Behavioral influence on operational performance

the influence of team reflexivity on anchoring & adjustment bias
and team performance within operations management

By

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PREFACE

This thesis report has been written for the major Supply Chain Management being part of the part-time Master of Science Business Administration at the Rotterdam School of Management, Erasmus University.

Herewith I would like to thank my coach prof. dr. ir. J. (Jan) Dul for his methodological expertise, content knowledge about human behavior and strong coaching skills. I would also like to thank my co-reader ir. M. (Maarten) Dirks for monitoring the business perspective of my research. I would like to thank both for helping me on the (written) rhetoric and logic of the report. Finally I would like to thank Steef van de Velde (Dean RSM), Stefanie Protzner (PhD candidate RSM), Sam Wood (Responsive) and all the business administration students for helping me on the data collection using the Littlefield Technologies simulation.

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SUMMARY

The use of teams in operations is a well-established way of structuring an organization with the purpose to perform tasks more effectively and improve operational performance and competitive advantage. There has been a great deal of research on teams and team performance in the academic literature (Tversky & Kahneman, 1974; Hayes et al., 1988; Boudreau et al. 2003). The results of this research and practice showed that team performance is not only influenced by operational factors but also by human behavior, in particular behavioral biases. It is argued that behavioral biases systematically affect (and often distort) a person's judgment and decision-making (Gino & Pisano, 2008). This study focuses on the anchoring & adjustment bias. The anchoring & adjustment bias is described as the tendency to rely too heavily, or "anchor", on one trait or piece of information and adjust too little from biased initial values (Tversky & Kahneman, 1974; Eply & Gilovich, 2006; Gino & Pisano, 2008). With this in mind it is relevant for the field of operations management to understand which factors have a de-biasing effect in decision-making and improve team performance. Therefore the general objective of this study is to contribute to the theoretical development regarding behavioral influence on team performance within the context of operations management and expend the understanding of team decision-making. The general research question is:

What influence does reflexivity have on the anchoring & adjustment bias and the performance of teams within the context of operations management of a manufacturing company?

From multiple literature reviews it can be concluded that teams work according to a circular input-process-output framework (Cohen & Bailey, 1997; Pagell & Lepine, 2002; Kozlowski & Bell, 2003; Mathieu et al., 2008). Inputs are the factors that enable and constrain the interactions between members of a team. The input factors combine to drive team processes, which describe the interactions of a team that lead towards the team's output. The definition of team performance, adopted in this study, is the extent to which teams make quality decisions in order to improve the company's competitive advantage.

When people behave they constantly make decisions. Decision-making in psychology is explained as the mental process in the selection of a course of action. This process comprises the components of identifying the nature of an issue by perception & interpretation, judgment, motivation and action (Rest et al., 1999; Kahneman, 2003). When people come to judgments and make decisions they use a limited number of heuristic principles, which are explained as experienced-based, simple and efficient rules. Heuristics are very useful, but sometimes they lead to severe and systematic errors, which are called biases (Tyversky & Kahneman, 1974). Bias occurs during different types of actions when people make decisions. These actions comprise the acquisition of information, information processing, deciding the outcome and learning from feedback. In the past few decades a large number of biases have been identified to support the evidence that human beings are limited in their ability to learn, think and

act (Simon, 1956; Tyversky & Kahneman, 1974; Gino & Pisano, 2008). Simon (1976) has showed in his research into decision-making processes that human beings are limited in particular in their ability to process information. Examples of information processing biases are the anchoring & adjustment bias, conservatism bias, and overconfidence bias. This study focuses on the anchoring & adjustment bias because with respect to other biases this bias can be measured in practice, not only proved experimentally (Kahneman, 2011). Furthermore it is suggested by Gino and Pisano (2008) that the effects of bias due to anchoring & adjustment might be relevant within operations management because of potential implications when managing inventory or forecasting.

Based on the work of Kray and Galinsky (2004) it is suggested that team reflexivity has a de-biasing effect and improves team performance. The definition of team reflexivity is the extent to which teams collectively reflect upon their objectives, strategies and processes and modify their functioning to current or anticipated circumstances (West, 2000). Based on this definition team reflexivity can be described as one of the tasks in the organization and control of work and therefore be placed in the category of team-level factors being an input factor in the process of teamwork, as mentioned before.

Based on the theoretical and practical exploration a theory is deduced which describes that team reflexivity indirectly improves team performance through reduction of anchoring & adjustment bias, because a lower bias with respect to anchoring & adjustment leads to better decision making. The specific research objective of this study is theory testing. The research strategy used in this study is a survey in order to test the probabilistic relation between team reflexivity (independent concept), anchoring & adjustment bias (mediator) and team performance (dependent concept). Team reflexivity is measured using items selected from a reflexivity measure for teams (Schippers et al., 2007; Swift & West, 1998). Anchoring & adjustment bias and team performance are measured using the Littlefield Technologies simulation. Anchoring & adjustment bias is measured on the decision-making parameters *order quantity*, *reorder point* and *number of machine purchases at station 1* based on an index rule (Kahneman, 2011). Team performance is measured by the cash ($) position of the Littlefield Technologies factory at the end of the simulation. Within the domain of the theory this research focuses on a population of management teams within the context of operations in a manufacturing company. The sample studied comprises teams (N=52) of students and practitioners in supply chain management and one random team without supply chain education or experience that played the Littlefield Technologies simulation. The collected data is analyzed on mediation by running the Preacher-Hayes script (bootstrap test) in SPSS in order to test if the indirect effect P1 # P2 is significant. The type of mediation is classified using the significance of the results of P1, P2 and P3 (Preacher & Hayes, 2008; Zhao, Lynch & Chen, 2010).

From the bootstrap analysis (appendix D) it is found that the mean indirect effect a # b for the proposed mediators is positive and significant (β=195,742), with a confidence interval of 95% excluding zero (β=54,570 to β=340,747). The direct effect c is also positive (β=255,936) and significant (p=.0080). Since a # b # c is positive the type of mediation is classified as complementary mediation. There is empirical evidence that the mediated

indirect effect (P1 # P2) and the direct effect (P3) both exist and point in the same direction. This means the identified mediators are consistent with the theoretical framework. Regression analysis shows that the identified mediators account for a large amount (Adjusted R-sq=.47) of the variation in team performance in which bias on *machine purchases at station 1* has the greatest influence. However, complementary mediation suggests an incomplete theoretical framework and therefore the likelihood of an omitted mediator in the direct path (P3) should be considered (Zhao, Lynch & Chen, 2010).

The results of this study show, for the sample studied, that multiple anchoring & adjustment biases mediate the relation between team reflexivity and team performance. This evidence further substantiates theory on teamwork (Kray & Galinsky, 2004; Mathieu et al., 2008). The results confirm that teams work according to a circular input-process-output framework and input factors have a de-biasing effect in the decision-making process. Secondly, evidence is given for the role of anchoring & adjustment biases in inventory management and forecasting. Thirdly, the results of the study show signs of complementary mediation giving evidence for the existence of a direct effect of team reflexivity on team performance. This result corresponds with the findings of other practitioners where evidence is given for a direct relation between team reflexivity and team performance (Schippers et al., 2003; Schippers et al., working paper). The results of this study implicate that managers or management teams should be aware of the internal factors in teams that may be directly influenced by them. One of those internal factors is team reflexivity and this is important for team performance, although further research has to give answer for which particular management teams and contexts this theory is applicable. Similar to the functioning of the human mind, management teams should identify the most important decision-making parameters on which they can be biased. Teams should only reflect the decisions on these key parameters, because reflection on all parameters would be very time-consuming and may possibly lead to a lower effectiveness of the teams. The results of this study should be evaluated taking into account that the ecological validity of the study outcome is low, because the study outcome will not fully apply to the real life context of the object of study. In real life management teams are formed of individuals with a skill-set and competence that complement to perform a certain task, while in this population the management teams comprise students which were randomly put together, possibly influencing the teams decision-making behavior. Furthermore team behavior in this study will not reflect a real life situation, because the decisions in real life have more consequences than in a simulated environment with the purpose to study basic concepts of supply chain management. The translation of the results, from the sample, to the population of all management teams has a low statistical reliability because a convenience sample is used for collection of the data. The use of a convenience sample implies that the population is not known, therefore the results of the study only apply to the particular group studied.

1 INTRODUCTION

In order for a company to ensure its continued existence a long-term, competitive advantage over its competitors is of great importance. One of the ways to create competitive advantage is through a higher gross margin than those of other companies in the industry. According to Porter (1985), improving the gross margin is the result of creating and sustaining superior performance within a company. For example if we look at the history of fashion distributer Inditex, parent of the popular Zara format, superior performance or operational excellence is created through a business formula of high fashion and low prices. Quick design turnarounds and good demand forecasting make it possible for the company to minimize inventory in its supply chain and thus reduce inventory costs such as storage and forced mark-down of unsold products. This results in lower operating expenses and a higher profit margin with respect to other high fashion retailers such as H&M.

In order to make sure that this kind of operational performance is sustainable it is important that businesses within the supply chain for a product or service co-operate (Elkington, 1994). An important part in this collaboration for operational performance is the effectiveness of employees working in teams (Pagell & LePine, 2002). The effective performance of these teams is therefore essential for the company's performance. In particular the quality of team decision-making is an important factor (De Dreu, 2007).

There has been a great deal of research and practical experience on team performance over the last decades. The results of this research and practice show that team performance is not only influenced by operational factors but also by human behavior, in particular behavioral biases (Tversky & Kahneman, 1974; Hayes et al., 1988; Boudreau et al. 2003). "Research in psychology [...] teaches us that behavioral biases and cognitive limits are not just noise; they systematically affect (and often distort) people's judgment and decision-making. Yet the implications of these forces for the design, management and improvement of operating systems is barely understood" (Gino & Pisano, 2008, p. 688). Behavioral biases are the result of the limited ability of humans to process information (Simon, 1976). With this in mind it is relevant for the field of operations management to understand which factors have a de-biasing effect on teams and therefore improve the quality of team decision-making. Therefore the general objective of this study is to contribute to the development of theory regarding behavioral influence on team performance within the context of operations management and to expand the understanding of team decision-making.

West (2000) proposed in his research that the behavioral characteristic reflexivity is a key factor for the performance of teams in operations. This is supported by the results of research into diversity and team outcomes (Schippers et al., 2003). However the exact functioning of the relationship between team reflexivity and team performance has yet received little attention in academic research. Team reflexivity is about reflecting on the process of decision-making and modifying the teams functioning accordingly. It is argued that for this reason it has a de-biasing effect on information processing and improves team performance (Kray & Galinsky, 2004).

In the past few decades a large number of biases with respect to information processing have been identified. Research into the effects of behavioral biases in operations management is scarce because, in general, the effects of psychological phenomena can be proven experimentally but not be measured in practice. Therefore this study focuses specifically on the anchoring & adjustment bias because according to Kahneman (2011) this bias can be measured in practice. Furthermore, it is suggested by Gino and Pisano (2008) that the effects of bias due to anchoring & adjustment might be relevant within operations management because of its potential implications when managing inventory or forecasting. This leads towards the following general research question:

What influence does reflexivity have on the anchoring & adjustment bias and the performance of teams within the context of operations management of a manufacturing company?

The literature review and deduced conceptual model is presented in chapter 2. Chapter 3 describes the research methodology. The results are presented in chapter 4. The discussion and conclusion described in chapter 5. The used references are listed in chapter 6.

2 LITERATURE REVIEW

In the history of academic research (management) teams have been studied extensively to identify factors that influence team performance. This chapter therefore gives a review on team performance, anchoring & adjustment bias and team reflexivity.

2.1 Team performance

The use of teams is a well-established way of structuring an organization by its management or members in order to work more effectively and perform better. There are different types of teams, such as work teams, parallel teams, project teams and management teams (Cohen & Bailey, 1997). A work team can be found in a manufacturing or service setting and be self-managed or directed by a supervisor. An example can be a team responsible for the manufacturing of a product or delivering a service, whereas a management team, for example, coordinates and provides direction to sub-units under their jurisdiction. What all teams share is that they are a collection of individuals that operate in a certain context, they exist to perform tasks, they share one or more common goals, they interact socially and see themselves and are seen by others as a social entity. This definition of a team is based on the work of Alderfer (1977), Hackman (1987), Guzzo and Dickson (1996) and Kozlowski and Bell (2003).

Since teams in organizational settings are often used, research into what makes teams work has been performed by many practitioners. Due to this attention in the academic field a large body of literature is available on teamwork. For this reason multiple literature reviews have been made ((Cohen & Bailey, 1997; Pagell & Lepine, 2002; Kozlowski & Bell, 2003; Mathieu et al., 2008). From that work it can be concluded that teams work according a circular input-process-output framework. Inputs are the factors that enable and constrain the interactions between members of a team. These factors include the characteristics of individual team members (e.g., gender, age, and competencies), team-level factors (e.g., task-structure, external leader influence) and organizational and contextual factors (e.g., rewards, interdependence, and environmental complexity). The first two inputs are internal factors that may be directly influenced by team-members or their managers. The organizational and contextual factors are often fixed for the short and medium term and not within the direct influence of team-members or managers. These various input factors combine to drive team processes, which describe the interactions of a team that lead towards the teams' output.

Within the definition of a team it is argued that a team produces something good for the organization for which it works and for this reason team output has received extensive attention in research within the field of Human Resource Management, Organizational Behavior and Operations Management (Cohen & Bailey, 1997; Mathieu et al., 2007; Gunasekaran et al., 2004). The output of a team, in particular the quality of team decision-making, is valued by the construct of performance. The degree of performance of a team can be described using the dimensions of organizational-level performance and team member-level performance. Organizational-level performance comprises factors such as efficiency, productivity, quality, customer satisfaction and innovation.

Performance on the team member level comprises factors such as employee satisfaction, safety, absenteeism, commitment and trust.
This study focuses on team performance in the context of operations management in a manufacturing company. A manufacturing company is part of the integral system of suppliers, manufacturers, distributors, retailers and customers for the production and delivery of a product or service, called the supply chain. The performance of teams in operations within every part of the supply chain can be evaluated using efficiency measures such as income or revenue per employee, inventory and asset turnover, order lead times, capacity utilization or, more generally, the return on investment or residual income. Companies that are strong in operations are able to generate more profit for each dollar of sales (Jacobs & Chase, 2011). The definition of team performance is therefore the extent in which teams make quality decisions in order to improve the company's competitive advantage.

2.2 Anchoring & adjustment bias

When people behave they constantly make decisions. Decision-making in psychology is explained as the mental process in the selection of a course of action. This process comprises the components of identifying the nature of an issue by perception & interpretation, judgment, motivation and action (Rest et al., 1999; Kahneman, 2003). When people come to judgments and make decisions they use a limited number of heuristic principles that are explained as experienced-based, simple and efficient rules. Heuristics are very useful, but sometimes they lead to severe and systematic errors, which are called biases (Tyversky & Kahneman, 1974).
In order to understand when the use of heuristics goes wrong, or how to distinguish bias from non-bias, it is required to understand the functioning of the human mind. The mind uses two systems which operate together (Stanovich & West, 2000). The first system operates automatically and fast, with limited to no effort and awareness of control. The second system does not operate automatically and is slow, but it is conscious and performs complex mental activities. The first system uses heuristics for deciding on action, but is sensitive to bias, because the system cannot handle complexity and makes simplifications. One of the tasks of the second system is to intercept and suppress the simplified and intuitive impulses from the first system and is therefore responsible for self-control (Kahneman, 2011). But as anyone can probably imagine constantly questioning the activities from the first system is highly unpractical and would also be very tiring. Therefore the human mind will not always fall back on the second system and this leads to the possibility of bias when making decisions.
When a fully rational decision is made leading to the optimal choice, given the information available, there is no bias (Simon, 1991). When rationality is bounded because decisions were made not leading to the optimal choice, there is bias. Bias occurs during different types of actions when people make decisions. These actions comprise the acquisition of information, information processing, deciding outcome and learning from feedback. In the past few decades a large number of biases have been identified to support the evidence that human beings are limited in their ability to learn, think and

act (Simon, 1956; Tyversky & Kahneman, 1974; Gino & Pisano, 2008). Simon (1976) has showed in his research into decision-making processes that human beings are limited in particular in their ability to process information. Examples of information processing biases are the anchoring & adjustment bias, conservatism bias, and overconfidence bias. Anchoring & adjustment bias is a person's tendency to rely too heavily, or "anchor", on one trait or piece of information when making decisions. Conservatism bias is a person's failure to update his opinions or beliefs when he receives new information. Overconfidence bias is a person's tendency to be more confident in his own behavior, opinions, attributes and physical characteristics than he ought to be. This study focuses on the anchoring & adjustment bias.

The anchoring & adjustment bias is described as the tendency to rely too heavily, or "anchor", on one trait or piece of information and adjust too little from biased initial values (Tversky & Kahneman, 1974; Eply & Gilovich, 2006; Gino & Pisano, 2008). In a news vendor setting it is found that people consistently order quantities that are weighted averages of the optimal order and the expected level of demand. As a result, subjects order too much when holding costs are above backorder costs and too little when backorder costs are above holding costs (Schweitzer and Cachon, 2000).

Anchoring effects are easy to recognize but from a psychological perspective the underlying mechanisms involved are hard to understand and explain. The challenge to figure out anchoring & adjustment has been the attention of multiple students in recent academic research (Frederick et al., 2010). Research has indicated that anchoring is influenced by numeric priming (Wong & Kong, 2000), semantics (Mussweiler & Strack, 2001), selective accessibility of information (Chapman & Johnson, 1994; Mussweiler & Strack, 1999) and scale distortion (Frederic & Mochon, 2012). Moreover, adjustment is the result of effortful adjustment (Eply & Gilovich, 2001). The first two psychological mechanisms are explained below.

Numeric priming is the phenomenon that anchoring effects are different with a numeric value of 7,300m and with 7,3km, while the semantics are similar.

Semantic influence on anchoring is the phenomenon that the anchoring effects are different when a numeric anchor is the same but the judgmental goal is given a different meaning, e.g. when asked the length of a runway for an airplane in the United Kingdom or the Netherlands with respect to an anchor value of 2,500m. The numeric values are the same, in fact the actual length of both runways could be the same, and still the anchoring effects might be different due to different semantics given to the subject based on the knowledge available at the time of judgment.

In general the anchoring & adjustment bias comprises two mental operations, people anchor on information that comes to mind and adjust according to a "test-operate-test-exit" method until a plausible value is reached or one is able and willing to search for a more accurate estimate (Eply & Gilovich, 2006).

2.3 Team reflexivity

Bias in decision-making distorts the quality of decisions and therefore has a negative influence on team performance. The academic literature describes very little about

factors which have a de-biasing effect in information processing, but from the work of Kray and Galinsky (2004) it is found that counterfactual mind-sets in teams have a de-biasing effect because it increases the search for disconfirmatory information. "Counterfactual mind-sets are thoughts of what might have been and they represent alternative realities for past events" (Kray & Galinsky, 2004, p. 70).
West (2000) proposed that team reflexivity is a key factor for the performance of teams in operations, which is supported by the results of research into diversity and team outcomes (Schippers et al., 2003; Schippers et al, working paper). West (2000) argues that reflexivity consists of three stages: reflection, planning and adaption (not necessarily linear). Reflection is paying attention, being aware, monitoring and evaluation of the team objectives, strategies, processes, organization and environment. Reflection includes behavior such as questioning, analysis, evaluating and learning. Planning is the stage between reflection and adaption (action), in which courses of action are contemplated, actions formed or plans developed. Adaption refers to actions taken by the team to change the execution of their tasks, which have been identified in the reflection stage, in order to reach the teams goals. Non-reflexivity is the state of acting without the awareness of acting (Rennie, 1992).
It is the author's judgment that counterfactual mind-sets (Kray & Galinsky, 2004) are a form of reflection described by West (2000) and therefore it is argued that team reflexivity has a de-biasing effect on team performance.
The definition of team reflexivity is the extent to which teams collectively reflect upon their objectives, strategies and processes and modify their functioning to current or anticipated circumstances (West, 2000). Based on this definition team reflexivity can be described as one of the tasks in the organization and control of work. The way work is organized and controlled refers to task-structure (Pagell & Lepine, 2002). Team reflexivity can therefore be placed in the category of team-level factors being an input factor in the process of teamwork.

2.4 Theory and propositions

This chapter summarizes the review of the literature and describes the deduction of the theory and associated propositions and conceptual model. Team reflexivity is the extent to which teams reflect upon and modify their functioning. Reflexivity is achieved when teams pay attention, are aware, monitor and evaluate their objectives, strategies, processes, organization and environment and modify their functioning based on their reflection. It is suggested that for this reason team reflexivity has a de-biasing effect on information processing bias (Kray & Galinsky, 2004). This leads towards the first probabilistic proposition.

P1: If team reflexivity is higher, then it is likely that anchoring & adjustment bias is lower.

A recent McKinsey study showed that when organizations work at reducing the effect of bias in their decision-making processes, they achieved returns up to seven percentage points higher (The Case for Behavioral Strategy [*McKinsey Quarterly],* 2010). These

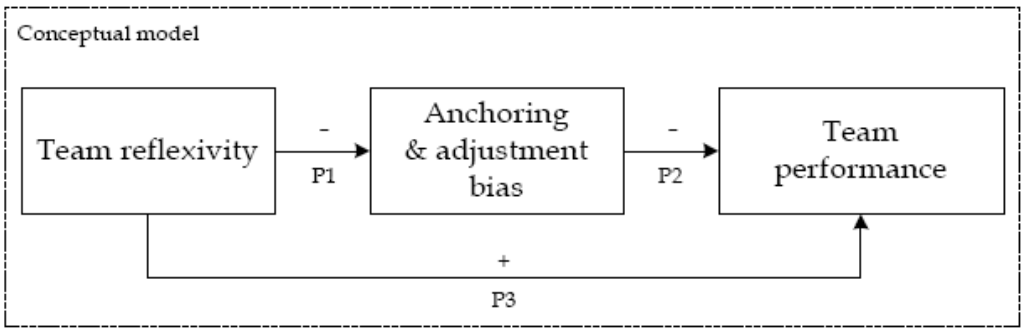
findings are supported by the work of De Dreu (2007) and Kahneman et al. (2011). In other words, reducing information processing bias makes a difference and improves performance. This implies that a lower anchoring & adjustment bias increases the performance of teams, because then those teams make better decisions. That leads towards the second probabilistic proposition.

P2: If anchoring & adjustment bias is lower, then it is likely that team performance is higher.

The work of West (2000) and empirical findings in the work of Schippers et al. (2003) shows that team reflexivity has a direct, positive influence on team performance. Based on this theory the third probabilistic proposition is made.

P3: If team reflexivity is higher, then it is likely that team performance is higher.

The above exploration leads towards the following conceptual model.



The theory describes a mediation model in which team reflexivity improves team performance through anchoring & adjustment bias, because a lower bias with respect to anchoring & adjustment leads to making better decisions. The objects of study for this research are teams. The specific research objective of this study is theory testing. The domain of the theory for which the propositions are believed to be true are all teams.

3 METHODOLOGY

3.1 Research design

This study is performed using a deductive logic (Saunders et al., 2003). The research strategy used in this study is a survey in order to test the probabilistic relation between team reflexivity (independent concept), anchoring & adjustment bias (mediator) and team performance (dependent concept). A survey strategy is chosen for this research because probabilistic propositions are to be tested in a large number of instances (Dul & Hak, 2008). An experiment is assumed to be unfeasible, because manipulation of the independent variable team reflexivity would be difficult to realize due to limited control of the team's behavior. The data are collected using a questionnaire and the Littlefield Technologies simulation software, leading to quantitative data.

Within the domain of the theory this research focuses on a population of management teams within the context of operations in a manufacturing company. The sample comprises teams of students in supply chain management that play the Littlefield Technologies simulation. This population is chosen because it is possible to acquire a large number of instances required for testing probabilistic propositions within a short time frame.

The collected data is analyzed on mediation by running the Preacher-Hayes script (bootstrap test) in SPSS in order to test if the indirect effect P1 # P2 is significant. The type of mediation is classified using the significance of the results of P1, P2 and P3 (Preacher & Hayes, 2008; Zhao, Lynch & Chen, 2010).

3.2 Data collection

3.2.1 Littlefield Technologies simulation

Littlefield Technologies is a web-based, discrete-event simulator of a factory that assembles Digital Satellite System receivers from kits of electronic components procured form a single supplier. The assembly process consists of board stuffing, testing and tuning (appendix A). The simulation covers basic operation management principles such as utilization, queuing, scheduling and inventory management due to the combination of a stock replenishment and queuing system. The simulation is played by a group of team members that can – individually – access the control board of the company online. The management teams start with a cash position of $1,000,000 and 9,600 kits in stock. Default values for the decision-making parameters are set by the administrator. The simulation runs for 268 days in total. The first 50 days the factory runs automatically in order for the teams to get familiar with the simulation. From day 51 onwards the teams are able to modify decision parameters such as lot size, contract choice, reorder point and reorder quantity, scheduling policy and the number of machines at each operating station. One day in real life corresponds with 24 days in the simulation. The teams play the simulation for one week, which means 168 simulated days. On day 218 the teams have no more control of their factory and the remaining 50

days will run automatically based on the latest input by the team. The teams have to deal with a rise in demand until day 140 after which demand gradually declines towards zero on day 268. Prior to day 141 the teams are confronted with a message from Dave Hopp, sales manager from Littlefield Technologies, that one of the biggest clients is offering a one-week discount (from day 141-147) on their products expecting to have significant effect on demand. The goal of the teams is to maximize the cash balance at the end of the game on day 268.
Littlefield Technologies was chosen for this study for the following reasons. Firstly, the simulation offers a time-efficient possibility to study group behavior within the context of operations management where anchoring & adjustment biases are likely to limit team performance. Secondly, the simulation Littlefield Technologies is a compulsory part of the operations management courses at the Rotterdam School of Management. This will ensure high response rates of the people participating in the study and gives the possibility to select a large enough sample for analyzing probabilistic propositions.

3.2.2 Sample selection

The instances in this study were sampled using a method of convenience sampling from teams comprising Master Business Administration (MBA), General Management (GM) and Part-time business administration (PTO) students from the Rotterdam School of Management, Erasmus University. Instances were also sampled from colleagues of PTO students working in the same business. Selection of the instances was performed in twofold. Firstly, a number of 72 individuals, divided into 15 teams were selected from the MBA (N=12) and PTO (N=2) classes in 2012. The PTO teams were working for ASML and Logisticon. One random team (N=1) was added to the 2012 data, for control purposes, without any supply chain education or experience. The random team was labeled PTO in the analysis. Secondly, a number of 231 individuals, divided into 44 teams were selected from the MBA (N=25), PTO (N=6) and GM (N=13) classes to improve the sample size. The latter comprises data that was used for an earlier study on team reflexivity and team performance by a business administration student in 2010. The combination of the data results in a total number of 303 individual participants, divided into 59 teams. The majority of the teams were composed randomly. Seven teams had to be taken out of the sample because they did not meet the criteria of minimum team size of 2 members. This lead to a total sample of 52 teams from the MBA (N=37), PTO (N=9) and GM (N=11) classes and a response rate of 88%.
The use of a convenience sampling method implies that findings from this study cannot be generalized to the population, because the population for which the sample is representative for is unknown. Moreover, a possible selection bias originates from the use of convenience sampling, because the sample comprises students in business administration who have to hand in a final report with reflection on their course of action. This could provide higher results on the team reflexivity measure than would be the case when using random sampling. Despite the mandatory participation of the students for playing Littlefield Technologies response bias is assumed to be low. The students are assessed only on the final score in the game and a report with their

reflection on their course of action (which had to be submitted after finishing the game). Participation in the survey was voluntary; the students are not assessed on the results of the questionnaire that was filled in for this study.

3.3 Measures

3.3.1 Team reflexivity

Team reflexivity is the extent to which teams reflect upon and modify their functioning (West, 2000). The measure for the team reflexivity construct is defined using the C-OAR-SE method (Rossiter, 2011; Diamantopoulos, 2005). Rossiter (2011) argues that highly content-valid measures are absolutely necessary for proper tests of theories and hypotheses and should replace the psychometric approach based on Churchill's scale development. "If a measure is not highly content-valid to begin with – then no subsequent psychometric properties can save it" (Rossiter, 2011, p. 1561).

Team reflexivity is measured using a multiple-item construct, comprising 15 items. The evidence is extracted from the object of measurement using a questionnaire (appendix B). A questionnaire was used due to its practical applicability, because it is less time consuming than conducting interviews in a large number of instances. Moreover, reliability is valued over the richness of data for which the choice is made for a questionnaire. The object to be rated is the team, the attribute to be rated is team reflexivity and the rater entities are the team members. Items used for the questionnaire are based on a reflexivity measure for teams (Schippers et al., 2007; Swift & West, 1998). The items were selected from the original questionnaire using the criteria of content validity. Therefore, the items cover the reflexivity factors of evaluation/learning, discussing processes, adaption and feedback-seeking behavior based on the work of West (2000). The items were rephrased in order to fit this particular study and because the questionnaire needed to be filled in after the Littlefield Technologies simulation was finished. Evaluation and learning comprises nine items, with questions such as "During the game, we stopped to assess whether the team was on the right track". Discussion processes comprises three items and are measured with questions such as "We carefully considered which kind of media (e-mail / telephone) was best-suited for which kind of message". Adaption is measured with one question: "What we discussed corresponds with what we do subsequently". Through two items comprising questions such as "We worked out how well we performed in comparison to other teams" feedback-seeking behavior is measured. A five-point Likert scale was used for the questionnaire, ranging from "totally disagree" to "totally agree".

Team reflexivity is measured on an individual team-member level. The individual team-member scores on reflexivity were aggregated to team level scores by taking the average team-member score for each item (Schippers et al., 2003). The items in the measure for team reflexivity are assumed to reflect the specific factors that underlie team reflexivity. The team-level item scores are therefore averaged for each factor. The factors evaluation / learning, discussing processes, adaption & feedback seeking are assumed to be a necessary condition and formative for team reflexivity (Diamantopoulos & Winklhofer,

2001; West, 2000). The average scores for each factor were therefore summed up to a score for team reflexivity (scale 4 - 20). This procedure is applied for the 2012 group. The data on team reflexivity for the 2010 group only comprised a limited number of items that corresponded with the 2012 measure. Therefore a separate score on team reflexivity was made based on the items in the 2010 measure. This measure comprises 5 items from the factor evaluation & learning and 3 items from the factor discussing processes. The items were assumed to be reflexive and were therefore averaged to a score on team reflexivity (scale 1-5). The results (N=10) from 2010 and 2012 measure were then compared in order to validate the use of the 2010 measure for team reflexivity. The correlation of the measures is high (ρ=0.974) and significant. Therefore the 2010 measure for team reflexivity is used for the analysis.
The measurement validity of team reflexivity is guaranteed due to selection of items based on content validity, capturing the meaning of the construct and using an answer scale free from measure-induced distortions. The reliability of the measure is tested using a short-interval retest (ρ=0.989) on three of the evaluation/learning items from the 2012 data, which were assumed by the author to be most valid for the content. The reliability is therefore assumed to be high. The measure was composed by the author, based on content validity criteria and not validated by expert judgment, leaving room for bias from the author's perspective within the selection of the items for the questionnaire. However the correlation results in the 2012 and 2010 measure show that the result on team reflexivity is not particularly sensitive for an author bias on item selection.

3.3.2 Anchoring & adjustment bias

The anchoring & adjustment bias is described as the tendency to rely too heavily, or "anchor", on one trait or piece of information and adjust too little from biased initial values (Tversky & Kahneman, 1974; Eply & Gilovich, 2006; Gino & Pisano, 2008).
The measure for anchoring & adjustment is therefore defined as the extent to which teams rely too heavily on an anchor value instead of choosing the most optimum value. As proposed by Kahneman (2011), the measure is defined as an index that expresses the effects of anchoring. The anchoring index is defined as the ratio between the actual value and the optimum value corrected for the anchor value. The actual values are measured on *reorder quantity*, *reorder point* and *number of machine purchases on station 1* decision parameters. The other decision parameters such as lot size and scheduling rules are assumed of less importance when sufficient capacity is arranged within the factory. The number of machine purchases on station 2 and 3 are also of less importance than is the case for station 1, because machines at the first station have highest processing times for each lot and unit.
The actual values for the decision parameters are the average value measured during 150 days (day 51-200). The data after day 200 is not included in the average because teams tended to take enormous amounts of risk at the end of the game and set the decision parameters at either 0 if they had enough inventory or order inventory for the last 68 days.

The most optimum values (zero bias) are specified for each decision parameter. The optimum *reorder quantity* is assumed to be the highest amount (29.700 parts) ordered by one of the teams, because within the simulation the holding costs of inventory are less than the opportunity costs of not investing cash. The optimum *reorder point* is assumed to be the value to cover maximum demand during the 4 day lead time of the order (5.280 parts), because holding costs of inventory for safety stock is less than lost sales in case of a stock out. The optimum *number of machine purchases on station 1* is assumed to be the amount of stations (6 stations) to create sufficient long-term capacity for lowest lead-time to the customer. This gives the teams the ability to agree the highest value contract with their customer and increase their income. Anchoring & adjustment bias is operationalized as the situation when teams anchor on the default values for the decision-making parameters instead of choosing the most optimum value. This means and index of 1 means bias and an index of 0 is non-bias.
The anchor value for *reorder quantity* is 7.200 parts and for *reorder point* the anchor is 1.440 parts. The anchor value on *machine purchases at station 1* differs from the teams, because the teams played Littlefield Technologies with a different game template. A number of 25 teams played according to a template with an anchor value of 3 machines at station 1 and a number of 27 teams with 2 machines at station 1. The indexing rule takes these differences into account.
Measurement validity is high because the measure captures the ideas of anchoring & adjustment. Reliability of the measure is low because the teams operate in a student setting. There are no consequences of wrong decisions and therefore students learn by iteratively searching for correct decisions, as is the idea behind the Littlefield Technologies simulation. Selection of the relevant decision-making parameters and optimum values for those parameters leaves room for bias from the author's perspective, because the choice is not validated by expert judgment. However the selection was done based on supply chain management theory, assuming the author's bias to be low.

3.3.3 Team performance

Team performance is a measure of the output of a team (Cohen & Bailey, 1997). This research focuses on management teams in the context of a manufacturing company. The long-term competitive advantage for a manufacturing company is, among other factors, created by a higher gross margin and customer satisfaction. In order to create a higher gross margin a manufacturing company needs to be strong in operations and earn more profit for each dollar of sales with respect to its competitors. Therefore team performance is measured by the cash ($) position of the Littlefield Technologies factory at the end of the simulation.
The cash position is calculated by the sum of the firms starting cash position plus revenues and interest minus the costs for debt interest, machine purchases and inventory. The revenues for the factory depend on a contract with the client where maximum delivery time is specified as a key performance indicator. In a situation where the actual delivery time exceeds the contract specified delivery time the team is not

getting paid for their product. Therefore cash position includes the valuation for customer satisfaction.
Measurement validity of team performance measure is assumed to be high because cash position captures the ideas of earning more profit for each dollar of sales and customer satisfaction, two key aspects of operational performance. Measurement reliability of team performance is also high because under the same decisions by the teams the performance will repeatedly be the same. There is limited room for bias from the perspective of the author, because the author was not involved in measuring team performance. The team scores were derived from the game database after the simulation was finished.

4 ANALYSIS & RESULTS

This chapter describes the exploration, the mediation analysis and the results of the collected data from the sample of management teams that played the Littlefield Technologies simulation.

4.1 Descriptives

The data for analysis is derived from 52 management teams from the MBA (N=37), PTO (N=9) and GM (N=11) classes from 2010 and 2012. Each team comprised two to seven students (M=4.1; SD=1.5).

Due to the combination of data from different classes, the results on team reflexivity have been analyzed on mean scores and standard deviation, to identify possible between-class differences. The mean score for team reflexivity for the sample is 3.72 with a standard deviation of 0.40. There is no significant difference in the mean scores on team reflexivity between the classes, although the PTO classes score slightly lower on team reflexivity.

Team Reflexivity

Type of class	Mean	N	Std. Deviation
MBA	3.7953	32	.36055
GM	3.7845	11	.25133
PTO	3.3867	9	.52479
Total	3.7223	52	.39833

A number of 29 teams from the year 2010 were instructed to keep a logbook in an attempt to manipulate team reflexivity. The analysis shows that there is no significant difference in the mean scores between the group that was manipulated (M=3.79; SD=0.27) and the group that was not manipulated (M=3.62; SD=0.50), although the manipulated group shows lower variability. The attempt to manipulate did not have the desired effect to create significant difference in team reflexivity. The students were required to submit a reflection report at the end of the simulation on which they were assessed. This probably caused team reflexivity to be high in general.

Team Reflexivity

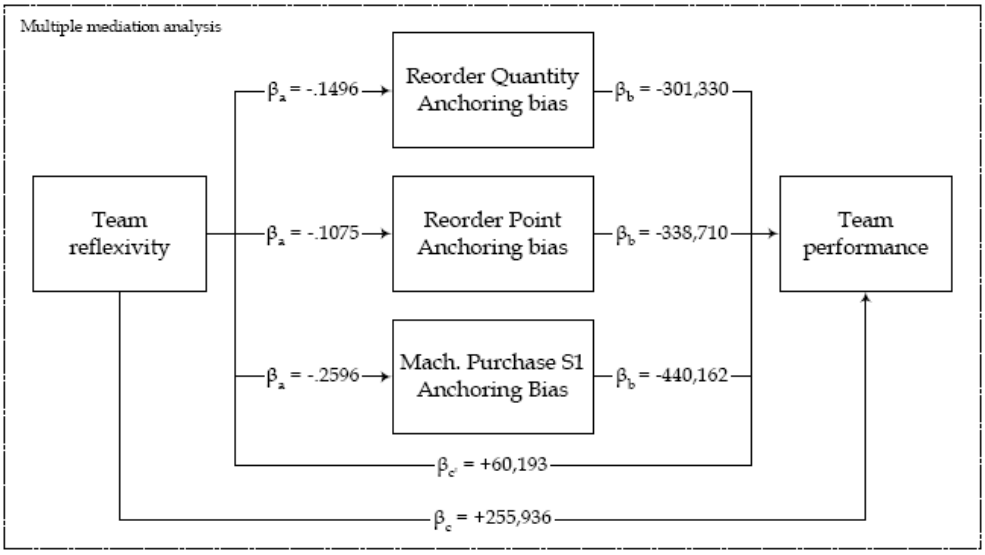
Reflexivity manipulated?	Mean	N	Std. Deviation
Yes	3.7959	29	.27375
No	3.6296	23	.50627
Total	3.7223	52	.39833

Scatter plots have been made in order to analyze the hypothesized relation between the variables on team reflexivity, anchoring & adjustment biases and team performance and improve understanding of the data (appendix C).

4.2 Mediation analysis

Mediation hypothesizes how or by what means an independent variable (X) affects the dependent variable (Y) through one or more potentially intervening variables, or mediators (M) (Preacher & Hayes, 2008). The independent variable for this study is team reflexivity. The dependent variable is team performance. Team reflexivity is hypothesized to influence team performance through the multiple mediating anchoring & adjustment biases defined as; *reorder quantity bias*, *reorder point bias* and *machine purchases station 1 bias*.

The collected data is analyzed on mediation by running the Preacher-Hayes script (bootstrap test) in SPSS. "Bootstrapping is a non-parametric resampling procedure and does not impose normality of the sampling distribution. Bootstrapping is a computationally intensive method that involves repeatedly sampling from the data set and estimating the indirect effect in each resample" (Preacher & Hayes, 2008). Through bootstrapping an empirical distribution is built to construct confidence intervals for the indirect effect. From the bootstrap analysis (appendix D) it is found that the mean indirect effect a # b for the proposed mediators is positive and significant (β=195,742), with a confidence interval of 95% excluding zero (β=54,570 to β=340,747). The direct effect c is also positive (β=255,936) and significant (p=.0080). Since a # b # c is positive the type of mediation is classified as complementary mediation. There is empirical evidence that the mediated indirect effect (P1 # P2) and the direct effect (P3) both exist and point at the same direction. This means the identified mediators are consistent with the theoretical framework.



Regression analysis shows that the identified mediators account for a large amount (Adjusted R-sq=.47) of the variation in team performance in which bias on *machine purchases at station 1* is of greatest influence. However, complementary mediation suggests an incomplete theoretical framework and therefore the likelihood of an omitted mediator in the direct path (P3) should be considered (Zhao, Lynch & Chen, 2010).

4.3 Additional analysis

The data used for analysis was collected from multiple classes of the Rotterdam School of Management, Erasmus University. The classes played the Littlefield Technologies simulation using different game templates. One group (N=27) used the template "Onemba" with 2 machines on the board stuffing station 1 by default. The other group (N=25) used the template "CEMS2009" with 3 machines on the board stuffing station 1 by default. The bias index results on *machine purchases at station 1* has been corrected for this difference in use of template, but the effect of the use of different game templates on team performance results is not exactly known. Therefore the data for both groups was analyzed separately on mediation (appendix E) to identify possible differences.

From the bootstrap analysis for the group which played using the "Onemba" template it is found that the mean indirect effect a # b for the proposed mediators is positive and significant (β=227,613), with a confidence interval of 95% excluding zero (β=38,238 to β=400,646). The direct effect c is also positive (β=150,365), but is not significant (p=.2447). This indicates a form of indirect mediation, which means the identified mediators are consistent with the theoretical framework. The existence of omitted mediators in the direct path in this case is unlikely, but the low significance in the direct effect could be the result of the low sample size. The effect of a # b # c is positive and in the case of a significant direct effect the results would correspond with the results found for the total group, suggesting complementary mediation.

From the bootstrap analysis for the group which played using the "CEMS2009" template it is found that the mean indirect effect a # b for the proposed mediators is positive but not significant (β=68,776), with a confidence interval of 95% not excluding zero (β=-89,721 to β=231,280). The direct effect c is positive (β=121,620), but is not significant (p=.3110). These results indicate a form of non-mediation, which means neither the direct nor the indirect effects are detected in the theoretical framework. Low significance could also for this group be the cause of the low sample size. The effect of a # b # c is positive and in the case of a significant direct and indirect effect the results would correspond with the earlier results, suggesting complementary mediation. Lower effect sizes (β) in the "CEMS2009" are most probably caused due to the different game templates used.

The mean of the *machine purchase station 1 anchoring bias* for the CEMS2009 group (M=.25) is slightly lower than the "Onemba" group (M=.42) which is result of respectively 3 and 2 machines by default on station 1, while the most optimum value 6 machines is equal for both templates. As a result of lower bias on machine purchases at station 1 the mean team performance for the group which used the "CEMS2009" template is also higher.

Compare means

Game template used		Bias reorder quantity	Bias reorder point	Bias machine purchase S1	Team Performance
Onemba	Mean	.7948	.5178	.4193	$1,420,662
	Std. Deviation	.25640	.20653	.32644	$292,405
CEMS2009	Mean	.7724	.4264	.2520	$1,692,679
	Std. Deviation	.18691	.14177	.27570	$184,102
Total	Mean	.7840	.4738	.3388	$1,551,439
	Std. Deviation	.22379	.18257	.31179	$279,949

A comparison of the mediation analysis and mean results for both groups show no unexpected results which would affect the study outcome.

4.4 Hypotheses testing

The theory tested in this study hypothesizes the influence of team reflexivity on team performance through multiple anchoring & adjustment biases. Hypothesis testing is done to analyze whether or not results from the study occurred by chance only. A significance level of 10% is used, because the study was performed with a low sample size, which is more often the result in a study where data is analyzed on team-level. Hypothesis testing is not performed to analyze whether the results from this study are true for the entire population. The population in this study is not known because the data was collected by means of a convenience sample and results cannot be generalized to the entire population. For this study the following hypotheses are tested based on the results of the multiple mediation analysis (appendix D).

H1: If team reflexivity is higher, then it is likely that anchoring & adjustment bias is lower?

Team reflexivity has a negative effect on the anchoring & adjustment biases, which is in line with the hypothesized relation. The effect of team reflexivity on reorder quantity (p=.056), reorder point (p=.094) and machine purchases station 1 (p=.016) is not significant. Therefore the first hypothesis is accepted.

H2: If anchoring & adjustment bias is lower, then it is likely that team performance is higher.

The anchoring & adjustment biases have a negative effect on team performance, which is in line with the hypothesized relation. The effect from bias on reorder quantity (p=.028), reorder point (p=.056) and machine purchases station 1 (p=.000) is only significant for machine purchases station 1. Therefore the second hypothesis is accepted.

H3: If team reflexivity is higher, then it is likely that team performance is higher.

Team reflexivity has a positive effect on team performance, which is in line with the hypothesized relation. The effect of team reflexivity on team performance (p=.008) is significant. Therefore the third hypothesis is accepted.

The hypotheses described above are accepted and indicate the results did not occur by chance only. The results are not true for the entire population of management teams within the context of operations in a manufacturing company, only for this specific group of management teams that played the Littlefield Technologies simulation.

5 DISCUSSION

The use of teams in business practice has been growing over the last decades. As a result (management) teams have been studied extensively in the academic field. Recent developments in behavioral sciences have shown that teams which collectively reflect upon their objectives, strategies and processes and modify their functioning to current or anticipated circumstances perform better than teams which do this to a lesser extent. It is known that the performance of teams is influenced by decision-making. Specifically less bias in the decision-making process increases team performance. This study is intended to explore the relation between team reflexivity and team performance and to identify why some teams make better decisions.

5.1 Theoretical implications

This research makes several contributions to the literature. First of all, evidence is presented that team reflexivity indirectly influences team performance. The results of this study show, for the group studied, that multiple anchoring & adjustment biases mediate the relation between team reflexivity and team performance. This evidence further substantiates the theory on teamwork (Kray & Galinsky, 2004; Mathieu et al., 2008). The results confirm that teams work according to a circular input-process-output framework and input factors have a de-biasing effect in the decision-making process. Secondly, evidence is given for the role of anchoring & adjustment biases in inventory management and forecasting. Thirdly, the results of the study show signs of complementary mediation giving evidences for the existence of a direct effect of team reflexivity on team performance. This result corresponds with the findings of other practitioners where evidence is given for a direct relation between team reflexivity and team performance (Schippers et al., 2003; Schippers et al., working paper).

5.2 Managerial implications

The results of this study imply that managers or management teams should be aware of the internal factors in teams that may be directly influenced by them. One of those internal factors is team reflexivity and this is important for team performance, although further research has to give answer for which particular management teams and contexts this theory is applicable. Similar to the functioning of the human mind, management teams should identify the most important decision-making parameters on which they can be biased. Teams should only reflect the decisions on these key parameters, because reflection on all parameters would be very time-consuming and may possibly lead to a lower effectiveness of the teams. Of course the importance of decision-making parameters may change over time.

5.3 Limitations and future research

The results of this study should be evaluated taking into account the following limitations: The ecological validity of the study outcome is low, because the study outcome will not fully apply to the real life context of the object of study. In real life

management teams are formed of individuals with a skill-set and competence that complement to perform a certain task, while in this population the management teams comprise students which were randomly put together, possibly influencing the teams decision-making behavior. Furthermore, team behavior in this study will not reflect a real life situation because the decisions in real life have more consequences than in a simulated environment with the purpose to study basic concepts of supply chain management. On the other hand, the teams within the population performed a task for which it is required to make collective decisions and it has been possible to measure the effects of this psychological phenomena.
The translation of the results, from the sample, to the population has a low statistical reliability because a convenience sample is used for collection of the data. The use of a convenience sample implies that the population is not known, therefore the results of the study only apply to the particular group studied. The reliability and internal validity for this study is high, expect team reflexivity was measured using a questionnaire, because precision of the measure was valued over richness of data and there was only limited time for collection of the data. The teams assessed themselves on the extent of reflexivity, which leads to a possible response bias.
The limitations of this study lead to possible directions for future research. Future research may observe the relation between team reflexivity and team performance in a real-life context. It is advised that the results on the team reflexivity measure in future studies are validated by other means of data collection, e.g. interviews. Including teams that have been working together for longer periods and are specifically formed to perform a specific task may give further understanding for which teams the theory is applicable. It might well be possible that dedicated teams that have specific competences and skill on e.g. supply chain management will not anchor on information when reflexivity is lower, because their knowledge and experience tells them otherwise. Future research may also observe if other biases in the decision-making process mediate team reflexivity and team performance and whether the context in which the teams operate is important for which biases are relevant. Finally, a better understanding of which factors influence team reflexivity will be a good addition to the academic literature.

5.4 Conclusion

The use of teams is a well-established way of structuring an organization with the purpose to perform tasks more effectively and improve business performance and competitive advantage. Recent studies have brought greater understanding of how teams work and what makes them perform in order to contribute to an organization that is sustainable. This research further substantiates the theory on teamwork and confirms that teams work according to a circular input-process-output framework. In particular this study, for the group studied, gives evidence that team reflexivity, as input factor in teamwork, has a de-biasing effect on anchoring & adjustment biases and improves team performance.

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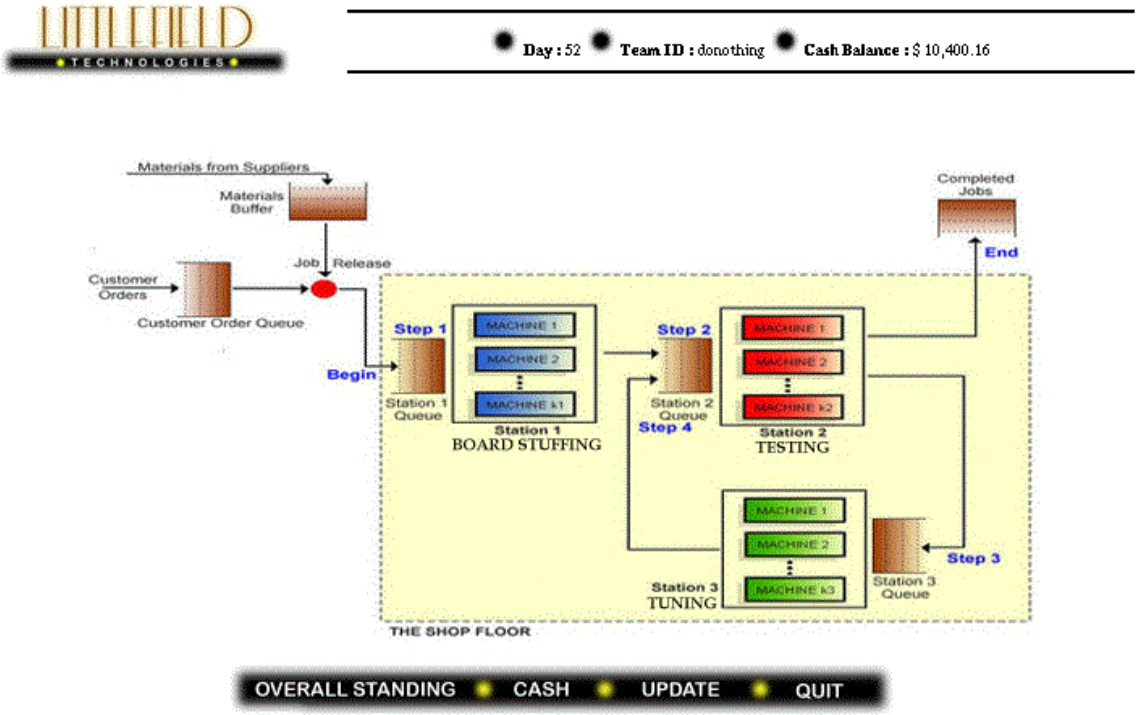
APPENDIX A – FACTORY FLOOR

The outline of the Littlefield Technologies factory shop floor.



APPENDIX B – TEAM REFLEXIVITY QUESTIONNAIRE

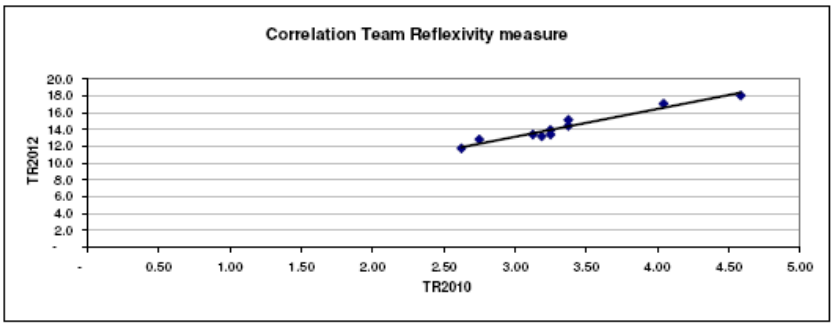
The following questionnaire was used for the team reflexivity measure.

	Questions	Characteristic	2012	2010
1	As a team we usually take well-considered decisions.	Evaluation	*	
2	During the game, we stopped to assess whether the team was on the right track.	Evaluation	*	*
3	We talked about different ways in which we can reach our objectives[a]	Evaluation	*	*
4	Before we got to work, we made sure everyone on the team had the same problem definition.	Evaluation	*	
5	We reflected on what we could learn from prior decisions made[a]	Evaluation	*	*
6	If a team member discovered a problem, he or she talked about it with other team members before taking action.	Evaluation	*	
7	We checked whether our activities procuced the expected results[a]	Evaluation	*	*
8	If things did not work out as planned, we considered what we could do about it.	Evaluation	*	
9	After a day (real time) was completed, we evaluated matters.	Evaluation	*	*
10	What we discussed corresponds with what we do subsequently.	Adaption	*	
11	We have been seeking feedback on our methods.	Feedback seeking	*	
12	We worked out how well we performed in comparison to other teams.	Feedback seeking	*	
13	We carefully considered which kind of media (e-mail/telephone) was best suited for which kind of message.	Discussing processes	*	*
14	When we noticed that the message did not come acreoss using one channel (e.g., e-mail), we switched to a more interactive channel (e.g., telephone).	Discussing processes	*	*
15	We always checked if our message had come across as intended.	Discussing processes	*	*

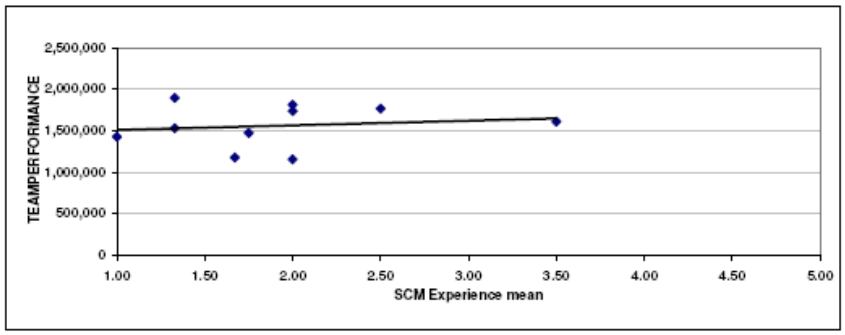
[a] items used for short interval test-retest analysis.

APPENDIX C – DESCRIPTIVES

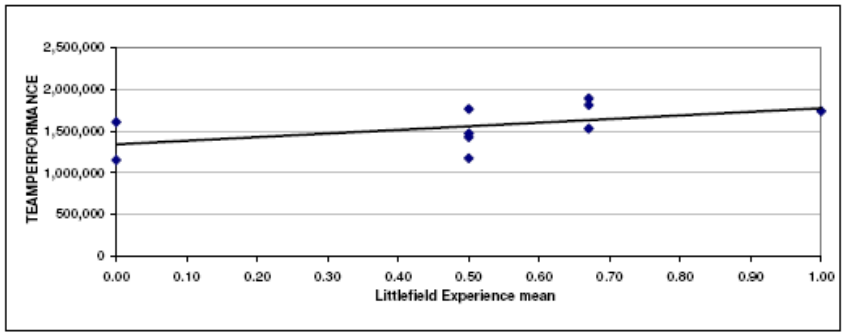
SCATTERPLOTS - GENERAL



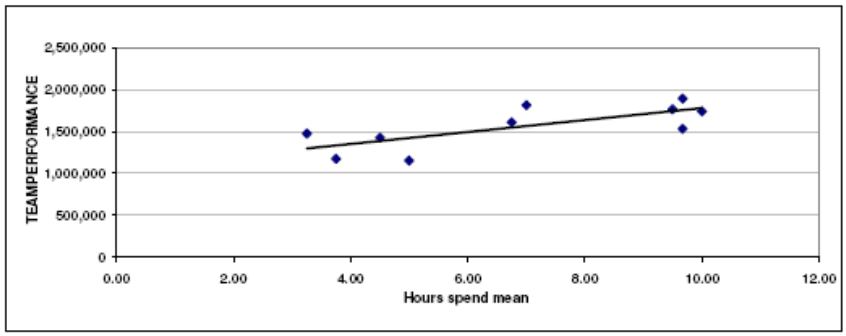
SCATTER PLOTS - CONTROL VARIABLES (2012 year only)



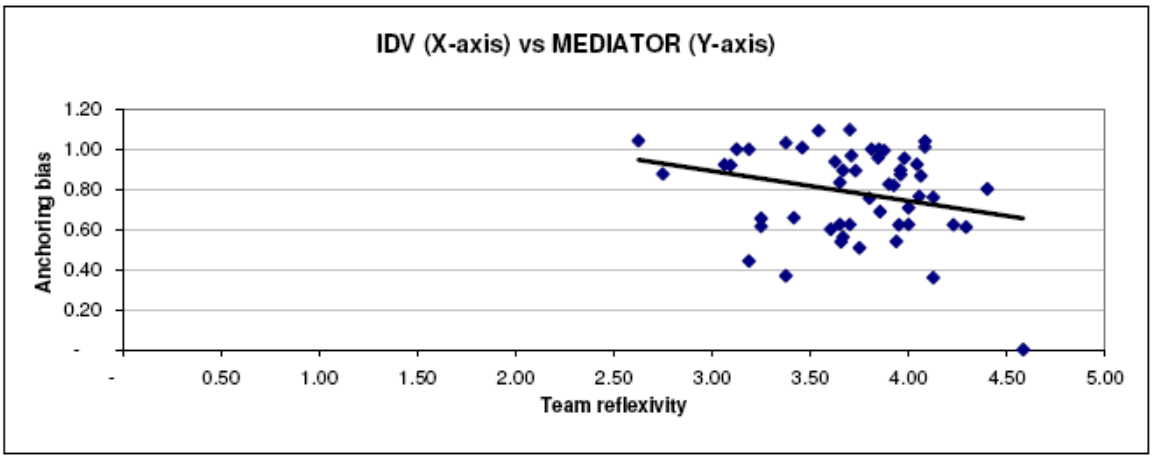
1 = No experience
5 = Very experienced

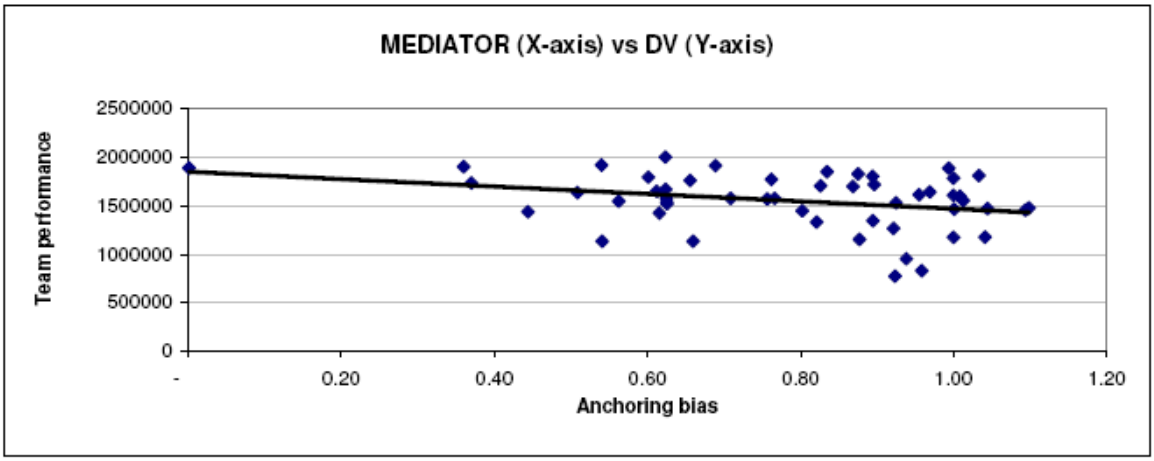


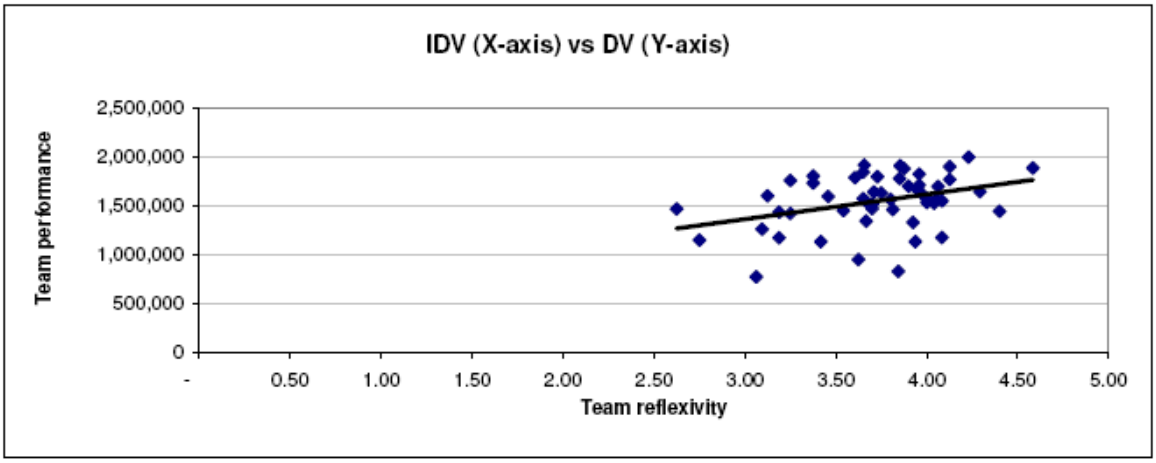
0 = NO
1 = YES



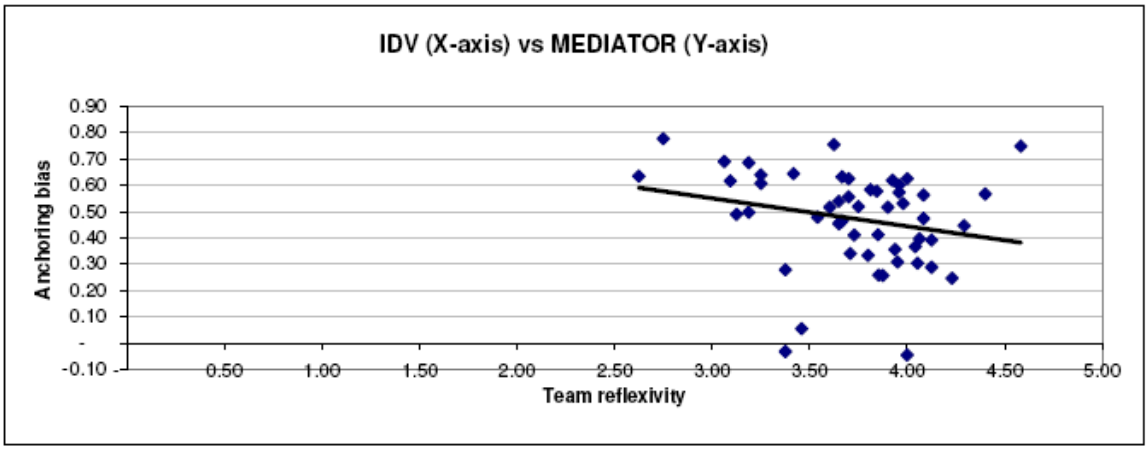
SCATTERPLOTS - REORDER QUANTITY

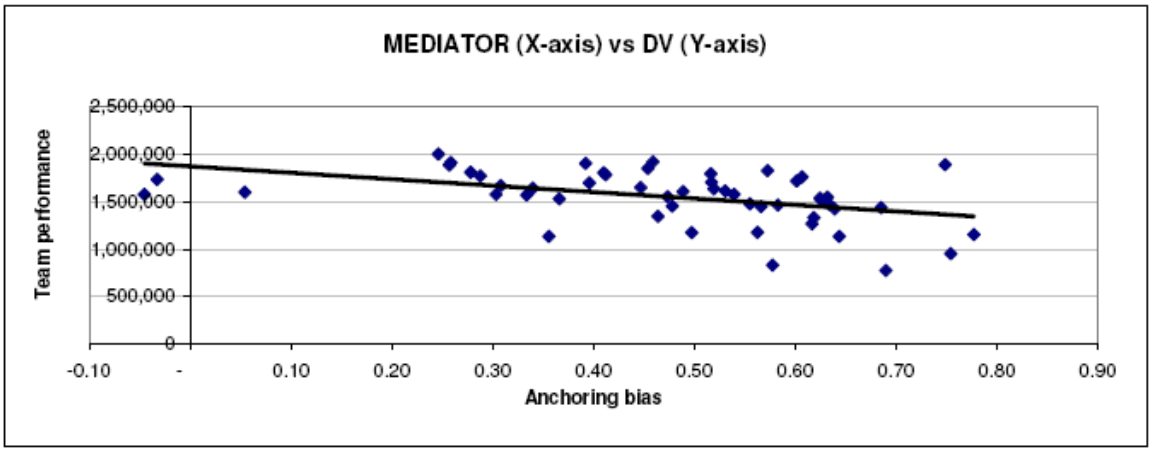


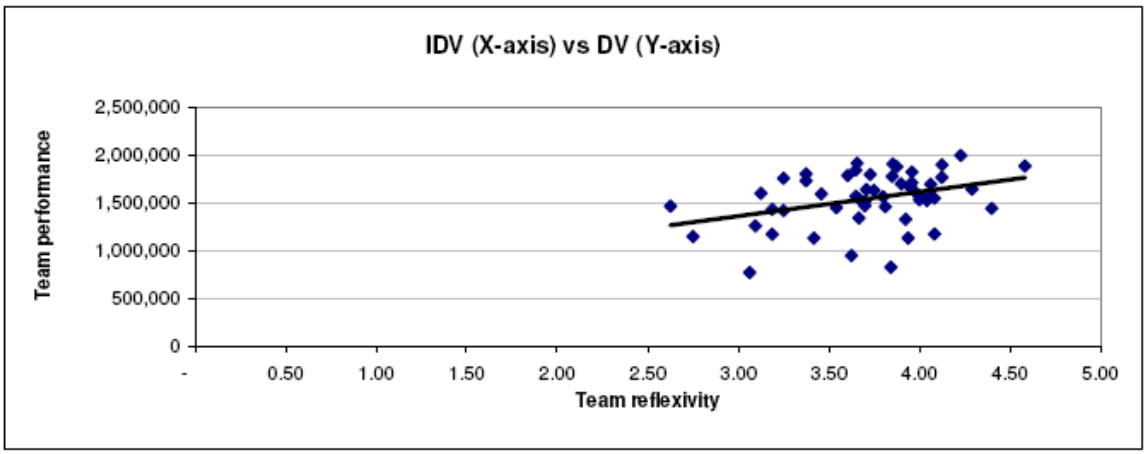




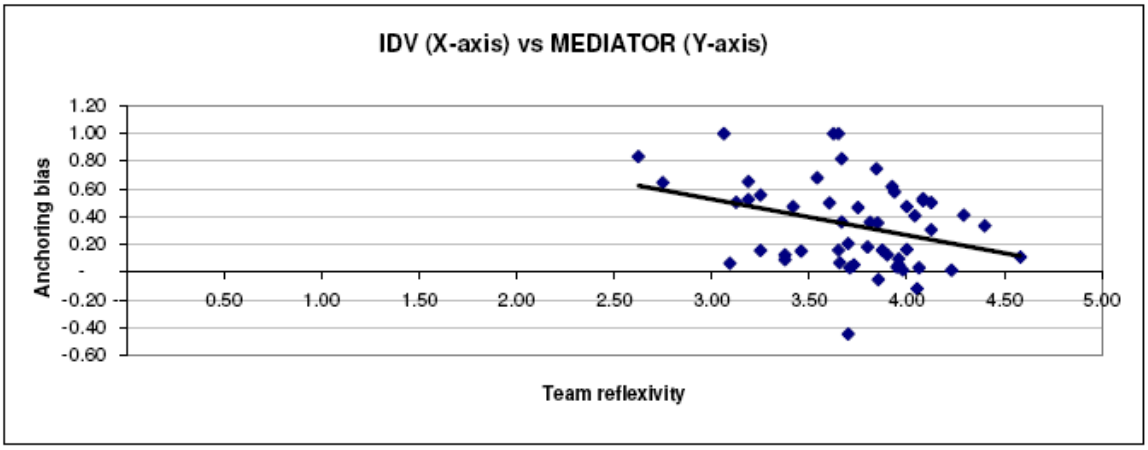
SCATTERPLOTS - REORDER POINT

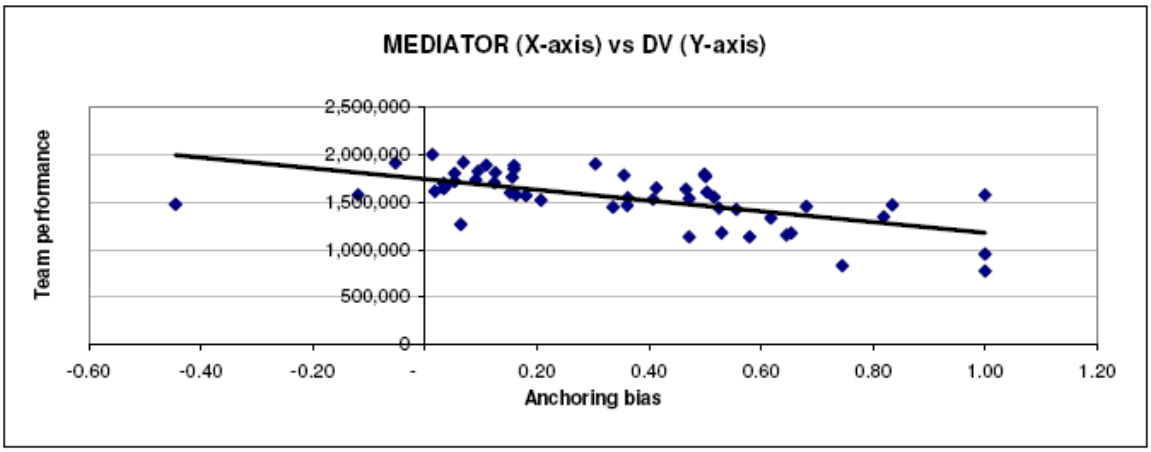


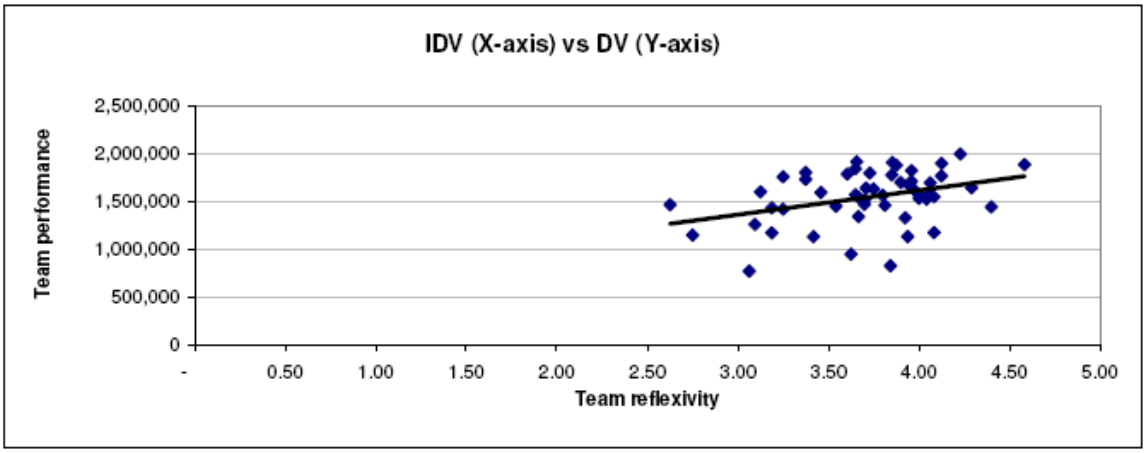




SCATTERPLOTS - MACHINE PURCHASE STATION 1







APPENDIX D – MEDIATION ANALYSIS

```
**************************************************************

Preacher And Hayes (2008) SPSS Macro For Multiple Mediation

Written by Andrew F. Hayes, The Ohio State University

http://www.afhayes.com

For details, see Preacher, K. J., & Hayes, A. F. (2008). Asymptotic

and resampling strategies For assessing And comparing indirecct effects

in multiple mediator models. Behavior Research Methods, 40, 879-891

**************************************************************

Dependent, Independent, and Proposed Mediator Variables:
DV =    Team_Per
IV =    Team_Ref
MEDS = AnchorRQ
       AnchorRP
       AnchorMP

Sample size
         52

IV to Mediators (a paths)
             Coeff        se         t         p
AnchorRQ    -.1496     .0766   -1.9529     .0564
AnchorRP    -.1075     .0630   -1.7056     .0943
AnchorMP    -.2596     .1044   -2.4859     .0163
Direct Effects of Mediators on DV (b paths)
             Coeff        se         t         p
AnchorRQ  -301330.3 132685.09   -2.2710     .0278
AnchorRP  -338709.8 173066.44   -1.9571     .0563
AnchorMP  -440162.2 104162.06   -4.2257     .0001

Total Effect of IV on DV (c path)
             Coeff        se         t         p
Team_Ref 255936.35 92567.703    2.7649     .0080

Direct Effect of IV on DV (c-prime path)
             Coeff        se         t         p
Team_Ref 60193.736 79156.057     .7604     .4508

Model Summary for DV Model
      R-sq  Adj R-sq         F       df1       df2         p
     .5115     .4699   12.3029    4.0000   47.0000     .0000
```

```
************************************************************

           NORMAL THEORY TESTS FOR INDIRECT EFFECTS

Indirect Effects of IV on DV through Proposed Mediators (ab paths)
            Effect        se         Z         p
TOTAL    195742.61 68647.586    2.8514     .0044
AnchorRQ 45069.065 29750.761    1.5149     .1298
AnchorRP 36402.092 27665.536    1.3158     .1882
AnchorMP 114271.45 52396.950    2.1809     .0292

************************************************************

           BOOTSTRAP RESULTS FOR INDIRECT EFFECTS

Indirect Effects of IV on DV through Proposed Mediators (ab paths)
              Data      boot       Bias        SE
TOTAL    195742.61 201595.68 5853.0701 73606.147
AnchorRQ 45069.065 43980.003 -1089.061 37334.050
AnchorRP 36402.092 39512.749 3110.6569 35366.282
AnchorMP 114271.45 118102.93 3831.4743 56675.615

Bias Corrected and Accelerated Confidence Intervals
              Lower     Upper
TOTAL    54570.247 340747.60
AnchorRQ -860.0897 166807.08
AnchorRP -7976.964 129121.46
AnchorMP 27144.200 249699.65

************************************************************

Level of Confidence for Confidence Intervals:
  95

Number of Bootstrap Resamples:
  5000

******************************** NOTES ************************************

------ END MATRIX -----
```

APPENDIX E – ADDITIONAL ANALYSIS

"Onemba" group

```
[DataSet2] E:\5. Afstuderen\Afstudeerrapportage\Dataverzameling\20120511_A
nalysis database_def_Onemba.sav

Run MATRIX procedure:

***************************************************************

Preacher And Hayes (2008) SPSS Macro For Multiple Mediation

Written by Andrew F. Hayes, The Ohio State University

http://www.afhayes.com

For details, see Preacher, K. J., & Hayes, A. F. (2008). Asymptotic

and resampling strategies For assessing And comparing indirecct effects

in multiple mediator models. Behavior Research Methods, 40, 879-891

***************************************************************

Dependent, Independent, and Proposed Mediator Variables:
DV =   Team_Per
IV =   Team_Ref
MEDS = AnchorRQ
       AnchorRP
       AnchorMP

Sample size
         27

IV to Mediators (a paths)
            Coeff        se         t         p
AnchorRQ    -.1706     .1085   -1.5720     .1285
AnchorRP    -.0873     .0900    -.9699     .3414
AnchorMP    -.2813     .1335   -2.1074     .0453

Direct Effects of Mediators on DV (b paths)
            Coeff        se         t         p
AnchorRQ -250278.2 166245.57   -1.5055     .1464
AnchorRP -159905.2 214452.50    -.7456     .4638
AnchorMP -607837.8 145597.04   -4.1748     .0004

Total Effect of IV on DV (c path)
            Coeff        se         t         p
Team_Ref 150365.29 126202.73    1.1915     .2447

Direct Effect of IV on DV (c-prime path)
            Coeff        se         t         p
Team_Ref -77248.32 99862.001    -.7736     .4474

Model Summary for DV Model
      R-sq  Adj R-sq         F       df1       df2         p
     .5834     .5076    7.7010    4.0000   22.0000     .0005
```

```
*************************************************************************

           NORMAL THEORY TESTS FOR INDIRECT EFFECTS

Indirect Effects of IV on DV through Proposed Mediators (ab paths)
            Effect        se         Z         p
TOTAL    227613.61 101326.11    2.2463     .0247
AnchorRQ 42698.719 37283.003    1.1453     .2521
AnchorRP 13951.849 22253.422     .6270     .5307
AnchorMP 170963.04 88018.192    1.9424     .0521

*************************************************************************

           BOOTSTRAP RESULTS FOR INDIRECT EFFECTS

Indirect Effects of IV on DV through Proposed Mediators (ab paths)
              Data      boot      Bias        SE
TOTAL    227613.61 238268.34 10654.727 92229.359
AnchorRQ 42698.719 34587.749 -8110.970 56080.724
AnchorRP 13951.849 19533.492 5581.6436 37367.495
AnchorMP 170963.04 184147.09 13184.053 88005.725

Bias Corrected and Accelerated Confidence Intervals
             Lower     Upper
TOTAL    38238.411 400646.63
AnchorRQ -8665.647 353036.86
AnchorRP -24083.72 136941.15
AnchorMP 26721.799 358177.09

*************************************************************************

Level of Confidence for Confidence Intervals:
  95

Number of Bootstrap Resamples:
  5000

******************************** NOTES **********************************

------ END MATRIX -----
```

"CEMS2009" group

```
[DataSet3] E:\5. Afstuderen\Afstudeerrapportage\Dataverzameling\20120511_A
nalysis database_def_CEMS2009.sav

Run MATRIX procedure:
***************************************************************

Preacher And Hayes (2008) SPSS Macro For Multiple Mediation

Written by Andrew F. Hayes, The Ohio State University

http://www.afhayes.com

For details, see Preacher, K. J., & Hayes, A. F. (2008). Asymptotic

and resampling strategies For assessing And comparing indirecct effects

in multiple mediator models. Behavior Research Methods, 40, 879-891

***************************************************************

Dependent, Independent, and Proposed Mediator Variables:
DV =   Team_Per
IV =   Team_Ref
MEDS = AnchorRQ
       AnchorRP
       AnchorMP

Sample size
         25

IV to Mediators (a paths)
             Coeff        se         t         p
AnchorRQ    -.1197     .1341    -.8927     .3813
AnchorRP    -.0537     .1029    -.5218     .6068
AnchorMP    -.0302     .2011    -.1502     .8819

Direct Effects of Mediators on DV (b paths)
             Coeff        se         t         p
AnchorRQ -341072.6 181308.56   -1.8812     .0746
AnchorRP -407213.3 242529.15   -1.6790     .1087
AnchorMP -201338.1 124897.42   -1.6120     .1226

Total Effect of IV on DV (c path)
             Coeff        se         t         p
Team_Ref 190397.70 128378.18    1.4831     .1516

Direct Effect of IV on DV (c-prime path)
             Coeff        se         t         p
Team_Ref 121620.88 117005.52    1.0394     .3110

Model Summary for DV Model
      R-sq  Adj R-sq         F       df1       df2         p
     .3750     .2500    2.9995    4.0000   20.0000     .0432
```

```
*************************************************************************

           NORMAL THEORY TESTS FOR INDIRECT EFFECTS

Indirect Effects of IV on DV through Proposed Mediators (ab paths)
            Effect        se         Z         p
TOTAL    68776.820 74636.913     .9215     .3568
AnchorRQ 40837.659 48971.434     .8339     .4043
AnchorRP 21857.768 42696.108     .5119     .6087
AnchorMP 6081.3931 39792.459     .1528     .8785

*************************************************************************

           BOOTSTRAP RESULTS FOR INDIRECT EFFECTS

Indirect Effects of IV on DV through Proposed Mediators (ab paths)
              Data      boot      Bias        SE
TOTAL    68776.820 89007.834 20231.014 86525.513
AnchorRQ 40837.659 35867.485 -4970.174 43189.913
AnchorRP 21857.768 37173.683 15315.915 62640.506
AnchorMP 6081.3931 15966.666 9885.2727 52600.365

Bias Corrected and Accelerated Confidence Intervals
             Lower     Upper
TOTAL    -89721.32 231280.06
AnchorRQ -13155.93 188815.38
AnchorRP -66372.56 161162.98
AnchorMP -63758.12 149563.34

*************************************************************************

Level of Confidence for Confidence Intervals:
  95

Number of Bootstrap Resamples:
  5000

******************************** NOTES ***********************************

------ END MATRIX -----
```