is negative and non-significant ( $\beta = -0.001$ ,  $p > 0.05$ ), which is in line with expectations. Even though expectations were of little significance, if we compare with previous studies of Driver effect being about 4 times less significant than Team effect (Bell et al, 2016), then it is not a surprise that little significance of Team Leadership mobility would lead to a non-significant Driver mobility effect. Next, we can see the coefficient for Trackside engineers' mobility, which is in line with expectations of significant Team effect ( $\beta = 0.983$ ,  $p < 0.01$ ), meaning that the mobility rate of Trackside engineers is 98% likely to positively affect performance. What is surprising is that the coefficient is positive and more significant than that of Team Leadership, but it still supports previous findings for Team effect being stronger than the Driver effect. The coefficient for the last independent variable in Model 2 – Senior mechanics mobility is negative and non-significant ( $\beta = -0.042$ ,  $p > 0.05$ ). This further supports Hypothesis 1 as we can see that employee's mobility effects at different layers of the race team are different from one another.

In Model 2 we can also find the support of Hypothesis 2a as we see this difference between mobility rates is different for the different functional roles employees hold. As all categories of employees in the analysis are based on the similarity of their functional roles, shows that the mobility of employees with certain functional roles has a stronger effect than others. In Model 2 we can also find partial support of Hypothesis 2b, as we can see the mobility effect of employees with functional roles related to engineering



(whether design or data engineering), except Senior Mechanics have a stronger effect on performance than employees who are non-engineers (drivers). This is also supported by a previous study (Bell et al, 2016) which reported that Drivers' effect on performance is 4 times less significant than the Team effect (engineers). The hypothesis will still hold if we also compare with the significance of Firm leadership mobility. Providing further support for the argument that the mobility of engineers will yield a stronger effect on performance than that of non-engineers.

Models 3 through 5 examine the moderation effect between Firm leadership mobility and Team Leadership mobility. In Model 5 we can see the coefficient is negative and non-significant ( $\beta = -0.972$ ,  $p < 0.05$ ) meaning that Hypothesis 3 is not supported, because a moderation effect between the two variables does not exist.

## **Chapter 7: Discussion and Conclusion**

Previous studies have shown complex results regarding mobility effects – gain and loss of advantage through the transfer of human and social capital, which are the results of mobility. But what literature has failed to do is explore if there is a difference in significance of the effect depending on the layer at which mobility occurs.

The purpose of this study is to shed further light on the complex relationship between employee mobility and performance. This is achieved by examining the difference in mobility effect between employees at different

functional roles and levels across the organization. The findings of this study provide a step towards understanding the underpinnings of mobility effects, which can help managers successfully utilize human assets across the organizations.

Accordingly, I utilized team performance, which can provide an accurate measure of the teams' competitive advantage, particularly when the organization primarily relies on its knowledge-based assets for such advantage (Coff, 1999). The nature and the quality of the data allow for direct observation of performance – in the case of Formula 1- the points earned in head-to-head competition, making it easier to observe the direct effect of mobility across the different layers of the organization.

The study reveals that the effects of employee mobility are closely related to the functional roles of employees and knowledge associated with those roles and that such relationship between mobility effect and functional role is not limited only to executives (Bermiss & Murmann, 2014). Moreover, the findings reported in the study suggest that the effect of mobility varies between the different functional roles, and the effects for some roles can be positive (Trackside engineers), Negative (Team Leadership), or non-significant (Firm Leadership, Drivers, Senior Mechanics). This is an important finding because it can explain to a certain degree the mixed results reported in previous studies regarding employee mobility (Hambrick and Mason, 1984) specifically in sports (Warner, Watts, and Wruck, 1988; Aime et al, 2010, Bas ter Weel, 2011).

The results showing a non-significant effect of Firm leadership mobility on performance is in accordance with previous findings of the non-significant effect of executive mobility in regulated industries (Hadlock et al., 2002). Even though in sports, including Formula 1, owners and executives take a more hands-on approach in managing the sports teams, the constraints they face in terms of regulations set by the governing bodies of the given sport in the case of Formula 1 the FIA, shows that industry constraints have an extremely large significance. Apart from that, the uncertainty surrounding every sporting event, especially in motorsport might also be another factor contributing to the lack of significance in Firm leadership mobility effect on performance.

The study also addresses a question that exists in mobility literature about how “to identify advantageous higher-order routines in more complex organizations and the location of key employees that may embody them” (Aime et al., 2010: 85). A way to interpret the findings in this paper is that there is variance in mobility between different functional roles and that this variance is caused by the nature of the different functional roles. This suggests that different roles are required and are associated with specific to the role deep tacit knowledge (e.g Trackside engineers responsible for analysis of data received from the car vs. Drivers responsible for operating the cars on the track). Such interpretation implies that even between key employees some matter more than others and can be added to the argument of firm-specific factors preventing employees from replicating their top performance to the new firm (Groysberg, 2008).

The study sheds more light on the issue of functional diversity which has not been extensively examined in the mobility literature. In this paper, I argue that the difference in mobility effect between employees can be interpreted as the functional knowledge and firm-specific factors associated with some positions to be more directly and strongly related to performance than that of other positions can best be explained through the above-given comparison: Trackside engineers vs. Drivers, leading to suggest that the data analysis process and the knowledge employees involved in this process carry with them (Trackside engineers) are more important for team performance than Drivers skills. Hence if the data is not analyzed properly or there is any miscommunication between Trackside engineers and Drivers during the race this can yield negative results on track. In such cases change of personnel in those positions can improve the communication between the team and the drivers during races and overall team performance and amount of points scored.

The study reveals that the effects of employee mobility are more closely related to the functional knowledge associated with their positions than it has been reported in prior research (Phillips, 2002), also this relationship is observed at other levels across the organization not only at the executive level (Bermiss and Murmann, 2014). Moreover, the findings suggest that the effects of employee mobility on organizational performance are driven by the characteristics of the knowledge the employees carry with them individually and collectively. So the results from Hypotheses 2a and 2b can be interpreted as any change in personnel within a given group may be associated with either disruption within the group knowledge exchange and

specific organizational practices (for groups whose mobility has a negative effect), or strengthen the link between the given group with other groups of employees with different functional roles, thus bettering performance. (for employees whose mobility has a positive effect). These findings can serve as an explanation of previous findings in Formula 1 literature (Phillips, 2014; Bell et al, 2016) where it was reported that team effect is stronger than driver effect. The paper does so by showing that employees with firm-specific functional knowledge such as engineers (Song, Almeida & Wu, 2003) yield stronger effect than that of employees whose performance is more directly related to their own set of skills (drivers) and relies on the communication with colleagues (Galbraith, 1977; Becker, 1976) who carry specific functional knowledge -engineers. Such difference between the effects of functional roles may also explain findings of previous studies regarding star performers (Groysberg, 2008) or cardiac surgeons (Huckman & Pisano, 2006) inability to replicate their top performance at their new workplace.

The findings reported in this study confirm results reported in previous studies of the value of knowledge workers (Song, Almeida & Wu, 2003, Rao & Drazin, 2002) but also further extend the theory to suggest that their value to the firm depends also on the functional role and seniority status they have within the organization, not only their skills or the firm-specific factors. (Groysberg, 2008). This can also help explain findings in previous research that in knowledge-intensive industries to improve and sustain performance organizations seeks highly-skilled personnel (Campbell, Coff, & Kryscynski, 2012).

An interesting finding is that regardless of the significant effect knowledge workers in managerial positions have on performance, their mobility does not moderate the effect of mobility of Firm leadership (Hypothesis 3). This further emphasizes the importance of whether an organization operates in a regulated industry (Hadlock et al, 2002) and how that affects the importance of executives' mobility on performance, despite executives' role in establishing organizational culture (Hambrick & Mason, 1984).

In addition to having a theoretical contribution to the mobility literature, specifically on how mobility effects are related to the importance of functional diversity of knowledge carried by employees across the different layers of the organization, the findings reported in this study also have managerial implications. By recognizing and examining the different mobility effects across the organizational layers managers can better manage their human capital and the knowledge embedded within it, thus optimizing organizational performance.

Like any other research, this study also has its limitations. First, it's important to recognize that the observational period is relatively short. A similar study using a longer observational period might yield different results. It is worth examining this issue further because the mobility literature until now has not investigated the difference between mobility effects across organizations and/or the possible factors contributing to existing variance in the significance of such effects. As discussed above literature has focused on exploring mobility effects separately for the different types of employees –

star performers (Groysberg, 2008), highly skilled personnel (Song, Almeida & Wu, 2003), an executive at the individual and group level (Finkelstein and Hambrick, 1990, Drazin and Rao 1999), or in the case of sports – managers (Pfeffer & Davis- Blake, 1986; Bas ter Weel, 2011).

Another limitation of the study is that for the dependent variable I have not distinguished at which place the driver has finished outside of the points awarding positions (from 1<sup>st</sup> to 10<sup>th</sup>). Fractional points in the positions (11<sup>th</sup> to 20<sup>th</sup>) may be used to further evaluate driver and team performance, which can have a change in the significance of mobility effects.

It is important to note that there are missing values for the independent variables in the categories Trackside Engineers and Senior Mechanics, which may ultimately affect the results from the analysis. Additionally, for Trackside engineers, not all engineers working trackside are included. This is because the data is not readily available. – specifically for trackside aerodynamicists, tire engineers, who are also responsible for car performance analysis during races.

The control variable Engine Directors mobility, as explained above, is to control for the effect of mobility of the directors managing engine design, development, and operations. It would be interesting to have an additional analysis exploring the effect of the engine on performance. By doing so we can better estimate the relative effect of chassis and engine on performance, which would allow us to more accurately calculate the mobility effects on performance for the different functional roles across the teams. It would be useful because Firm Leadership is responsible for all partnership relations,

which includes partnerships with engine suppliers, meaning that there will be a correlation between changes in engine supplier and changes in Firm leadership, which will ultimately affect overall performance. Another limitation for the study is the absence of a variable controlling for starting position of the driver, which is assumed to affect finishing positions. This is important because some tracks have specifications that do not allow for overtaking, meaning that starting and the finishing positions of drivers can be the same.

Despite its limitations, the study brings up important questions that have been left underexamined by the mobility literature. Questions regarding relative mobility effect across organizational layers and the possible factors that contribute to the observed variance. As well as how firm leadership's effects on choice of corporate structure ultimately affects engineer's freedom of creativity, hence car performance. This should be examined to see what types of corporate structures and decision-making structures stifle or encourage creativity and innovation- top-down decision-making approach or distributed responsibility and decision-making power across all layers of the organization.

While existing research on mobility has studies the effect of turnover on the executive level (Finkelstein and Hambrick, 1990, Feldmann et al. 2009; Drazin and Rao 1999; Jackson et al. 1991; Bermiss and Murmann, 2014) Literature has not yet been studied how and why mobility effects of non-executives, other knowledge workers - star performers (Groysberg, 2008) and engineers (Song, Almeida & Wu, 2003) affect performance. But these studies



have differentiated between the different functional roles knowledge workers hold. This opens a new avenue for exploration of the complex relationship between mobility and performance.

# APPENDIX

Table 1. Descriptive Statistics and Correlation Matrix

	Mean	S.D.	Min	Max	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1 Race Performance by points	10.32	12.97	0	66	1.00																							
2 Firm leadership mobility	0.0219	0.126	0	2	-0.04	1.00																						
3 High seniority status mobility	0.0214	0.0811	0	12	-0.06*	0.29***	1.00																					
4 Driver mobility	0.0539	0.246	0	2	-0.09**	0.22***	0.50***	1.00																				
5 Trackside engineers mobility	0.0268	0.118	0	15	-0.03	0.15***	0.38***	0.35***	1.00																			
6 Senior mechanics mobility	0.0168	0.135	0	2	-0.01	0.12***	0.29***	0.28***	0.26***	1.00																		
7 Budget(log)	6.802	2.107	4.357	13.13	0.70***	-0.04	-0.06*	-0.08**	-0.05	-0.04	1.00																	
8 Team size	191581	124043	765	469409	0.08**	-0.03	-0.02	-0.03	-0.01	0.00	-0.33***	1.00																
9 Race Driver retirement cause technical	0.234	0.472	0	2	-0.24***	0.04	0.06*	0.10***	0.09**	0.02	-0.10***	0.03	1.00															
10 Race Driver retirement cause collision	0.133	0.37	0	2	-0.18***	-0.02	-0.01	-0.04	-0.03	0.01	-0.10***	-0.00	-0.11***	1.00														
11 Ranking_inverse	0.283	0.263	0.0909	1	0.73***	-0.04	-0.04	-0.08**	-0.04	-0.02	0.84***	-0.09**	-0.10***	-0.11***	1.00													
12 Historical Performance number of titles five years back	0.501	1.207	0	5	0.52***	-0.04	-0.04	-0.05+	-0.02	-0.02	0.65***	-0.09**	-0.07*	-0.09**	0.78***	1.00												
13 CEO tenure in years	5.345	4.443	0	14.97	0.12***	-0.10***	-0.07*	-0.02	-0.01	-0.00	-0.08**	0.47***	-0.03	0.02	0.08**	0.20***	1.00											
14 BOD average tenure in years	8.126	5.948	0	22.78	0.13***	-0.09**	-0.02	-0.05	0.01	-0.01	-0.03	0.63***	0.03	-0.05+	0.05+	0.03	0.16***	1.00										
15 C-level Managers average tenure in years	5.277	2.716	0	12.5	0.12***	-0.07*	-0.05	-0.03	-0.02	-0.05	0.10***	0.28***	0.04	-0.05+	0.13***	0.30***	0.09***	0.52***	1.00									
16 Team Principal tenure in years	7.914	11.7	0	43.92	-0.03	-0.06+	-0.03	-0.00	0.01	-0.01	-0.03	0.08**	-0.07*	-0.03	-0.02	-0.01	0.13***	0.23***	-0.12***	1.00								
17 Technical Leadership average tenure in years	4.852	2.401	0	12.83	-0.03	-0.02	-0.03	-0.03	0.03	-0.04	-0.00	0.07*	-0.08**	0.05	-0.01	-0.03	0.15***	0.01	-0.04	0.13***	1.00							
18 Race Team Leadership average tenure in years	5.504	2.233	0.234	9.31	0.01	-0.02	-0.06*	-0.04	-0.03	-0.04	0.12***	-0.03	-0.06*	-0.01	0.07*	0.12***	0.14***	0.08**	0.03	0.28***	0.26***	1.00						
19 Drivers average tenure in years	5.454	3.784	0.0192	15.41	0.43***	-0.02	-0.08**	-0.13***	-0.06*	-0.04	0.41***	0.22***	-0.05+	-0.06+	0.42***	0.15***	-0.13***	0.37***	0.22***	-0.09**	-0.02	-0.00	1.00					
20 Driver's salary(log)	8.814	1.619	5.481	11.51	0.61***	-0.04	-0.08**	-0.14***	-0.07*	-0.02	0.56***	0.27***	-0.06+	-0.07*	0.61***	0.33***	-0.07*	0.40***	0.29***	-0.12***	-0.08**	-0.07*	0.82***	1.00				
21 Trackside engineers average tenure in years	3.62	1.981	0.0247	9.387	0.51***	-0.02	-0.09**	-0.10***	-0.12***	-0.00	0.57***	-0.14***	-0.11***	-0.07*	0.55***	0.27***	-0.06*	-0.07*	-0.09**	-0.10***	-0.10***	0.08**	0.47***	0.60***	1.00			
22 Senior mechanics average tenure in years	4.855	2.348	0.0137	13.5	0.29***	0.02	-0.04	-0.07*	-0.05	-0.10***	0.33***	0.13***	-0.08**	0.00	0.24***	0.04	-0.02	0.07*	-0.06*	0.11***	0.22***	0.12***	0.48***	0.42***	0.12***	1.00		
23 Supplier Engine Director in years	4.235	3.566	0.0055	14.91	0.11***	0.01	-0.02	-0.01	-0.04	-0.00	0.03	0.19***	0.07*	-0.07*	0.20***	0.47***	0.37***	0.03	0.16***	0.15***	-0.12***	0.15***	-0.22***	-0.10***	0.06*	-0.27***	1.00	
24 Supplier Engine Director mobility	0.0157	0.174	0	2	-0.02	0.14***	0.21***	0.18***	0.12***	0.04	-0.03	0.04	0.03	-0.01	-0.02	-0.01	-0.00	0.03	0.01	-0.04	-0.02	-0.01	0.03	0.00	-0.04	0.04	-0.06*	1.00

Note: N=1207

+p<0.1

\*p<0.05

\*\*p<0.01

\*\*\*p<0.001

**Table 2: Main Results**

Negative Binominal Regression Analyses for Performance

Variables	Negative Binominal Regression				
	Model 1	Model 2	Model 3	Model 4	Model 5
Budget(log)	2.471*** (0.520)	2.550*** (0.520)	2.545*** (0.522)	2.534*** (0.519)	2.552*** (0.520)
Team size	0.000+ (0.000)	0.000+ (0.000)	0.000+ (0.000)	0.000+ (0.000)	0.000+ (0.000)
Race Driver retirement cause technical	-0.790*** (0.076)	-0.810*** (0.076)	-0.807*** (0.076)	-0.809*** (0.076)	-0.811*** (0.076)
Race Driver retirement cause collision	-0.596*** (0.097)	-0.586*** (0.096)	-0.593*** (0.097)	-0.586*** (0.096)	-0.585*** (0.096)
Ranking_inverse	-0.030 (0.442)	0.018 (0.440)	0.024 (0.441)	0.020 (0.440)	0.025 (0.440)
Historical Performance number of titles five years back	0.046 (0.096)	0.028 (0.096)	0.034 (0.096)	0.030 (0.096)	0.027 (0.096)
CEO tenure in years	0.012 (0.021)	0.010 (0.021)	0.010 (0.022)	0.009 (0.021)	0.010 (0.021)
BOD average tenure in years	-0.027 (0.017)	-0.030+ (0.017)	-0.030+ (0.017)	-0.030+ (0.017)	-0.029+ (0.017)
C-level Managers average tenure in years	-0.165* (0.075)	-0.128+ (0.075)	-0.135+ (0.076)	-0.129+ (0.076)	-0.127+ (0.076)
Team Principal tenure in years	-0.060 (0.040)	-0.063 (0.041)	-0.060 (0.041)	-0.066 (0.040)	-0.064 (0.041)
Technical Leadership average tenure in years	-0.063* (0.032)	-0.074* (0.032)	-0.071* (0.032)	-0.073* (0.032)	-0.074* (0.032)
Race Team Leadership average tenure in years	-0.107*** (0.028)	-0.119*** (0.031)	-0.114*** (0.030)	-0.118*** (0.030)	-0.119*** (0.031)
Drivers average tenure in years	0.188*** (0.037)	0.178*** (0.037)	0.184*** (0.037)	0.180*** (0.037)	0.178*** (0.037)
Driver's salary(log)	-0.227+ (0.118)	-0.229+ (0.118)	-0.243* (0.118)	-0.231+ (0.118)	-0.230+ (0.118)
Trackside engineers average tenure in years	0.147*** (0.041)	0.159*** (0.041)	0.160*** (0.041)	0.160*** (0.041)	0.159*** (0.041)
Senior mechanics average tenure in years	-0.052* (0.026)	-0.053* (0.027)	-0.057* (0.027)	-0.053* (0.027)	-0.052* (0.027)
Supplier Engine Director in years	0.042 (0.056)	0.069 (0.056)	0.065 (0.056)	0.069 (0.056)	0.070 (0.056)
Supplier Engine Director mobility	0.124 (0.174)	0.120 (0.177)	0.026 (0.173)	0.124 (0.178)	0.116 (0.178)
Firm leadership mobility		0.167 (0.326)	0.133 (0.325)		0.259 (0.394)
High seniority status mobility		-1.079* (0.466)		-1.069* (0.467)	-1.015* (0.489)
Driver mobility		-0.001 (0.153)	-0.098 (0.146)	0.007 (0.153)	0.010 (0.155)
Trackside engineers mobility		0.983** (0.316)	0.913** (0.321)	1.023*** (0.307)	0.969** (0.318)
Senior mechanics mobility		-0.042 (0.239)	-0.107 (0.238)	-0.041 (0.240)	-0.041 (0.240)
Firm leadership mobility x High seniority status mobility					-0.972 (2.159)
Constant	- 10.848*** (3.118)	- 11.171*** (3.110)	- 11.049*** (3.121)	- 11.095*** (3.107)	- 11.165*** (3.111)
Year fixed effect	Yes	Yes	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes	Yes	Yes

Note. N=1,207

Standard errors in parentheses

\*\*\* p&lt;0.001, \*\* p&lt;0.01, \* p&lt;0.05, + p&lt;0.1

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# Employee mobility and Performance in Formula 1

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직원 이동성은 개인 및 집단 수준(임원, 스타 수행자, 지식 근로자)에서 연구되었습니다. 스포츠에서 – 코치와 선수. 다양한 유형의 직원에 대한 이러한 효과는 별도로 연구되기 때문에 한 가지 중요한 질문에 답이 없습니다. 다른 조직 계층에 있는 직원의 이동성이 성과에 동등하게 영향을 줍니까?

2014 년부터 2019 년까지 Formula 1 의 패널 데이터를 사용하여 지식 기반 관점과 인적 및 사회적 자본 주장을 불러와 기능적 역할과 지식 풀을 기반으로 Formula 1 팀의 다양한 직원 그룹 간의 이동성 효과의 차이를 비교합니다. 분석은 고정 효과가 있는 음의 이항 회귀 모델을 사용하여 수행됩니다. 이 연구에서 나는 직원 이동성의 영향이 다른 조직 계층에 따라 다르며 이 차이가 직원의 기능적 역할에 크게 의존한다고 가정합니다. 또한

엔지니어와 같은 지식 근로자의 이동성은 다른 직원보다 팀 성과에 더 큰 영향을 미친다고 주장합니다.

연구 결과는 가설과 일치하며, 직원 이동성 효과가 성과에 미치는 영향은 직원의 기능적 지식과 직접적으로 관련이 있음을 시사합니다. 가장 중요한 발견은 지식 근로자의 이동성이 팀 성과에 가장 큰 영향을 미친다는 것을 시사합니다. 흥미롭게도 나는 팀 리더십의 이동성이 성과에 상당한 영향을 미치는 것은 하지만 확고한 리더십과 성과 사이의 관계를 조절하지 않는다는 것을 발견했습니다.

이 연구는 이론을 확장하여 근로자의 가치가 근로자의 기술이나 회사 고유의 요인뿐만 아니라 조직 내에서 수행하는 기능적 역할에도 달려 있음을 발견했습니다. 이 연구는 이동성 문헌에서 광범위하게 조사되지 않은 기능적 다양성 문제를 조명합니다.

주요어: 직원 이동성, 성과, Formula 1, 인적 자본, 지식 기반 관점, 기능적 다양성

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