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Abstract

Firms who want to compete in dynamic markets are finding that they must build more agile operations to ensure success. One way for a firm to increase organizational agility is to allocate employees to multiple project teams, simultaneously - a practice known as multiple team membership (MTM). MTM allows for the potential of improved project performance through additional flexibility and learning, however, there is also the possibility of negative performance effects from MTM due to overwork, coordination neglect, and problems with resource blocking and starving. In this paper we theorize about these conflicting predictions prior to building and testing an empirical model that draws on a unique dataset consisting of 1,503 construction projects in the Europe District of the United States Army Corps of Engineers (USACE). Although USACE is a government entity, it operates similar to for-profit construction services companies. We find that MTM shows an inverted U-shaped relationship with on-time project delivery whereby it is first related to improved performance and then later related to worse performance. To extend our exploration we examine whether MTM makes teams more fragile operationally. We do this by investigating whether teams that experience turnover are more susceptible to the negative effects of MTM. Our empirical results support this proposition and deliver additional insight that the effect is driven by unanticipated turnover. Our findings provide understanding into the benefits and the difficulty in building a more agile workforce.

Key Words: Multiple Team Membership, Turnover, Fluid Teams, Project Management

1. Introduction

Firms face dynamic and uncertain markets and so building agile operations are a key determinant of organizational success (Fisher and Raman 2010; Girotra and Netessine 2014). In many contexts, this need for agility has led to an increasing use of fluid, project teams (Edmondson and Nembhard 2009; Huckman, Staats, and Upton 2009; Reagans, Argote, and Brooks 2005). In a fluid team, employees with potentially diverse experiences are brought together to execute a project and then the team is broken up and individuals move on to the next project. The constant assembling of the right talent at the right place permits organizations to respond more nimbly than might be possible with an organizational-level response. However, a standard model of fluid teams with individuals fully dedicated to one team (Huckman and Staats 2011), may prove inefficient. In many situations projects must be completed in a structured sequence and so there may be lag time between steps or there may not be enough work at each phase of the project to ensure full utilization of the team. As a result, organizations have responded by staffing individuals to multiple teams simultaneously, a practice known as multiple team membership (MTM). Firm usage of MTM is growing and although MTMs have received theoretical attention (O'Leary, Mortensen, and Woolley 2011), their operational implications have received little study and so it is important to understand these outcomes from both a practical and theoretical perspective.

There are compelling reasons to expect positive and negative performance outcomes from MTM. The deployment of MTM may aid operational performance in three ways. First, MTMs may build volume flexibility (Goyal and Netessine 2011; Kesavan, Staats, and Gilland 2014), permitting any given team to scale its effort in response to the actual work demands. Second, MTMs may augment individual learning since there are greater opportunities to see entire start-to-finish project cycles (Pisano, Bohmer, and Edmondson 2001; Reagans, Argote, and Brooks 2005), as well as more chances to work with others and thus learn vicariously (Bresman 2010). Finally, with MTM utilization, employees see a greater variety of ideas and may be able to bring these ideas from one project to the next, thus aiding performance (Hargadon and Sutton 1997; Huckman and Staats 2011).

Despite these potential benefits there are also compelling reasons to predict a negative relationship between MTMs and project performance. First, when team members are engaged in multiple teams simultaneously, they may grow overworked and their performance may suffer (Kc and Terwiesch 2009; Staats and Gino 2012; Tan and Netessine 2014). Second, as individuals' work across many teams then coordination may suffer – resulting in coordination neglect that may lead to declines in operational performance (Heath and Staudenmayer 2000; Staats, Milkman, and Fox 2012). Finally, although MTMs are meant to take advantage of potential downtime for workers, instead if the desired work is non-overlapping then it is possible that there may be increased levels of resource blocking and starving of resources during the project. Given that these effects may be a function of the amount of MTM, namely at lower values of MTM the positive effects may dominate while at higher values of MTM the negative effects may dominate, this suggests that there may be an inverse U-shape relationship between MTM and performance.

As a result of these conflicting effects, our first research question asks: *How does multi-team membership contribute to project performance?*

If multi-team membership provides its beneficial flexibility, at the cost of fragility to team performance, as the prior paragraphs suggest, then it is important to explore the implications of MTM in situations where such disruptions might occur. One such disruptive circumstance is when teams experience turnover – the departure of team members from the project. Prior work notes that turnover may have a direct and disruptive impact on operational performance (March 1991; Rao and Argote 2006; Ton and Huckman 2008; Narayanan, Balasubramanian, and Swaminathan 2009). We examine the potential operational consequences of turnover in project teams with an important consideration – was the turnover anticipated or not (Huckman, Song, and Barro 2013)? With anticipated turnover, organizations can plan and respond, thus minimizing or even eliminating the effect. As a result, in order to study a disruption we investigate unanticipated turnover. The use of MTM in projects that experience unanticipated turnover may prove particularly problematic since managers' may have less flexibility to replace employees due to minimal slack in the labor pool, problems of blocking and starving may increase, and coordination as a whole may suffer. Therefore our second and final research question is: *How do multiple team membership and unanticipated turnover jointly affect project performance?*

The Europe District of the United States Army Corps of Engineers (USACE) is the setting for our empirical analysis and research. Although it is a government entity, USACE operates like other for-profit construction services companies. USACE employees manage projects in 94 different countries located in Western Europe and the Continent of Africa. Employees are required to work on multiple teams in the countries of operation.

The attention devoted to project-based organizations has increased recently due to the nature of globalization. Beyond its current relevance, the Europe District is an appropriate setting for our analysis for several reasons. First, there is a large volume of projects completed that provides for us with a sufficient sample size. In addition, the context has MTM, which enables us to observe employees operating on multiple projects simultaneously, which is central to our study. Similar to previous studies, we use project-level data. Fortunately, we are able to link individual employee attributes to project data, thereby allowing us to analyze the impact of engaging on multiple teams. With this well-defined linkage between employee attributes and performance, we are able to highlight the relationship between MTM and turnover on on-time delivery. Second, there is high turnover as individuals rotate through the Europe District and then return to the United States. This phenomenon allows us to explore the impact of *unanticipated* turnover caused by the enforcement of a human resource policy and understand the challenges faced by managers who must staff projects to ensure on-time delivery in the midst of turnover. Third, the district is responsible for projects throughout Europe and Africa, which allows for multiple observations of employees engaged in diverse areas.

We contribute to the understanding of the development of agile operations in three ways. First, we empirically show the complex effect of MTM on project outcome. Prior work develops theory that MTM affects operational performance (O'Leary, Mortensen, and Woolley 2011) and the limited empirical exploration has used survey data to show a positive relationship on manager rated performance (Cummings and Haas 2012). We leverage archival organizational data and find that the project team performance first improves then degrades as MTM increases. MTM has emerged as a strategy for both workforce utilization and flexible response to dynamic conditions and so MTM is likely to remain a common labor paradigm in management. However, the efficiency gains from MTM may be substantially reduced or offset entirely if employees are assigned to too many teams.

Second, we gain insight on the optimal level of MTMs in our setting. We find that the stationary point of the inverted U-shape is at 63 MTMs, which is 45% less than the average MTM in our sample. Finally, for our third contribution we explore the fragility of MTM. By leveraging the implementation of a human resource policy that permits us to identify *unanticipated* and *anticipated* turnover, we better understand how different types of turnover influence outcomes and importantly we explore what happens when MTM and unanticipated turnover are combined. Consistent with a view that MTM may result in a more fragile operating system, we find that *unanticipated* turnover is even more harmful to operational performance when MTM is higher, as compared to when it is lower. This observation identifies the increased systemic risk that comes from high levels of MTM.

2. Performance and Multiple Team Membership

2.1 Multiple Team Membership

The traditional view that individuals join *one* team and stay on that team until project completion is often not the case in modern organizations (Arrow and McGrath 1995; Hackman 2002). Over the past 30 years, many organizations have recognized that the flexibility offered by individuals working on multiple projects at the same e time may improve individual, team, and organizational performance (Edmondson and Nembhard 2009). Scholars have labeled this practice multiple team membership (MTM) (O'Leary, Mortensen, and Woolley 2011). The transition to MTM can be observed in a wide array of industries and functions including: information technology (Baschab and Piot 2007), consulting (Gardner, Gino, and Staats 2012), education (Jones and Frederickson 1990), health care (Richter, Scully, and West 2005; Valentine 2015) and new product development (Edmondson and Nembhard 2009).

Although the performance effects of MTM have not been extensively explored empirically, prior scholars have theorized about the potential positive or negative impact of MTM on team performance (O'Leary, Mortensen, and Woolley 2011). Cummings and Haas (2012) use survey data to show that working on multiple teams is related to positive, managerially-rated team performance. Examining the operational performance of MTM more rigorously, in practice, is important because MTM could be related to either improved or worse team performance. We begin by examining the performance benefits of MTM.

There are at least three ways MTM may positively affect team performance. First, MTM may offer a manager volume flexibility – the ability to increase capacity up or down to meet service demand (Goyal and Netessine 2011). In prior work in call centers, researchers found that volume flexibility allowed management to quickly redirect employees based on demand and to position employees in critical stages to improve performance (Iravani, Van Oyen, and Sims 2005). Kesavan, Staats, & Gilland (2014) found that leveraging volume flexibility with a flexible labor force-mix—as captured by full, part time, and seasonal labor—resulted in increased sales and profits and decreased expenses for retail operations, at least up to a point. In a team context, volume flexibility could prove beneficial since work is rarely uniformly distributed. If individuals take part in multiple teams at the same time, then they have the potential to move between different projects based on project needs—when one project is particularly time-intensive then multiple people can focus their attention there, with the hopes that other projects might need less time at that moment (we discuss potential challenges with this approach below). This type of flexibility has been referred to as temporal flexibility (Kesavan, Staats, and Gilland 2014).

Second, when organizations use MTM, employees can augment their individual learning. Research has consistently shown that one of the most important predictors of team performance is team or individual prior experience (Pisano, Bohmer, and Edmondson 2001; Reagans, Argote, and Brooks 2005). Multiple team membership may aid individual learning in two ways. First, by operating on many teams, and engaging in multiple tasks, there is an opportunity for greater learning by doing. Individuals get the opportunity to be a part of more projects that are cycling through start to finish, than they would if they were only on one project at a time. Second, MTM may benefit individual learning when people have the opportunity to see how others do the task – often called vicarious learning (Bresman 2010; Gino et al. 2010). By watching others, an individual can learn how to complete a task successfully or learn from the mistakes that the other person might make (KC, Staats, and Gino 2013).

Finally, when individuals work on multiple teams they are exposed to a diversity of ideas and people and they may then have the opportunity to provide the knowledge that they gain on one team to another (Hargadon and Sutton 1997). Prior literature focused on transfer of ideas from one project to the next (Cummings 2004; Huckman and Staats 2011). For example, when an individual identifies a novel solution on one project, they may be able to bring that solution to another project (Narayanan, Balasubramanian, and Swaminathan 2009; Staats 2011). MTM offers the opportunity to share knowledge real-time across multiple, simultaneous projects.

While MTMs have positive aspects, they can lead to a decline in performance through at least three different mechanisms. First, there is potential to overload the workforce through engagement on too many teams or tasks. It is well established that engaging employees on too many tasks can lead to “overwork,” which is observed when individuals are given too much work relative to a normal load (KC 2013; Kc and Terwiesch 2009; Staats and Gino 2012; Tan and Netessine 2014). For instance, in a restaurant setting when a server has too many tables and is given additional requests, it is difficult for that server to continue to provide high quality service, so customer satisfaction and overall revenue suffer (Tan and Netessine 2014) . This phenomenon is not isolated to the restaurant industry and has also been observed in financial services (Staats and Gino 2012), and health-care (Kc and Terwiesch 2009). When employees are overworked they are unable to sustain high levels of performance. Even when employees are performing similar tasks on multiple projects, they may be over extended and cannot produce quality work. MTMs extend employees in different directions, thus creating a situation where employees may be in a continuous state of overwork and as a result team performance may suffer.

Second, when employees work on too many teams, there may be coordination challenges that reduce efficiency. Prior research on virtual and distributed teams notes that teams often struggle to perform to their potential when they work in different locations or do their work at different times (O'Leary and Cummings 2007). Team members working on multiple teams may find it possible to perfectly synchronize their activities, but in all likelihood will be forced to accomplish tasks at different times due to their other project commitments. Combined with the risk of overwork, this may lead to increased conflict, decreased shared understanding (Mortensen and Neeley 2012), and in general, lower team performance (Staats, Milkman, and Fox 2012).

Finally, there is an opportunity for MTM to block and starve resources in the project lifecycle. In the case of two consecutive machines, if the downstream machine fails to operate, the upstream machine becomes blocked. We apply this idea to project teams as well. If a flexible labor force exists and that labor force is over extended, and a situation arises where more employees are needed on one project versus another, the manager may be unable to secure team members' time to meet critical requirements. In this case, the benefits of flexibility and MTM are lost. Even though the manager could move the employees to meet a critical demand, the performance on the other projects would suffer, creating a starving effect within the process (Schultz et al. 1998). If starving occurs, then individuals are unable to work on the project when there is work to be done and team performance suffers. These potential conflicts are likely to increase as teams are made up of more individuals working across a greater number of teams.

As noted, it is possible that there are benefits and costs at play for any project team, albeit in varying amounts. We posit that the balance between the two changes as the amount of MTM increases within a team. At low levels of MTM the benefits may outweigh the costs because employees are less likely to be effected by the difficulties of overwork, blocking/starving, and coordination neglect. However, as MTM increases these costs may increase dramatically. This suggests MTM has an inverted U-shaped relationship with project performance and so our first hypothesis is as follows:

Hypothesis 1: Multiple team membership and project performance have an inverse U-shaped relationship.

2.2 The Disruptive Consequences of MTM; The Case of Turnover

The discussion above notes that MTM may have both positive and negative performance consequences. Although increasing MTM may provide some flexibility and learning, it may also introduce fragility to the team. If this is the case then such fragility may prove particularly costly when teams experience disruptions. One operational disruption that many teams experience, at some point during their existence, is team member turnover. Therefore, we first consider the operational consequences of turnover and then examine its joint effect with MTM.

Prior research details how turnover may negatively or positively affect operational performance (Narayanan, Balasubramanian, and Swaminathan 2009; Hausknecht and Holwerda 2013). Scholars have argued that turnover is inherently disruptive and therefore has negative effects (Argote and Epple 1990; Kacmar et al. 2006). From this perspective, high turnover hinders a firm's ability to provide services, because trained employees depart and the onus is on the firm to quickly recruit, train, and retain proficient replacements (Ton and Huckman 2008; Kacmar et al. 2006). Note, that in cases where individuals require little prior knowledge to complete the work or existing operations have grown complacent and new individuals bring a fresh, innovative perspective, then turnover may prove helpful in either lowering costs or injecting new ideas (Argote and Epple 1990; Glebbeek and Bax 2004).

However, in most contexts turnover introduces operational challenges that may inhibit performance. Interestingly, recent work shows that organizations may be able to mitigate the effects of turnover. For example, Ton and Huckman (2008) find that process conformance lessens the negative effect of turnover in the retail setting. Huckman and Song (2013) consider *anticipated* turnover and find that by managing *anticipated* annual turnover of hospital residents, a large teaching hospital was able to continue providing excellent care to its patients. This phenomenon is also observed in military units that rotate into areas of conflict (e.g., Afghanistan, in recent years). The military maintains high levels of stability even during large organizational transitions in and out of the region (Huckman and Staats 2013). In each case, senior managers forecast personnel requirements and make appropriate adjustments to manage the inherent risk induced by turnover while capturing the benefits, discussed above.

Although prior work highlights that managers are able to better offset the negative effects of turnover when it is *anticipated* the same may not prove true for *unanticipated* turnover. *Unanticipated* turnover occurs when the departure occurs unexpectedly so that the firm has limited time to make labor force adjustments. As discussed earlier, turnover may have negative effects on organizations (Narayanan, Balasubramanian, and Swaminathan 2009; Hausknecht and Holwerda 2013); however, there could also be additional negative impacts on the firm due to *unanticipated* turnover. First, *unanticipated* turnover creates immediate disruptions. Because managers cannot foresee the impending turnover, they are unable to plan appropriate actions to ensure proper team composition. The residual effect of this action contributes to degradation of performance, which could delay project delivery time (Shaw et al. 1998).

A second negative consequence of *unanticipated* turnover is that it changes how teams are composed, as highlighted previously. If projects are in varying stages of completion, the knowledge shared amongst team members is compromised. This creates a state of overwork for employees with project specific knowledge. The employees who remain must transfer knowledge to new members, if new members are staffed to the project. Superiors sometimes determine to accept risk and not staff new members on projects because they feel that the remaining employees can nudge the project forward. The remaining employees are stretched on both the current project where the *unanticipated* turnover arose, and also on the other projects on which the employees are simultaneously engaged.

As discussed, MTM and unanticipated turnover both occur in organizations and both can negatively affect performance. In the case of the former, MTM can create an overworked, over-scheduled, and poorly coordinated workforce that is unable to reach its performance potential. In the case of the latter, turnover induces untenable disruptions that are the result of purging knowledgeable employees at critical moments during the project life-cycle. Although each when considered separately can be detrimental to performance, here we explore whether they have an interaction effect, whereby they together speed the degradation of performance.

Earlier we noted that MTM overworks the labor force, blocks a manager's flexibility to maneuver employees due to minimal slack in the labor pool to meet critical demands, and results in poor coordination. Turnover may exacerbate each of these effects. Because employees are working on more than one team, when they leave, their departure disrupts not just one team or project, but also the portfolio of teams or projects on which an individual employee is participating. Ideally managers would respond to disruptions from turnover through the flexibility that the MTM offers—for example, moving an individual onto another team that needs a person with similar skills as the departing team member. However, not only is the problem felt across multiple teams, but when managers are unable to select which employee departs and which employee stays in the organization, they lose the ability to mitigate the negative effects of blocking. In reality, unless the company is running with idle capacity then there are even fewer employees in the organization with the appropriate skills to place on critical projects at critical moments and the interaction of MTM and *unanticipated* turnover will negatively impact performance. Finally, with fewer resources to complete a project there is a greater risk that coordination challenges will increase and the quality of performance by the remaining team members will diminish.

As a result, we hypothesize that the negative effects of *unanticipated* turnover will noticeably worsen project performance when interacted with *MTM*. Thus we hypothesize:

Hypothesis 2: MTM and unanticipated turnover have a negative interaction effect with project performance.

3. Organizational Setting

To study our research questions we require a field site with at least four features: (1) a project-based environment with sufficient sample size of projects; (2) project staffing that includes MTM, as opposed to a setting with single team staffing; (3) turnover of team members over time and a shock to the system that enables us to disentangle anticipated from unanticipated turnover; (4) detailed tracking of individual and project variables. The United States Army Corps of Engineers (USACE) provides just such a setting. USACE, headquartered in Washington, D.C., has approximately 37,000 civilian employees delivering engineering services to customers in more than 130 countries worldwide. A large part of the work that the USACE undertakes is handled like other for-profit construction services companies. USACE builds and manages large-scale construction projects around the world. For example, USACE manages the United States (U.S.) Army military construction program totaling over $44.6 billion from 2007-2014. USACE also owns and operates 24% of the hydropower capacity for the U.S. (3% of the total electric capacity for the U.S.). The USACE is organized into nine separate divisions, each further parsed into organizations called districts. There are six districts outside the continental U.S.

We targeted the Europe District as the focus of this study because of: (1) the global nature of the district; (2) the higher volume of projects completed relative to other districts; (3) the higher turnover experienced as individuals rotate through the Europe District and then return to the United States; (4) the modus operandi of requiring employees to participate on multiple teams simultaneously; (5) we were able to secure access for our research project. These setting attributes allow for a rich exploration of the phenomenon in which we are interested in.

The Europe District of the USACE has been operating for over 50 years and is currently responsible for conducting projects in 94 countries. Headquartered in Wiesbaden, Germany, the district provides engineering, construction, stability operations, and environmental management products and services to the Army, Air Force, and other U.S. government agencies and foreign governments throughout the U.S. European Command and U.S. Africa Command. The district's global responsibilities create unique operational challenges since there are country-specific regulations and human resource policies with which they must comply.

USACE is project-based and government-owned, yet independently-operated. USACE does not receive direct financial support from the U.S. government, instead it charges agencies for a-la-carte project management, and, much like a private corporation, must keep its customers satisfied by completing projects on time and within the specified budget in order to remain in operation. USACE's operational construct is similar to a global architecture and engineering (A&E) firm that conducts large-scale construction projects. Projects are reviewed monthly and managers are required to update project information continuously. These organizational attributes allow for generalizability of our results to other project-based companies and industries.

3.1 Organization Policies: The Five-Year Rule

Since the USACE Europe District operates outside the continental U.S., it is subject to a unique personnel policy that comes from the U.S. Code Title 10, US Code 156–"ROTATION OF CAREER-CONDITIONAL AND CAREER EMPLOYEES ASSIGNED TO DUTY OUTSIDE THE UNITED STATES." This policy, referred to as the five-year rule, mandates that no employee may remain on an assignment outside the continental U.S. longer than five years. The rule was put in place to increase the global assignment opportunities for a higher percentage of the workforce. USACE personnel report that without the five-year rule enforcement, most USACE employees would choose to stay in Europe for longer than five years because of the additional pay and the opportunity to live abroad (Roncoli 2013). The five-year rule forces employees to move despite their personal preferences, or the preferences of their direct supervisors. However, the five-year rule has only been intermittently enforced since its publication in 1960.

The various military commanders, who take on the role of a CEO of the organization, determined whether the rule was enforced or not. Due to the constant change in military leadership, the individual USACE districts cannot anticipate when the five-year rule will be enforced, thus it is effectively an exogenous event and so we can use this enforcement in order to examine the consequences of anticipated turnover and unanticipated turnover. Because of the swift enforcements of decisions within the organization, there is limited threat of leakage of information to the subordinate organizations, which would allow them to prepare for the enforcement of the five-year rule. Our sample time period for the study covers January 2004 through December 2012. In the initial period the five year rule was not enforced. Then in May 2005 a new leader assumed the position as deputy commander of USACE and in August 2006 announced that the five-year rule would be enforced. In discussions with the commander who made the decision to implement the policy, he enforced the rule when he was informed, a year into his tenure that it was not being enforced. There was no notice given to the organization prior to implementation. Thus, it is possible to examine how teams responded to this shock to the system. We note that when the five-year rule was implemented, the policy significantly affected the organization at all levels.

In 2013, prior to collecting data, we visited and observed the USACE European District over a 30-day period. We interacted with project managers, division managers, and senior leadership. In discussions with the managers, we learned that there was no science to the assembly of an individual project delivery team. Instead, when a new project came in it was given to the individual judged to have the most idle capacity.

4. Data

The data used to explore our research question was provided by USACE. Our sample is composed of all 1,503 projects conducted at USACE European District from January 2004 to December 2012. Our data includes 861 individual employees, and indicates the projects they worked on in each month. These data can be used to calculate how many simultaneous projects each employee participated in each month, yielding approximately 1.25 million person-project-month records. We also can combine these data with project outcome data. Because the outcome is project-level, all variables are aggregated to the project level, which yields a total of 1,503 project observations.

Examining the summary statistics in our data (Table 1) we find that the average project length is 39 months, with considerable variation across projects. Because employees are operating at a managerial level on projects that they are assigned, the employees are engaged on many project teams in a given month. The average multiple team membership is 101 teams. If one assumes that there are 4 1/3 weeks in a month and that individuals work 40 hours per week then that implies individuals have 172 working hours per month and therefore are spending 1.7 hours per project, on average. Interviews with USACE personnel confirmed that these numbers matched their expectations. Since USACE served as general contractor on most projects that meant that much of the project team's time was spent monitoring and working with sub-contractors outside of USACE and so these small number of hours per project per month are reasonable. Finally, the average size of a project team is 16.8 members.

4.1 Dependent Variables

The primary objective measures of performance in the project management space have been well established: schedule, cost, and quality (Gaddis 1959; Dumond and Mabert 1988). A project should be delivered on time, on budget, and at the expected quality (or better on any of these dimensions). Ideally it would be possible to consider performance on all dimensions simultaneously. However, the realities of our context focus our attention on performance, on-time delivery, for two primary reasons. First, quality is measured at the end of a project during the formal project sign-off. If the quality level is not acceptable then the project is not signed off and it remains open. As such, on-time delivery effectively measures both quality and performance. Second, although ideally we could look at budget performance, the financial data was deemed too sensitive to share and so we did not receive it.

Project managers estimate and record an expected delivery date for each project prior to the start of the project. We measure performance on this dimension by creating an indicator variable, *on-time*, which equals one if a project was delivered on or before the deadline and equals zero otherwise.

4.2 Independent Variables

This study seeks to examine multiple team membership, turnover, and their interaction terms. Therefore, to start, we construct a measure for multiple team membership. Operationalizing this variable is non-trivial. We follow the guidance of O'Leary et al. (2011), by calculating the average number of MTMs that are present across team members over the life cycle of a project. As mentioned earlier, employees track which projects they work on in a given month. Therefore, each month we calculate the total number of additional projects that each individual took part in. These values are then averaged over all the employees on that project in the given month. Finally, we construct our variable, *MTM,* by averaging these monthly values from across the project's entire lifecycle.

We then create our unanticipated and anticipated turnover variables using the impact of the five-year rule on the labor force. *Unanticipated* turnover represents a variable for the proportion of employee project turnover affected by the enforcement of the five-year rule. As discussed previously, the five-year rule began to be enforced in August 2006. We use this fact to identify those employees who would be immediately impacted by this policy. Those employees who have over 48 months in Europe as of July 2006 are directly affected by the policy.

Using the policy implementation in August of 2006 we construct both *unanticipated turnover* and *anticipated turnover*. *Unanticipated* turnover captures the turnover from individuals subjected to the implementation of the five-year rule, while anticipated turnover captures all other team departures. Note, given the implementation of the five year rule, our measure of unanticipated turnover is, in fact, unanticipated. Given that our measure of anticipated turnover captures all other turnover it is likely to include some cases that are anticipated (e.g., a person announcing a move back to the US) and some that are unanticipated (a person taking another job). Our interviews suggested that the latter turnover type was rare in this context. We note that since our focus of interest is on the unanticipated variable our measure is captures unanticipated turnover, although it is possible that there may be additional unanticipated turnover.

4.3 Controls

We control for factors that may affect our operational performance.

Policy Impact. This variable represents the impact the five-year rule has on a project. This variable is constructed by first determining the number of employees in a given month who were identified as the affected population. The affected population is defined as any employee who has at least 48 months in the organization as of July 2006, the month prior to the notification of the policy enforcement. We then average the monthly observations and collapse them at the project level to determine overall, potential five-year rule impact on a given project.

Team Characteristics. Highly skilled teams may generate better project outcomes. Therefore, we control for average team *years of experience within the USACE Europe District (Tenure), government service level (Status),* and *education level (Education)*, each of which are associated with workers' productivities by proxying their general-or firm-specific human capital levels (Huckman and Pisano 2006; Gardner, Gino and Staats 2012). Given that these three variables are correlated we construct a composite measure for use in our models. We calculate these variables by averaging the individual characteristics of employees on a particular project in a particular month, and then averaging these monthly terms across all months of the project.

Project Characteristics. Construction projects are complex endeavors and more complex projects routinely require more members to facilitate completion. This leads us to proxy project complexity through project member size. We define *ProjectMemberSize* as the resources assigned to a project, which should influence its ability to remain on schedule; the employees are the primary resource at the disposal of the organization. Table 3 provides summary definitions of all variables included in the models based on accessibility.

4.4 Empirical Approach

We aim to estimate models that capture the effects of MTM and turnover on on-time delivery. Because our data is a complete history of each project over eight years, but are limited to a binary dependent variable, we need to ensure we select a model that accounts for heteroscedasticity. We thus chose to use a logistic regression model, with robust standard errors. Therefore, to test our hypotheses, we estimate the following models:

Model 1: $$\log it(On.Time_i) = \beta_0 + \beta_1(MTM_i) + \beta_2(MTM_i^2) + \beta_3(Controls_i)$$

Hypothesis 1 predicts that MTM will show an inverted U-shaped relationship with performance and so $\beta_1 > 0$ and $\beta_2 < 0$.

Model 2:

$$\begin{aligned}&\log it(On.Time_i) = \beta_0 + \beta_1(MTM_i) + \beta_2(MTM_i^2) + \beta_3(Unanticipated_i)\\ &+\beta_4(Anticipated_i) + \beta_5(Unanticipated_i \chi MTM_i) + \beta_6(Anticipated_i \chi MTM_i)\\ &+\beta_7(Controls_i)\end{aligned}$$

Hypothesis 2 predicts that the interaction of unanticipated turnover and MTM will be more negative than the interaction of anticipated turnover and MTM ($\beta_5 < \beta_6$).

5. Results

Table 2 presents the correlations for all variables included in the empirical model. No pair of variables in the models indicates multicollinearity. As an additional check, we found that the largest variance inflation factor (VIF) is 2.5, which falls below the conventional threshold of 10 (Wooldridge 2012).

Column (1) and Column (2) in Table 4 presents the results from the logistic regression of on-time delivery on first MTM and then MTM and MTM^2. The main effect of the independent variable, MTM, is of note. As seen in Column (1), the coefficient on MTM is negative and statistically significant, and its magnitude indicates that a one unit increase in MTM decreases the odds of on-time delivery by 9%. However, before concluding that the relationship between MTM and performance is linear we must examine the quadratic effect. In Column (2), we add the quadratic term to test Hypothesis 1. Examining the main effects on the independent variables, MTM and MTM^2, the coefficients on the variables are of the expected sign, but not statistically significant. However, although we do not initially see a quadratic relationship, given the strong theory in support of a potential relationship we conduct additional analyses.

Our first step is to simply plot the data, but since on-time delivery takes only values in {0,1}, a standard scatter plot of the data is unlikely to be helpful. To more clearly visualize the data, we leveraged binscatter (Chetty, Friedman, and Rockoff 2013). Binscatter generates binned scatter plots, which solves the binary variable problem by averaging the on-time delivery variable within evenly-sized bins. Figure 3 reports the results from this program and the plot visually indicates an inverted U-shape, although the skewness of the distribution may make it difficult to identify a quadratic relationship.

As a result, we conduct several additional analyses to examine the underlying relationship.

First, we created indicators for the size of MTMs in bin sizes of 15 and placed each project into the appropriate indicator. Then we estimated a model that replaced MTM and MTM^2 with the indicators for each group. As shown in Table 5, we observe positive coefficients on the first half of the groups, with a mixed amount of statistical significance, and negative coefficients for the later half of the groups again with a mixed amount of statistical significance. This provides initial support for Hypothesis 1. As a second step, we split the sample both before and after the potential stationary point that Column (2) in Table 4 suggests to investigate the possible quadratic effect. Nelson and Simonsohn (2014) suggest this analysis as the most appropriate way to investigate a quadratic effect. In particular, by looking both before and after a potential stationary point, one would expect to see first a positive slope and then a negative slope for the regression coefficients, if in fact the relationship is inverted U-shaped. Column (1) and Column (2) in Table 6 presents the results from the logistic regression of on-time delivery on MTM for first the pre-stationary point data and then the post-stationary point data. The results support a quadratic relationship as the coefficient on MTM is first positive and statistically significant, and its magnitude indicates that a one unit increase in MTM increases the odds of on-time delivery by 93.5%. In Column (2), the post-stationary point data, the coefficient on MTM is negative and statistically significant, and its magnitude indicates that a one unit decrease in MTM decreases the odds of on-time delivery by 46.5%. This provides further support of our Hypothesis 1.

Finally, given that a small number of outliers may make it difficult to pick up the quadratic effect, as illustrated in Figure 4, we conduct the same analysis as in Table 4, but after dropping the 5% of observations that have the most extreme values for MTM. With the added constraint to MTM we reduce our data by 5% to 1429 observations, which we will now discuss.

Column (1) and Column (2) in Table 7 presents the results from the logistic regression of on-time delivery on MTM and MTM^2. Column (1) replicates the analysis with the full sample with the linear term. In Column (2), we add the quadratic term to test Hypothesis 1. Examining the main effects in Column (2) on the independent variables, MTM and MTM^2, the coefficients on the variables are as expected. As seen in Column (2), the coefficient on MTM is positive and significant at the 5% level, corresponding to increased probability of on-time delivery as MTM increases; the coefficient on MTM^2 is negative, corresponding to a decrease in the probability of on-time delivery tests the negative relationship between MTM and on-time delivery and is significant at the 1% level with a stationary point when MTM is 63; providing strong support for Hypothesis 1. Finally, although the stationary point is well within the data, we conduct an additional analysis to identify the 95% confidence interval surrounding the stationary point. Using the delta method suggested by Muggeo (2003), we find an interval of [59 MTMs, 103 MTMs] which is also within the observation period.

We now turn to Column (4) in Table 4 in order to test Hypothesis 2. The coefficient on the interaction of MTM and unanticipated turnover is negative and significant at the 5% level. Thus, we see evidence that the negative effects of MTM are even greater when teams experience higher levels of unanticipated turnover, than when they experience lower levels of unanticipated turnover. We see the same pattern of results if we examine Column (4) in Table 7. These results support Hypothesis 2.

5.1 Alternative Explanations

We now examine alternative explanations for our findings. All regressions results reported are available from the first author upon request. First, in a study that explores the relationship between employees working together and their volume of work and quality of performance; selection of employees on projects is a concern. If, for some reason, worse team members were assigned more projects, our results could reflect that bias. This seems unlikely since in other settings good team members are more likely to receive more projects. However, in our case neither of these factors appears to be in play as typically, in the European District of

USACE, the Chief of the Project Management division assigns project managers to projects based on employee availability, rather than matching projects to project manager tenure or other skill attributes. In addition, employees are unable to select the projects in which they participate. Our interviews indicate that this is consistent with how other division chiefs place employees on project teams. Furthermore, the project lead has no input on project team members.

Second, the length of the projects may influence outcomes. When projects have a shorter time horizon they may be more sensitive to the disruption of MTM and *unanticipated* turnover. For example, when a team member departs, the remaining team members may become overloaded, while at the same time on-boarding new members to meet project deadlines. This would lead us to expect that projects that have longer time horizons are less susceptible to these same disruptions. We find empirical support for this assertion through robustness checks. While MTM degrades project performance, *unanticipated* turnover is less of a factor when project length is greater. One would expect that if there is more time to integrate new members to a team that there would be far less turbulence. Finally, as an alternative to the quadratic relationship that is hypothesized we examine higher order polynomials. When we add either a cubic or a cubic and quadratic term for MTM to the regression models in Tables 4 and 7, we do not see a statistically significant relationship with these terms.

Finally, the

6. Discussion and Conclusion

21st century work is increasingly being completed by project teams. However, operations research examining the performance implications of such work is still relatively limited. Recent work has started to unpack factors such as specialization and variety (Narayanan, Balasubramanian, and Swaminathan 2009), team familiarity (Huckman, Staats, and Upton 2009), team member incentives (Lu, Van Mieghem, and Savaskan 2009; Roels, Karmarkar, and Carr 2010; Gurvich and Van Mieghem 2013). In this paper we empirically examine the important topic of multiple team membership. Using eight years of data from the USACE Europe District, we find that MTM has an inverted U-shaped relationship with probability of a project being delivered on-time. Our findings are consistent with prior theoretical work (O'Leary, Mortensen, and Woolley 2011). We considered, but did not find empirical support for, alternate explanations for this reduction in on-time delivery. Extending the exploration to whether MTM creates difficulty with fragility we examine the consequences of turnover and MTM together. We find that the interaction of MTM and unanticipated turnover is related to worse on-time project delivery. This suggests that teams with higher MTM are less able to cope with the consequences of unanticipated turnover than their lower MTM counterparts.

In the context of our setting, we find it is important to consider the magnitude of the effect size. For example, we find that after passing the stationary point we find that an incremental project results in an average decrease of 0.1% in on-time delivery. A delay of 0.1% is equivalent to an 11.7 day slip in the project schedule and the cost to the customer is approximately $220,628 dollars for a project that averages 22 million dollars. A weeklong delay of a construction project on a military installation in Europe has residual impacts on that community. Consequences might include delays in other projects, lost contracts due to non-availability, and also loss of community support. In a time of diminished resources, a delay could also absorb funds needed for future projects.

6.1 Theoretical Contributions

This study contributes to the operations management literature on teams and performance in several ways. This study provides insight into how MTM and turnover influence performance outcomes. Thus, it responds to calls from the scholarly literature for more organizational-level focus on how multiple teams operate within organizations and how they influence operations (Boudreau et al. 2003). First, with our detailed data on projects and employees on teams, we provide evidence that MTM has an inverted U-shaped relationship with on-time delivery.

O'Leary et al. (2011) begin the theoretical conversation centered on the individual, team, and organizational mechanisms driving how MTM may influence performance. By leveraging archival data in a project-based organization we are able to test and extend the theory. We are able to investigate the volume of projects in an employee's portfolio of projects and how that impacts performance. Although our study takes place within a government organization, the procedures and expectations extend to different contexts.

Second, we show that the organization that we study overuses MTM. Our findings reveal that the average level of MTM in our sample is approximately 45% larger than the stationary point of the inverted U-shape from our analyses. As the counterfactual analysis in the prior project shows, the cost implications of MTM are substantial and so by adding additional staff it may be possible to more than cover their salaries through the savings from reduced project staffing.

Third, we inject the dimension of turnover into the conversation of MTM and performance. We determine that both overall turnover and how the type of turnover matters based on our study of the enforcement of the five-year rule human resource policy. By separately theorizing about and then evaluating the implications of the type of turnover on the outcome of the projects, we are able to suggest strategies to place slack into the staffing process. Introducing how a policy drives the type of turnover that influences organizational outcomes allows us to extend the discussion on turnover and its effects on organizations (Huckman, Song, and Barro 2013). Our findings of *unanticipated* turnover highlight the fact that organization-imposed policies generate unintended consequences that should be considered.

Fourth, our paper helps to make the call for the need for work on the human capital pipeline. In many firms, increasingly services, but also manufacturing, the primary operational input is labor. As a result, managing that labor is the most important operational lever. The operations management field has a long and rich tradition in developing tools and techniques for matching supply to demand in product settings. There is an open need to transform and deploy these tools for the human capital pipeline and people analytics, more generally. For example, not only can questions, such as the one asked here, about optimal team construction be answered analytically, but thinking about the system of teams opens itself to analytical inquiry. Moreover directly analogous questions to the inventory environment – for example, how many consultants should a firm keep on its bench waiting to be deployed on future projects – would seem amenable to looking at as a safety stock problem. These new areas of exploration will open up important theoretical avenues to operations scholars while also providing meaningful benefits to practice.

6.2 Limitations and Venues for Future Research

This study has limitations, and its results should be interpreted accordingly. First, we use one dependent binary variable. Although this a limitation of available data, further insights could be gained through detailed analysis of continuous measures at different points in the life-cycle of a project. Future research could focus on identifying MTM compositions throughout the life of a project to determine the relationship of MTM on on-time delivery during phases of a project.

Second, there is a threat of omitted variable bias that is common to many empirical models. It would be helpful to add more variables to the model, such as location of the projects or specific attributes of teams within a location, but this data was unavailable. However, location is not a threat in our analysis because 90% of the projects are done within Germany. Although we are not aware of any specific areas of bias, additional research with more granular data would nullify this potential issue in our analysis.

Third, the five-year rule may be highly correlated to experienced employees, which could contribute to the decrease in on-time delivery. Note that this would be problematic if our hypothesis focused on unanticipated turnover vs. anticipated turnover. However, here we are interested in disruptions to the team. For our theoretical purpose disruption due to unanticipated turnover and disruption due to unanticipated turnover of experience personnel are equally appropriate for our interaction hypothesis. Nevertheless, future research could focus on employee experience in a project setting where forced turnover occurs to gain insight into turnover

Finally, our results come from one organization in one industry, and it is possible that they will not generalize. To neutralize this drawback we have detailed information on employee work and performance outcome measures. In this context, we are able to leverage the deep knowledge of a single organization with empirical tests of our hypotheses. However, future work could focus on multiple organizations and conduct a comparative study.

6.3 Practical Implications and Conclusion

Our analysis has important implications for managers in project-based organizations. Managers within this setting must not only be cognizant of how they staff their projects, but also be aware of the additional projects in which team members are involved. We find that employees engaged in MTM can both positively and negatively impact project outcomes. In other words, some teams have too little MTM, and so the organization is leaving improvement opportunities on the floor, while others have too much MTM and so are yielding worse project performance than they could otherwise expect to have. Our results also show the fragility potentially introduced by MTM. This offers a cautionary tale and suggests that managers should be careful and thoughtful when deploying MTM in more fragile situations.

Our findings are especially timely, as many organizations are moving to smaller labor forces. Although organizations cannot foresee the future, by developing appropriate policies, including MTM and turnover, may provide important levers that managers can actively control to provide the best outcomes.

7. References

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8. Tables and Figures

Table 1: Summary Statistics

Variable	Count	Mean	SD	Min	Max
Project Length (YRS)	1503	39.29	20.56	11	95
MTM	1503	101.01	54.74	0	351
Tenure (YRS)	1503	4.86	1.50	0.46	11.62
Education	1503	7.72	2.99	0	17
Status	1503	7.54	2.78	0	14
Project Member Size	1503	16.76	18.06	1	114

Table 2: Correlation Table

Variables	MTM	Unanticipated	Anticipated	Tenure	Education	Status	Project Member Size
Unanticipated	0.467						
Anticipated	0.381	0.528					
Tenure	-0.189	-0.177	-0.266				
Education	-0.063	0.048	-0.165	0.611			
Status	-0.071	0.067	-0.150	0.741	0.821		
Project Member Size	0.141	0.178	0.199	-0.128	-0.044	-0.074	
Policy Impact	0.148	0.229	0.478	-0.094	-0.034	-0.004	-0.123

Table 3: Variable List

Variable	Overview
On Time Delivery	(1) A dummy variable of on-time delivery of projects to intended customers.
Multiple Team Membership (MTM)	(2) The number of additional projects in which team members are engaged.
Unanticipated Turnover	(3) The proportion of turnover influenced by the five-year rule.
Anticipated Turnover	(4) The proportion of turnover not influenced by the five-year rule.
Policy Impact*	(5) The density of employees on a project whom are identified as immediately influenced by the project.
Tenure*	(6) Employee tenure in the Europe District.
Education*	(7) Employee education level.
Status*	(8) The general service level (GS).
Project Member Size*	(9) The number of members on a project team.
***** ***Control Variables***	

Table 4: MTM and Turnover On-Time Delivery

	Dep. Variable:	***Dep. Variable:***	***Dep. Variable:***	***Dep. Variable:***
	On-Time	***On-Time***	***On-Time***	***On-Time***
	(1)	(2)	(3)	(4)
MTM	-0.009***	0.008	0.002	0.005
	(0.002)	(0.009)	(0.009)	(0.008)
MTM2		-0.00009	-0.00007+	-0.00003
		(0.000)	(0.00005)	(0.00004)
Unanticipated			-0.278	1.887
			(0.452)	(0.862)
Anticipated			1.793**	1.709
			(0.582)	(1.291)
MTM*Unanticipated				-0.025**
				(0.009)
MTM*Anticipated				-0.001
				(0.013)
Constant	-3.477***	-4.222***	-3.812***	-4.351***
	(0.435)	(0.635)	(0.605)	(0.653)
Tenure	YES	YES	YES	YES
Status	YES	YES	YES	YES
Education	YES	YES	YES	YES
Project Member Size	YES	YES	YES	YES
Policy Impact	YES	YES	YES	YES
Observations	1503	1503	1503	1503

Robust standard errors in parentheses +p<0.10,*p<0.05,**p<0.01,***p<0.001

Table 5: Regression of On-Time Delivery on bins of MTM

	Dep. Variable:
	On-Time
	(1)
Bin 1	0.262
	(0.326)
Bin 2	0.569*
	(0.285)
Bin 3	0.507+
	(0.314)
Bin 4	0.350
	(0.315)
Bin 5	-0.610+
	(0.416)
Bin 6	-0.105
	(0.353)
Bin 7	-1.091*
	(0.435)
Bin 8	-0.944
	(0.500)
Bin 9	-1.064
	(0.570)
Constant	-4.603***
	(0.497)
Tenure	YES
Project Member Size	YES
Policy Impact	YES
Status	YES
Education	YES
Observations	1455

Robust standard errors in parentheses
+p<0.10,*p<0.05,**p<0.01,***p<0.001

Table 6: Pre and Post Stationary Point Models

	Pre-Stationary Pt	***Post-Stationary Pt***
	Dep. Variable:	***Dep. Variable:***
	On-Time	***On-Time***
	(1)	(2)
MTM	0.660***	-0.454*
	(0.196)	(0.195)
Constant	-4.500***	-3.779***
	(0.465)	(0.422)
Tenure	YES	YES
Status	YES	YES
Education	YES	YES
Project Member Size	YES	YES
Policy Impact	YES	YES
Observations	564	939

Robust standard errors in parentheses +p<0.10,*p<0.05,**p<0.01,***p<0.001

Table 7: MTM and Turnover On-Time Delivery

	Dep. Variable: On-Time	***Dep. Variable: On-Time***	***Dep. Variable: On-Time***	***Dep. Variable: On-Time***
	(1)	(2)	(3)	(4)
MTM	-0.009***	0.021*	0.015	0.016
	(0.002)	(0.010)	(0.010)	(0.010)
MTM2		-0.0002**	-0.0002*	-0.0001+
		(0.00006)	(0.00005)	(0.00006)
Unanticipated			-0.156	2.039
			(0.454)	(0.863)
Anticipated			2.003***	1.054
			(0.578)	(1.294)
MTM*Unanticipated				-0.026**
				(0.009)
MTM*Anticipated				0.008
				(0.013)
Constant	-3.626***	-4.855***	-4.322***	-4.735***
	(0.443)	(0.661)	(0.661)	(0.698)
Tenure	YES	YES	YES	YES
Status	YES	YES	YES	YES
Education	YES	YES	YES	YES
Project Member Size	YES	YES	YES	YES
Policy Impact	YES	YES	YES	YES
Observations	1429	1429	1429	1429

Robust standard errors in parentheses +p<0.10, * p<0.05, ** p<0.01,***p<0.001

Table 8: MTM and Turnover On-Time Delivery

	Completed by 72 Months **Dep. Variable: On-Time** (1)	*Completed by 60 Months* **Dep. Variable: On-Time** (2)	*Completed by 48 Months* **Dep. Variable: On-Time** (3)	*Completed by 36 Months* **Dep. Variable: On-Time** (4)	*Completed by 24 Months* **Dep. Variable: On-Time** (5)
MTM	0.0112	0.0126	0.01222	0.02439	0.01566
	(0.009)	(0.010)	(0.010)	(0.014)	(0.015)
MTM2	-0.00004	-0.00004	-0.00003	-0.00008	-0.00003
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Unanticipated	2.44672**	2.63619**	2.68163**	2.76880*	4.80240**
	(0.906)	(0.920)	(0.967)	(1.218)	(1.771)
Anticipated	2.10913	2.10897	2.70210*	1.65627	-0.05384
	(1.287)	(1.297)	(1.358)	(1.811)	(2.106)
MTM*Unanticipated	-0.03084**	-0.03158***	-0.03118**	-0.03101**	-0.05828***
	(0.009)	(0.010)	(0.010)	(0.012)	(0.017)
MTM*Anticipated	-0.0067	-0.0066	-0.0084	-0.00545	0.01591
	(0.013)	(0.013)	(0.014)	(0.019)	(0.020)
Constant	-4.91735***	-5.07027***	-5.35392***	-6.22294***	-7.41472***
	(0.746)	(0.782)	(0.855)	(1.149)	(1.919)
Tenure	YES	YES	YES	YES	YES
Status	YES	YES	YES	YES	YES
Education	YES	YES	YES	YES	YES
Project Member Size	YES	YES	YES	YES	YES
Policy Impact	YES	YES	YES	YES	YES
Observations	1403	1306	1171	894	535
VCE	**CLUSTER**	**CLUSTER**	**CLUSTER**	**CLUSTER**	**CLUSTER**

Standard errors in parentheses +p<0.10, * p<0.05, ** p<0.01,***p<0.001

Table 9: MTM and Turnover On-Time Delivery

	Completed 24 Months Post Five Year Rule ***Dep. Variable: On-Time***	*Completed 36 Months Post Five Year Rule* ***Dep. Variable: On-Time***	*Completed 48 Months Post Five Year Rule* ***Dep. Variable: On-Time***
	(1)	(2)	(3)
MTM	0.03655*	0.04407*	0.03571*
	(0.015)	(0.019)	(0.016)
MTM2	-0.00003	-0.00009	-0.00004
	(0.000)	(0.000)	(0.000)
Unanticipated	9.54106**	2.89687	2.06185
	(3.498)	(2.391)	(1.803)
Anticipated	2.26761	2.10756	4.65288*
	(2.603)	(2.432)	(2.166)
MTM*Unanticipated	-0.08543***	-0.04595**	-0.04177**
	(0.024)	(0.016)	(0.015)
MTM*Anticipated	-0.00376	-0.02274	-0.04331
	(0.023)	(0.025)	(0.024)
Constant	-12.97366***	-5.72118**	-5.04132**
	(3.812)	(2.134)	(1.554)
Tenure	YES	YES	YES
Status	YES	YES	YES
Education	YES	YES	YES
Project Member Size	YES	YES	YES
Policy Impact	YES	YES	YES
Observations	263	392	512
VCE	**CLUSTER**	**CLUSTER**	**CLUSTER**

Standard errors in parentheses * $p<0.05$, ** $p<0.01$,*** $p<0.001$

Figure 1: Illustrates Unanticipated Turnover Influences Outcomes

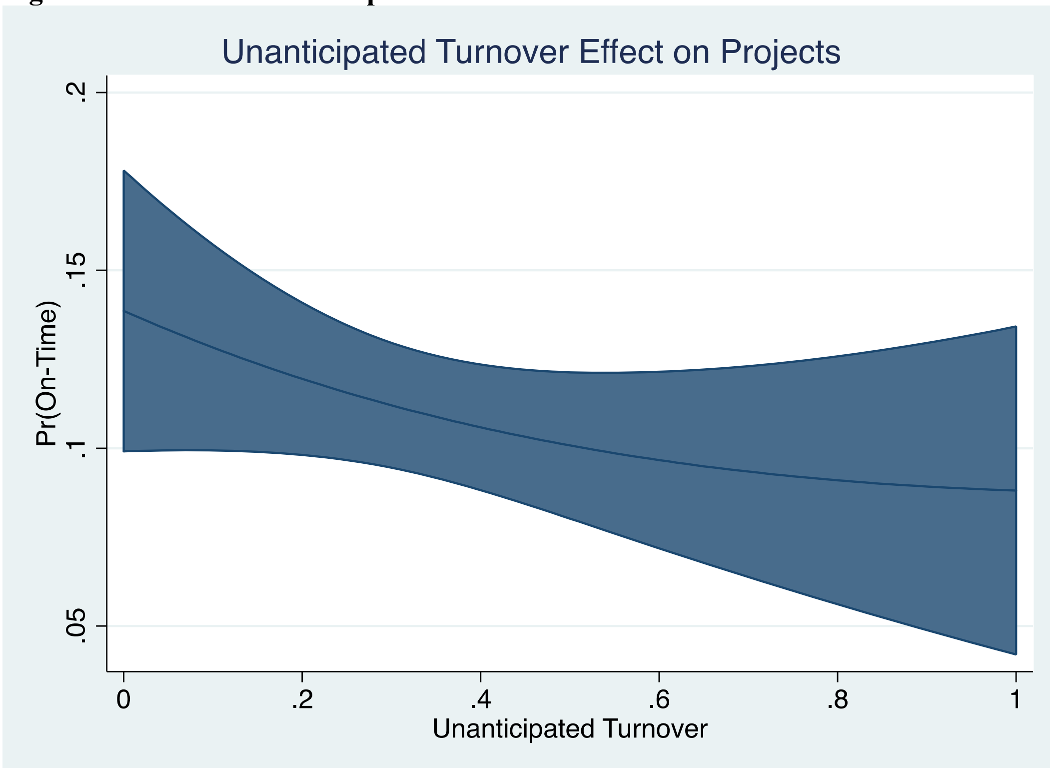
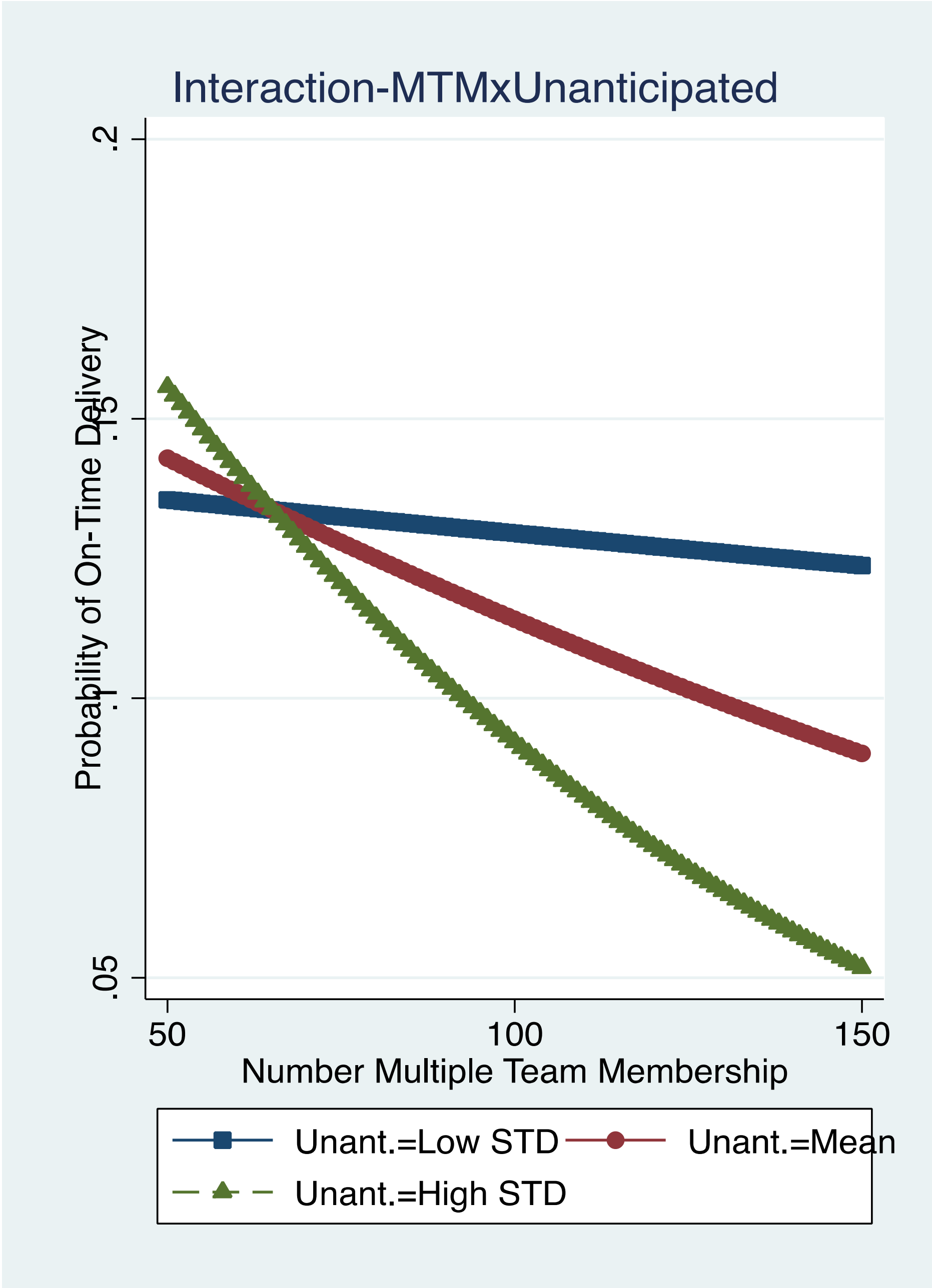


Figure 2: Illustrate Interaction of MTM and Unanticipated Turnover



Note: This figure illustrates the negative moderating effect of unanticipated turnover on the relationship between MTM and On-Time delivery. The *red line* is the main effect of these interactions. We observe the distinct differences in the slopes where unanticipated turnover has a steeper negative slope than anticipated turnover's effect on the relationship to MTM and On-Time delivery. If there is an increase in unanticipated turnover and anticipated turnover by one standard deviation (*the green line*) the negative slope of unanticipated turnover is even more pronounced.

Figure 3: Distribution of MTMs in Bins of 15

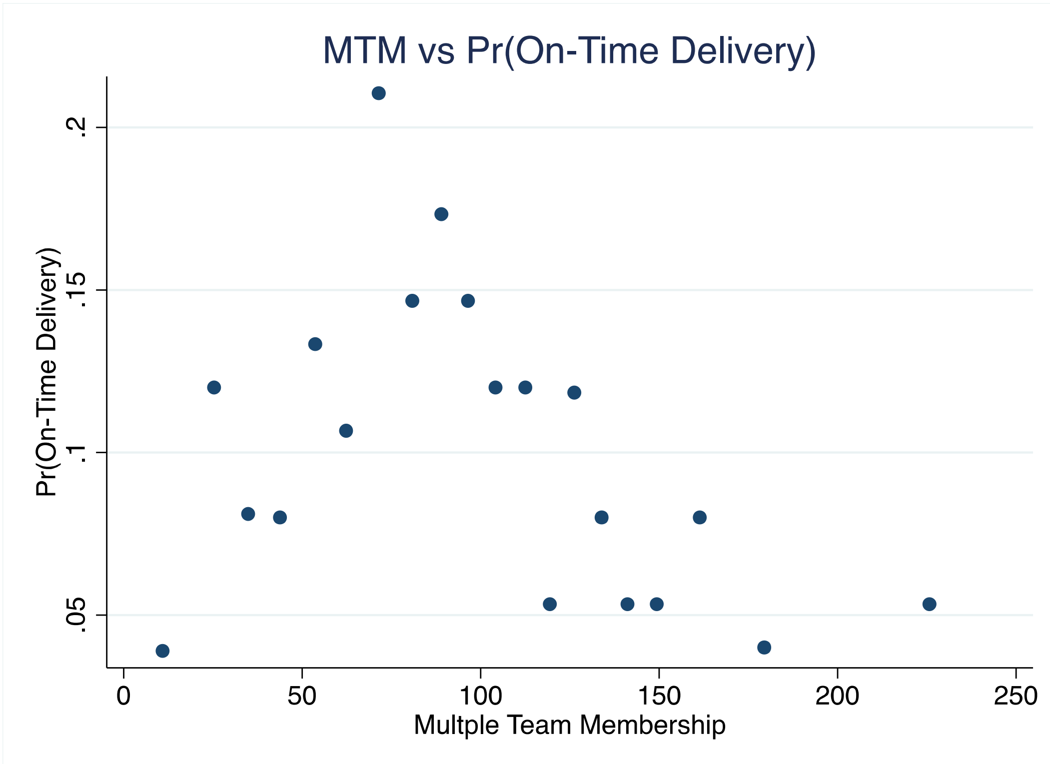


Figure 4: Histogram of MTMs