The Effect of Empowering Leadership on Team Cohesion and Team Performance in Geographically Dispersed R&D Teams

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Group 16

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Abstract

This research paper studied a theoretical model connecting empowering leadership to general team performance, but also including mediating and moderating variables such as team cohesion and geographical dispersion. Data was collected from 263 R&D teams (team leaders and members) across the Netherlands. It turned out that, as anticipated, empowering leadership is directly positively related with team performance, as well as the mediating effect through team cohesion. Lastly, geographical dispersion moderates this latter mediating effect positively. These findings fill a gap in the research on this last mediating relationship specifically and on all relations in the field of R&D teams. The outcomes imply that good team cohesion is critical for geographically dispersed teams when it comes to performance, where for non-dispersed teams it is also directly important to install empowering team leaders. Team cohesion can be achieved through creating highly interdependent tasks or organizing face-to-face team building interactions occasionally. These findings around team cohesion are of great importance to companies as Prodrive that have a strongly autonomy based culture and that operate from different locations. Conclusively, for Prodrive it is key to strengthen team cohesion across their geographically dispersed R&D teams.

Key words: ***Empowering Leadership, Team Cohesion, Team Performance, Geographical Dispersion, Research & Development (R&D)***

Word count: 4163

Introduction

Globalization of the world economy has had a strong impact on new product development (NPD) and may still have. New products need to be launched to the market faster to ensure competitive advantage. These changes in NPD processes also result in different assets required from project teams which also impacts team performances. Due to globalization, companies expand easier across countries. Assisting tools such as Skype and virtual reality contribute strongly to these expansions and facilitate long-distance communication and cooperation. Geographical dispersion can be best described as a group of people that cooperate with one another but are physically dispersed across geographically distant locations (Vaidya & Seetharaman, 2008). Due to the lack of face-to-face communication and interaction, geographically dispersed team members tend to have less understanding of each other which may in turn contribute to misunderstandings and conflict (Kerber & Buono, 2004).

This also holds for Prodrive Technologies (Prodrive) which is a highly client-oriented-company that is located at the Science Park and founded in 1993. Prodrive develops and produces a variety of technical products, systems and solutions that are mainly developed on customer order basis. Moreover, Prodrive is one of the faster growing privately owned technology companies in Europe and expanding across different parts on the globe. This results in project teams operating from different locations with multiple cultures and time zones. Prodrive utilizes new technologies to run dispersed projects and has a strongly autonomy based culture, which requires a form of leadership that supports this. Different types of leadership have been investigated by Zhou et al. (2016) in which empowering

leadership is best suited for these projects. More specifically, empowering leadership is described as a leadership style where employees are encouraged to develop self-control and are authorized to make decentralized decisions (Liu et al., 2003).

Tung and Chang (2011) already examined the intervening role of team cohesion on the relationship between the empowering leadership and the team performance in management teams. However, no geographical dispersion has been included in their research. Hill and Bartol (2015) research the moderating effect of empowering leadership and effective collaboration on the relationship between geographically team dispersion and team performance. Despite previous research, there are still gaps in literature that will partially be filled by this paper, in which we will contribute to the research on the effect of empowering leadership on team performance. In addition we look at Prodrive specifically and will see how their geographically dispersed teams perform and are affected by empowering leadership.

The research question of this paper is as formulated as follows:

ñWhat is the effect of Empowering Leadership on Team Performance in R&D teams? Is this effect mediated by Team Cohesion? And are these effects moderated by the Geographical Dispersion in the team?

In the next section we elaborate and discuss the literature regarding the relationships between empowering leadership, team performance, geographical dispersion and team cohesion. From these relationships we derived our hypotheses and conceptual model. Next to this we report our method of research involving multiple R&D projects from a wide variety of companies. To conclude, the results will be presented and discussed.

Theoretical background, Research Model, Hypotheses

This research paper principally investigates the relationship between empowering leadership and team performance, as well as the hypothesis that this relation is mediated by team cohesion and moderated by geographical dispersion. The research model is portrayed below.

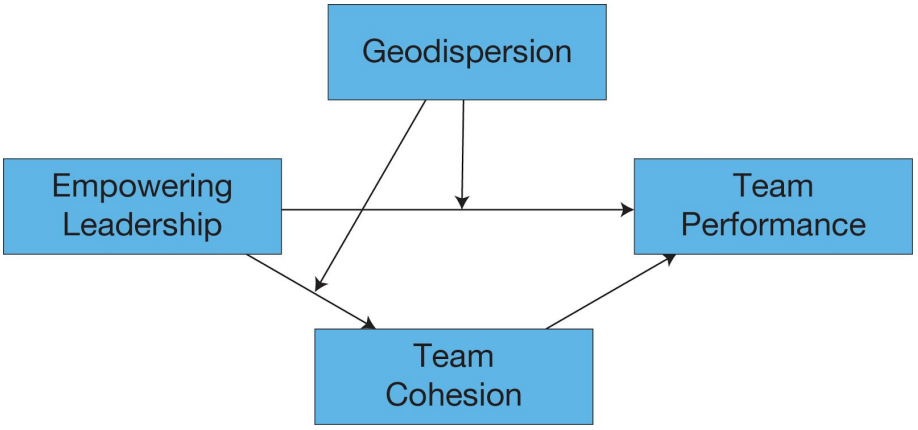

Figure 1 : Research Model

In this section, the research model and hypotheses are elaborated on, first focusing on the independent construct and its relation with the dependent constructs afterwards.

Empowering Leadership

Leadership is defined by Iqbal, Anwar and Haider (2015) as a process by which an executive can direct, guide and influence the behavior and work of others towards the accomplishment of specific goals in a given situation. Leadership can be either directive, which is the more traditional approach, or empowering, in terms of control.

According to Zhou et al. (2016), directive and empowering leadership styles refer to whether the team leaders are inclined to solely give direct instructions to the team members or to

decentralize the decision making, by providing the team members authority. Both leadership styles have several benefits and fit to different industries, teams and situations.

More specifically, Liu et al. (2003) described empowering leadership as a leadership style where employees are targeted to act individually and to develop self-control.

This research paper focusses on R&D teams. As these teams require creativity and have a non-routine task nature, team members are expected to perform better if they are less restricted in their way of working and have relatively more freedom to act autonomously. Therefore it is expected that empowering leadership, which encourages these characteristics, has a positive impact on multiple aspects related to team performance of R&D teams.

Empowering Leadership and Team performance

R&D employees mainly work on team level, the work of Rispens, Greer and Jehn (2007) is used as a basis to define team performance. In the above mentioned research paper, performance reflects the team's perception of team performance. Both self-assessment of team-members and judgment of team leaders are taken into account.

The influence of empowering leadership on team performance has been documented in several empirical studies. Srivastava, Bartol and Locke (2006) explored the effect of empowering leadership on team performance in management teams using knowledge sharing and team efficacy as mediators. Results from this study indeed supported the hypothesis that empowering leadership was positively related to both knowledge sharing and team efficacy, which, in turn, were both positively related to performance. Therefore also the direct positive relation between empowering leadership on team performance is supported. Zhu and Chen (2015) separately examined the influence of both group-focused and differentiated individual-focused empowering leadership on R&D teams specifically and these relations were found to be positive.

Following the results from the above mentioned studies, empowering leadership is expected to be positively related to team performance in R&D teams. Therefore the first hypothesis to be tested in this research paper is formulated as follows:

Hypothesis 1: Empowering Leadership has a positive effect on Team Performance in R&D teams.

Empowering Leadership, Geographical Dispersion and Team Performance

In the study of Vaidya and Seetharaman (2008), the term geographical dispersion was used to define the physical dispersion of group members across geographically distant locations. As researchers aim to answer increasingly complex questions in this era of rapid technology development, it is more likely that the people involved in the research and development are situated in different locations and institutions across the world. As the geographical dispersion of a team increases, communication and collaboration between the team members becomes more challenging due to time zone problems, cultural differences etc.

The challenges of collaboration within geographically dispersed teams and the problem of monitoring the behavior of team members enhances the need of the distribution of leadership functions to team members while still preserving collaboration (Bell & Kozlowski, 2002). Hill and Bartol (2015) research the moderating effect of empowering leadership and effective collaboration on the relationship between geographically team dispersion and team performance. Their findings suggest that the positive impact of empowering leadership on team performance increases at higher levels of team dispersion, which can be explained by a higher need for this type of leadership in situations where team members are geographically dispersed. Empowering leadership enables members of a team to make more decisions autonomously and therefore works well with decreasing team member proximity.

Based on these results, the second hypothesis of this research paper is formulated as follows:

Hypothesis 2: The relationship between Empowering Leadership and Team Performance is positively moderated by Geographical Dispersion.

Empowering Leadership and Team Cohesion

Brawley, Carron and Widmeyer (1998) described team cohesion as a dynamic process that is reflected both in the tendency for a group to stick together as well as remain united while pursuing the group objectives or in regard to satisfying the team members' affective needs. A decrease in team cohesion and satisfaction was assigned to directive leadership by Antonuccio, Davis, Lewinsohn and Breckenridge (1987). Tung and Chang (2011) found a positive effect of team cohesion on the relationship between empowering leadership and team performance in a management team setting. As empowering leadership creates more autonomy, it can be assumed this increases the feeling of responsibility and ownership amongst team members, which will lead to a greater sense of team cohesion. The relation between empowering leadership and team cohesion is therefore expected to be positive. Thus the third hypothesis of this research paper can be formulated as follows:

Hypothesis 3: Empowering Leadership has a positive effect on Team Cohesion.

Empowering Leadership, Team Cohesion and Team Performance

As stated by Kratzer, Leenders and van Engelen (2006), R&D team members are more willing to work together, communicate with each other continuously and solve and coordinate design tasks through contribution and engagement from all team members. The above mentioned can be attained through team cohesion, and is expected to affect the overall performance of the team.

The reason for exploring the relation between the team cohesion construct and performance is that the members of a cohesive group would probably have a higher motivation towards the group objectives and engaging in its activities (Cartwright, Dorwin & Zander, 1968).
Tung and Chang (2011) already examined the intervening role of team cohesion on the relationship between the empowering leadership and the team performance in management teams. Therefore it is expected that empowering leadership leads to stronger team cohesion in R&D teams as well, which in turn influences the team performance. The fourth hypothesis of this research paper can therefore be formulated as follows:

Hypothesis 4: Team Cohesion mediates the positive effect of Empowering Leadership on Team Performance.

Team Cohesion and Geographical Dispersion

It has been shown that teamwork quality decreases with decreasing team member proximity (Hoegl & Proserpio, 2004). This is because core aspects of teamwork quality such as communication, coordination, mutual support, team effort, and cohesion are more difficult to achieve with an increasing distance between team members (Hoegl, Ernst & Proserpio, 2007). This increasing distance between team members might ultimately result in a less cohesive team, enhancing the need and potential for Empowering Leadership. From this the following hypothesis can be derived:

Hypothesis 5: The mediating effect of Team Cohesion on the relationship between Empowering Leadership and Team Performance will be enhanced by an increase in Geographical Dispersion.

Method

Sample and Data Collection

This research gathered data in the length of 5 years (2013 - 2017) from 263 R&D teams, which are all located in the Netherlands. In total 1.015 team members participated in this research, which all filled in an individual questionnaire containing 132 questions. The age of these team members ranged from 19 to 76 years old, with an average age of 34. 80,3% of the participants is male, 16,85% is female and from 2,86% the information was missing. The 265 team leaders of the research completed an individual questionnaire with 46 questions.

Measures and Reliability Constructs

In this study four variables from the survey questionnaire were used: Geographical Dispersion, Team Cohesion, Empowering Leadership and Team Performance. A standardized questionnaire was used, which included all the measurement scales. Finally, all the analyses were executed in SPSS, SPSS PROCESS and RStudio.

Team Cohesion

This construct is the result of four questions following from the questionnaire. In order to measure Team Cohesion, a 5-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree was used. The construct validity is $\alpha = 0.810$ (Wendt, Euwema & Van Emmerik, 2009).

Geographical Dispersion

This construct is the result of one question following from the questionnaire. In order to measure Geographical Dispersion, a 3 point scale is used to indicate Geographical Dispersion: all members are located at the same location, some members are located at another location, all members are located at other locations.

Team performance

In order to measure Team Performance, a 7-point Likert scale ranging from 1 = strongly disagree to 7 = strongly agree was used. This construct is the result of three questions from the questionnaire, with a validity of $\alpha = 0.813$ (Rispens et al., 2007).

Empowering Leadership

This construct is the result of seven questions following from the questionnaire. In order to measure Empowering Leadership, a 5-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree was used. The construct validity is $\alpha = 0.821$ (Ahearne, Mathieu & Rapp, 2005).

Analysis procedures

As a first step to analyzing the data, missingness and possible outliers are checked.
In the data table, there is 1 missing value for Team Cohesion (<0.4%), 1 missing value for General Team Performance (<0.04%), 2 missing values for Empowering Leadership (0.8%) and 11 missing values for Geographical Dispersion (<5%). Since the missingness is at a negligible percentage, Missingness Completely at Random is assumed. In order to handle the missingness, available-case analysis (pairwise deletion technique) is used.

The multivariate detection method was used for outliers. Only the 4 constructs of interest were used: General Team Performance, Team Cohesion, Empowering Leadership and Geographical Dispersion. Mahalanobis distances were calculated for all cases. Even-though the rule of thumb for the Mahalanobis distance cannot be used due to the violation of the normality assumption, a cutoff point of 4.5 is used for the Mahalanobis ratio.

$\boldsymbol{MD\ ratio} = \boldsymbol{Mahalanobis\ Distance} / \boldsymbol{q}$ where q is the number of variables, in this case 4.

The boxplot of the MD ratio was obtained from RStudio (see Appendix A). One coinciding points was found to be an outlier according to the cutoff point, this was case 20151501. The high MD was caused by a wrong entry of GEODIS (score 0). This case was not used for further analysis.

For better interpretability and to reduce multicollinearity in the moderation model, where an interaction term is present, the relevant constructs/variables are standardized.

In order for the regression analysis to be meaningful, the residuals should be normally distributed. Since the sample is large enough (>>30), the normality assumption can be made thanks to the Central Limit theorem.

To obtain the direct effects and the moderation effects, SPSS, an IBM software package, was used. The mediation effects were tested using SPSS PROCESS, as were the moderated mediation effects.

Bivariate regression analyses were used to test Hypotheses 1 and 3. A hierarchical regression analysis was used to test Hypothesis 2. Multiple Regression Analyses were used to check Hypotheses 2, 4 and 5. Of which the last one was a multigroup analysis, as this Hypothesis included moderated mediation.

Results

Regression model for Hypothesis 1

The direct effect of Empowering Leadership on General Team performance is obtained by the model below:

$$\textit{General Team Performance}_i = \alpha + \beta_1 * \textit{Empowering Leadership}_i +$$

The p-value for H0: $\beta_1 = 0$ is much less ($p < 0.001$) than the threshold value 0.05, therefore the hypothesis that Empowering Leadership has no effect on General Team Performance is rejected and our Hypothesis 1 is supported.

$$\textit{General Team Performance}_i = 2.353 + 0.807 * \textit{Empowering Leadership}_i +$$

Regression model for Hypothesis 2

An interaction term between the two independent variables Empowering Leadership and Geographical Dispersion was added in the model. Main effects are included in line with the hierarchy principle. The significance of the regression parameter of this interaction term is checked. All variables were standardized in order to prevent multicollinearity.

$$\textit{General Team Performance}_i = \alpha + \beta_1 * \textit{Empowering Leadership}_i + \beta_2 * \textit{Geographical Dispersion}_i + \textit{Geographical Dispersion}_i * \textit{Empowering Leadership}_i +$$

The p-value for the hypothesis that $\beta 3 = 0$ is 0.062, therefore slightly greater than the threshold value 0.05, which means that the effect is almost significant. The hypothesis that there is a moderating effect of Geographical Dispersion on the positive effect of Empowering Leadership on General Team Performance is therefore not supported by the data.

Regression model for Hypothesis 3

The significance of the direct effect of Empowering Leadership on Team Cohesion is tested.

$$\textbf{\textit{Team Cohesion}}_i = \alpha + \beta_1 * \textbf{\textit{Empowering Leadership}}_i +$$

The p-value for H0: $\beta 1 = 0$ is strongly significant ($p < 0.001$), therefore the Hypothesis that Empowering Leadership has no effect on General Team Performance is rejected and our Hypothesis 3 is supported.

$$\textbf{\textit{Team Cohesion}}_i = 1.745 + 0.606 * \textbf{\textit{Empowering Leadership}}_i +$$

Regression model for Hypothesis 4

A starting point to estimate the mediating effect of Team Cohesion on the relation between Empowering Leadership and General Team Performance is including the mediator as an additional independent variable, as can be seen in the model below:

$$\textbf{\textit{General Team Performance}}_i = \alpha + \beta_1 * \textbf{\textit{Team Cohesion}}_i + \beta_2 * \textbf{\textit{Empowering Leadership}}_i +$$

The p-value for $\boldsymbol{H}0 : \beta_1 = 0$ is less than the threshold value 0.05, therefore the Hypothesis that Team Cohesion has no effect on General Team Performance is rejected. Also the p-value for H0: $\beta_2 = 0$ is lower than 0.001, therefore the Hypothesis that Empowering Leadership has no effect on General Team Performance is still rejected, however the estimated direct effect was reduced in comparison with the model without Team Cohesion. The indirect effect of Empowering Leadership on General Team Performance via Team Cohesion can be estimated by multiplying the direct estimates (EL-TCH = 0.606; TCH-GTP = 0.604), which gives an estimated indirect effect of 0.366. The confidence interval of this effect goes from 0.234 to 0.507, as this interval does not cross zero, the effect is significant. Therefore our Hypothesis 4 ***Team Cohesion mediates the positive effect of Empowering Leadership on Team Performance***

is supported. The direct effect between Empowering Leadership and General Team Performance is still significant but the estimate has decreased, so there is partial mediation.

Regression model for Hypothesis 5

The same model as for Hypothesis 4 can be used to distinguish the mentioned mediating effect under different levels of Geographical Dispersion. A multigroup analysis was performed with subgroups GEODIS = 1 (N = 156/ 59.3%), 2 (N = 79/ 30%) and 3 (N = 12/ 4.6%).

For the group of GEODIS equal to 1, the direct effect of Empowering Leadership on General Team Performance was highly significant ($p < 0.001$) with estimate 0.383. The indirect effect was 0.196 and also significant (confidence interval 0.084 - 0.323). The total effect (0.5795) was significant as well ($p < 0.001$). For the group of GEODIS equal to 2, the direct effect of Empowering Leadership on General Team Performance was significant ($p = 0.034$) with estimate 0.2614. The indirect effect was 0.2590 and also significant (confidence interval 0.129 - 0.4283). The total effect (0.5205) was strongly significant as well ($p < 0.001$). For the group of GEODIS equal to 3, the direct effect of Empowering Leadership on General Team Performance was not significant. The indirect effect was significant (confidence interval 0.094 - 1.658) with estimate 0.583. The total effect (0.921) was also significant ($p = 0.003$). These results imply partial mediation for GEODIS 1 and 2, and full mediation for GEODIS 3. This supports our Hypothesis 5, ***the mediating effect of Team Cohesion on the relationship between Empowering Leadership and Team Performance will be enhanced by an increase in Geographical Dispersion.*** However, as the sample size of the group of GEODIS equal to 3 was only 12, this result is not very strong from a statistical point of view.

To check for multicollinearity between the independent constructs, variance inflation factors were calculated. The VIF scores of all variables are less than 2 (see Appendix C), which are considered low, therefore multicollinearity will not be a problem.

Discussion

Theoretical implications

As stated earlier, some research has already been conducted regarding the relationships between empowering leadership, team cohesion and team performance, in general or in regard to geographically dispersed teams. More specifically, Srivastava et al. (2006) dived into the effect of empowering leadership on team performance in management teams. In addition, Tung and Chang (2011) considered the role of team cohesion on the relation between empowering leadership and team performance in management teams. However, this still leaves enough space for new studies and insights, especially among R&D teams as mostly managerial teams were investigated.

First, a significant positive effect was obtained between empowering leadership and general team performance in R&D teams, which confirms the current findings in literature about other industries. Secondly, the moderating effect of geographical dispersion on the direct relationship between empowering leadership and team performance was not found to be significant, not positively nor negatively, this gap in the available literature therefore remains. Moreover, a significantly positive mediation of team cohesion on the relation between empowering leadership and team performance in R&D teams was found, this mediation effect turned out to be extra important in highly geographically dispersed teams. This mediation effect was not yet investigated in an R&D setting, also the clear influence of geographical dispersion on this mediating effect was not yet described in available literature, which highlights the significant theoretical contribution of this research paper.

Managerial implications

In general, it can be concluded that it is wise to install empowering leaders in R&D teams, as they improve the team performance directly. The team performance is also increased by an increase in team cohesion, which then again improves the overall performance.

For teams that are highly geographically dispersed, which means that all members are situated at different locations, the direct effect of empowering leadership on team performance becomes insignificant. The indirect effect via team cohesion is however still significant and even increases as geographical dispersion increases, this implies that the focus should be on improving team cohesion specifically and not empowering leadership per se. Improving team cohesion can be achieved through, for instance, creating highly interdependent tasks (Hambley, O'Neill & Kline, 2007), but also organizing face-to-face team building interactions occasionally (Hart and McLeod, 2003). Especially with larger projects, the costs of these trips can easily be earned back.

Limitations and future research

The entire study on geographically dispersed teams was based on only 12 observations that scored maximally on this item, implicating all team members work from different locations. Therefore, in future research it would be interesting to focus on more teams of which all members operate from different places and see if similar results can be obtained.
Moreover, it appeared that the direct positive effect of empowering leadership on team performance is less for geographically dispersed teams than for non-dispersed teams. This sets the question what type of leadership would then enhance performance of geographically dispersed teams.

In addition, the companies and team leaders were all based in the Netherlands. It would also be of interest to survey teams from a different perspective, for instance team leaders situated in the US but with European team members.

Besides, no control variables were applied in the model, which could have brought new insights as well. Think of the difference between young and old people dealing with geographically dispersed team leaders/members. Finally, the research has been conducted across a longer period of 5 years, this could also be investigated as a control variable.

Benchmark Analysis

To finalize this study, a benchmark analysis was performed for the two teams of Prodrive. Team 1 being a non-dispersed team (score GEODIS = 1) and team 2 being a geographically dispersed team (score GEODIS = 2). The scores for these two teams were compared with the mean scores of the whole sample using one-sample t-tests in order to compare Prodrive as a whole and the two teams separately. The significance of these differences is derived from the 95% confidence interval of the difference (see Appendix D). Inclusion of 0 in the interval implies non-significance.

Geographical dispersion shows a significantly lower score for team 1 compared to other companies in the sample and a significantly higher score for team 2, these results were expected.

Results show a non-significant difference between the general team performance score of Prodrive team 1 and the mean score of all the companies. Team 2, the geographically dispersed team, on the other hand, has a significantly lower score.

The two teams have a significant higher score than the sample mean in empowering leadership. A high score in this construct is an indicator of how much the team members feel

empowered by their leaders. Indeed, Prodrive has a strongly autonomy based culture, which requires a form of leadership that supports this.

Team cohesion scores for both teams are significantly different from the mean score, the non-dispersed team scoring higher and the geographically dispersed team scoring lower than the sample mean.

The performance and team cohesion of the geographically dispersed team are both lower than the mean, improving the cohesion could lead to an increase in performance. Feasible recommendations for improving team cohesion timely are further elaborated on in the managerial implications.

Although the non-dispersed team scores relatively high on empowering leadership and team cohesion, the performance is not significantly higher. Possible positive effects on performance are therefore not directly observed, this could also be explained by lower scores on other predictors of performance that were outside the scope of this research.

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Appendix A - Output Outliers

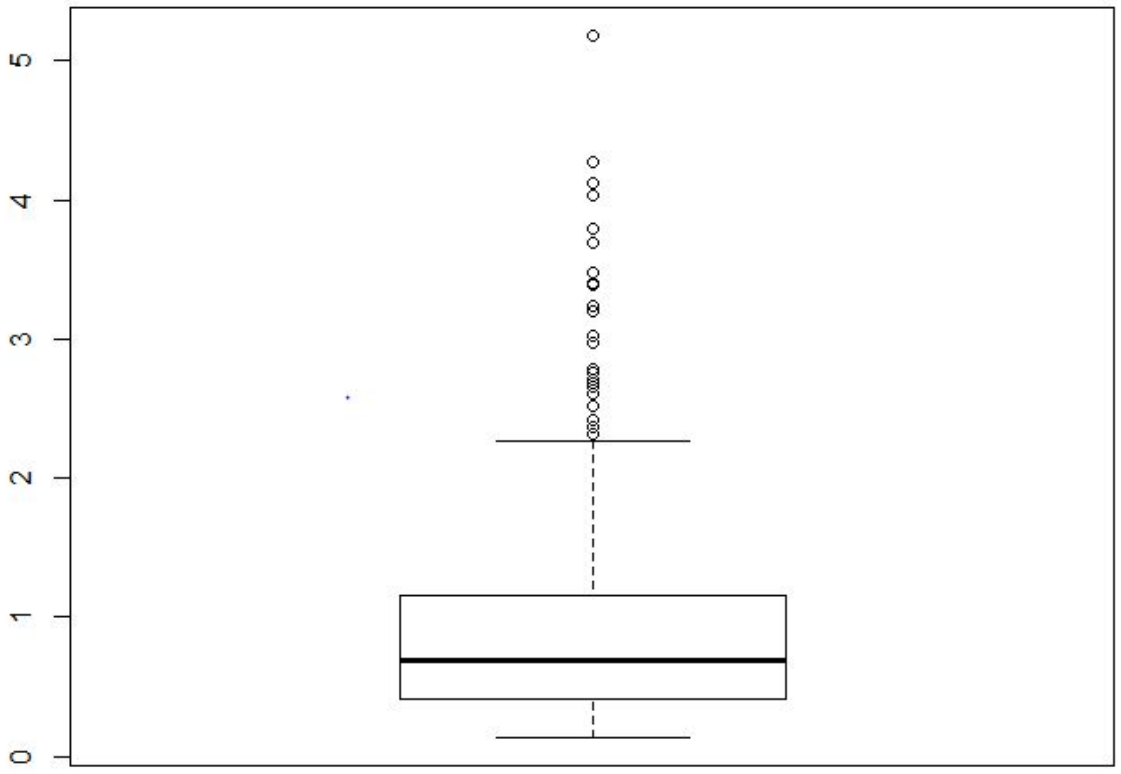

Figure 1 - Mahalanobis distances analysed

Appendix B - Output Regression

B.1: SPSS output of EL mean - GTP mean

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	EL_mean[b]	.	Enter

a. Dependent Variable: GTP_mean

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,521[a]	,271	,268	,57437

a. Predictors: (Constant), EL_mean

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	31,650	1	31,650	95,939	,000[b]
	Residual	85,114	258	,330		
	Total	116,764	259			

a. Dependent Variable: GTP_mean

b. Predictors: (Constant), EL_mean

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2,353	,318		7,411	,000
	EL_mean	,807	,082	,521	9,795	,000

a. Dependent Variable: GTP_mean

B.2: SPSS output of EL mean - GTP mean, moderated by GEODIS

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Moderator, Zscore (GEODIS), Zscore (EL_mean)[b]	.	Enter

a. Dependent Variable: GTP_mean

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,556[a]	,310	,301	,56403

a. Predictors: (Constant), Moderator, Zscore(GEODIS), Zscore (EL_mean)

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	35,250	3	11,750	36,935	,000[b]
	Residual	78,577	247	,318		
	Total	113,828	250			

a. Dependent Variable: GTP_mean

b. Predictors: (Constant), Moderator, Zscore(GEODIS), Zscore(EL_mean)

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5,439	,036		152,717	,000
	Zscore(GEODIS)	,024	,036	,035	,659	,510
	Zscore(EL_mean)	,384	,037	,558	10,488	,000
	Moderator	,064	,034	,100	1,877	,062

a. Dependent Variable: GTP_mean

r.

B.3: SPSS output of EL mean - TCH mean

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	EL_mean[b]	.	Enter

a. Dependent Variable: TCH_mean

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,582[a]	,339	,336	,36700

a. Predictors: (Constant), EL_mean

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	17,826	1	17,826	132,345	,000[b]
	Residual	34,750	258	,135		
	Total	52,576	259			

a. Dependent Variable: TCH_mean

b. Predictors: (Constant), EL_mean

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1,745	,203		8,602	,000
	EL_mean	,606	,053	,582	11,504	,000

a. Dependent Variable: TCH_mean

B.4: SPSS/PROCESS output of EL mean - GTP mean, mediated by TCH mean

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	TCH_mean, EL_mean[b]	.	Enter

a. Dependent Variable: GTP_mean

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,616[a]	,380	,375	,53086

a. Predictors: (Constant), TCH_mean, EL_mean

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	44,339	2	22,169	78,667	,000[b]
	Residual	72,426	257	,282		
	Total	116,764	259			

a. Dependent Variable: GTP_mean

b. Predictors: (Constant), TCH_mean, EL_mean

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1,299	,333		3,901	,000
	EL_mean	,441	,094	,285	4,709	,000
	TCH_mean	,604	,090	,405	6,710	,000

a. Dependent Variable: GTP_mean

```
****************** TOTAL, DIRECT, AND INDIRECT EFFECTS ********************

Total effect of X on Y
     Effect         SE          t          p       LLCI       ULCI
      ,8071      ,0824     9,7949      ,0000      ,6448      ,9693

Direct effect of X on Y
     Effect         SE          t          p       LLCI       ULCI
      ,4411      ,0937     4,7087      ,0000      ,2566      ,6255

Indirect effect of X on Y
            Effect    Boot SE   BootLLCI   BootULCI
TCH_mean     ,3660      ,0696      ,2336      ,5067
```

B.5.1: PROCESS output of standardized EL - standardized GTP, mediated by standardized TCH for GEODIS = 1

```
************* PROCESS Procedure for SPSS Release 2.16.3 *****************

          Written by Andrew F. Hayes, Ph.D.       www.afhayes.com

**************************************************************************
Model = 4
    Y = ZGTP
    X = ZEL
    M = ZTCH

Sample size
        156

**************************************************************************
Outcome: ZTCH

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      ,6120      ,3745      ,6249    92,1981     1,0000   154,0000      ,0000

Model
              coeff         se          t          p       LLCI       ULCI
constant     -,0298      ,0633     -,4706      ,6386     -,1549      ,0953
ZEL           ,6090      ,0634     9,6020      ,0000      ,4837      ,7343

**************************************************************************
Outcome: ZGTP

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      ,6316      ,3989      ,6122    50,7592     2,0000   153,0000      ,0000

Model
              coeff         se          t          p       LLCI       ULCI
constant      ,0022      ,0627      ,0354      ,9718     -,1217      ,1261
ZTCH          ,3220      ,0798     4,0372      ,0001      ,1644      ,4796
ZEL           ,3834      ,0794     4,8305      ,0000      ,2266      ,5402
```

```
************************** TOTAL EFFECT MODEL ****************************
Outcome: ZGTP

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      ,5786      ,3348      ,6730    77,5186     1,0000   154,0000      ,0000

Model
              coeff         se          t          p       LLCI       ULCI
constant     -,0074      ,0657     -,1122      ,9108     -,1372      ,1225
ZEL           ,5795      ,0658     8,8045      ,0000      ,4495      ,7095

***************** TOTAL, DIRECT, AND INDIRECT EFFECTS ********************

Total effect of X on Y
     Effect         SE          t          p       LLCI       ULCI
      ,5795      ,0658     8,8045      ,0000      ,4495      ,7095

Direct effect of X on Y
     Effect         SE          t          p       LLCI       ULCI
      ,3834      ,0794     4,8305      ,0000      ,2266      ,5402

Indirect effect of X on Y
         Effect    Boot SE   BootLLCI   BootULCI
ZTCH      ,1961      ,0611      ,0843      ,3228
```

B.5.2: PROCESS output of standardized EL - standardized GTP, mediated by standardized TCH for GEODIS = 2

```
************** PROCESS Procedure for SPSS Release 2.16.3 ******************

          Written by Andrew F. Hayes, Ph.D.       www.afhayes.com

**************************************************************************
Model = 4
    Y = ZGTP
    X = ZEL
    M = ZTCH

Sample size
         79

**************************************************************************
Outcome: ZTCH

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      ,5332      ,2843      ,6851    30,5888     1,0000    77,0000      ,0000

Model
              coeff         se          t          p       LLCI       ULCI
constant     -,0428      ,0939     -,4557      ,6499     -,2298      ,1442
ZEL           ,5911      ,1069     5,5307      ,0000      ,3783      ,8039

**************************************************************************
Outcome: ZGTP

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      ,5974      ,3569      ,6254    21,0903     2,0000    76,0000      ,0000

Model
              coeff         se          t          p       LLCI       ULCI
constant     -,0425      ,0899     -,4727      ,6378     -,2215      ,1365
ZTCH          ,4383      ,1089     4,0250      ,0001      ,2214      ,6551
ZEL           ,2614      ,1207     2,1658      ,0335      ,0210      ,5018
```

```
************************** TOTAL EFFECT MODEL ****************************
Outcome: ZGTP

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      ,4689      ,2198      ,7489    21,6965     1,0000    77,0000      ,0000

Model
              coeff         se          t          p       LLCI       ULCI
constant     -,0612      ,0982     -,6236      ,5347     -,2568      ,1343
ZEL           ,5205      ,1117     4,6580      ,0000      ,2980      ,7430

***************** TOTAL, DIRECT, AND INDIRECT EFFECTS ********************

Total effect of X on Y
     Effect         SE          t          p       LLCI       ULCI
      ,5205      ,1117     4,6580      ,0000      ,2980      ,7430

Direct effect of X on Y
     Effect         SE          t          p       LLCI       ULCI
      ,2614      ,1207     2,1658      ,0335      ,0210      ,5018

Indirect effect of X on Y
         Effect    Boot SE   BootLLCI   BootULCI
ZTCH      ,2590      ,0751      ,1292      ,4283
```

B.5.3: PROCESS output of standardized EL - standardized GTP, mediated by standardized TCH for GEODIS = 3

```
************** PROCESS Procedure for SPSS Release 2.16.3 ******************

          Written by Andrew F. Hayes, Ph.D.       www.afhayes.com

**************************************************************************
Model = 4
    Y = ZGTP
    X = ZEL
    M = ZTCH

Sample size
         12

**************************************************************************
Outcome: ZTCH

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      ,7712      ,5948      ,5681    14,6766     1,0000    10,0000      ,0033

Model
              coeff         se          t          p       LLCI       ULCI
constant      ,0457      ,2233      ,2045      ,8421     -,4520      ,5433
ZEL           ,7929      ,2070     3,8310      ,0033      ,3316     1,2542

**************************************************************************
Outcome: ZGTP

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      ,8682      ,7538      ,5196    13,7813     2,0000     9,0000      ,0018

Model
              coeff         se          t          p       LLCI       ULCI
constant      ,1888      ,2140      ,8823      ,4006     -,2955      ,6731
ZTCH          ,7356      ,3024     2,4323      ,0378      ,0512     1,4200
ZEL           ,3376      ,3109     1,0859      ,3057     -,3660     1,0413
```

```
************************** TOTAL EFFECT MODEL ****************************
Outcome: ZGTP

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      ,7694      ,5920      ,7750    14,5118     1,0000    10,0000      ,0034

Model
              coeff         se          t          p       LLCI       ULCI
constant      ,2224      ,2608      ,8527      ,4138     -,3589      ,8037
ZEL           ,9209      ,2417     3,8094      ,0034      ,3821     1,4597

***************** TOTAL, DIRECT, AND INDIRECT EFFECTS ********************

Total effect of X on Y
     Effect         SE          t          p       LLCI       ULCI
      ,9209      ,2417     3,8094      ,0034      ,3821     1,4597

Direct effect of X on Y
     Effect         SE          t          p       LLCI       ULCI
      ,3376      ,3109     1,0859      ,3057     -,3660     1,0413

Indirect effect of X on Y
         Effect    Boot SE   BootLLCI   BootULCI
ZTCH      ,5833      ,3489      ,0944     1,6582
```

Appendix C - RStudio Output VIF Scores

```
> vif(Reg2)
  ZGEODIS  ZEL_mean Moderator
 1.007032  1.012636  1.018346
```

***Figure 1** - VIF scores regression Hypothesis 2*

```
> vif(Reg4)
TCH_mean  EL_mean
1.512965 1.512965
```

Figure 2 - VIF scores regression Hypothesis 4

```
> vif(Reg5)
  ZGEODIS  ZEL_mean  TCH_mean Moderator
 1.007096  1.587906  1.570561  1.019981
```

Figure 3 - VIF scores regression Hypothesis 5

Appendix D - SPSS Output Benchmark Analysis

One-Sample T-Test GTP Team 1

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
GTP_mean	250	5,4419	,67954	,04298

One-Sample Test

	Test Value = 5.5					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
GTP_mean	-1,352	249	,178	-,05809	-,1427	,0266

One-Sample T-Test GTP Team 2

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
GTP_mean	250	5,4419	,67954	,04298

One-Sample Test

	Test Value = 5.333					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
GTP_mean	2,534	249	,012	,10891	,0243	,1936

One-Sample T-Test TCH Team 1

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
TCH_mean	250	4,0646	,45842	,02899

One-Sample Test

	Test Value = 4.25					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
TCH_mean	-6,396	249	,000	-,18545	-,2426	-,1283

One-Sample T-Test TCH Team 2

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
TCH_mean	250	4,0646	,45842	,02899

One-Sample Test

	Test Value = 3.9375					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
TCH_mean	4,382	249	,000	,12705	,0699	,1842

One-Sample T-Test EL Team 1

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
EL_mean	249	3,8268	,43682	,02768

One-Sample Test

	Test Value = 3.9285					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
EL_mean	-3,673	248	,000	-,10169	-,1562	-,0472