Risk Assessment In Manufacturing Of L-Band In Mobile Satellite Service Industry With Special Reference To United Arab Emirates

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Abstract: The paper concerns the L band MSS (Mobile Satellite Services) Industry and is a study of risks involved in the new hardware product development phase in companies in the above-mentioned field. Knowledge of these risks before embarking on an NPD project can translate to monetary savings depending on how well these risks are managed. Hardware product development usually involves multiple teams and additional planning since manufacturing and quality control is involved. It is usually more complicated than managing a software development project where problems can be much easily managed and resolved, especially since mistakes can be easily undone. So, in order to assess the risks involved and their impact on schedules, a panel of experts in the industry were consulted, with combined experience across all stages of product management, project management and product development. A questionnaire was prepared with input taken from the industry as well as reputable publications in the field. Hypothesis evaluated based on responses to the questionnaire, which helped to arrive at a better picture with regards to the predominant risks in this field. Knowing these risks beforehand would help account for them in the planning stage and/or mitigate them better, thereby helping the concerned MSS organizations. This input would be very useful to project managers handling such projects, not only in the MSS industry, but also any other industry which involves manufacturing of hardware products.

Index Terms: Risk Management, NPD, MSS, Manufacturing, Product Management, Project Schedule Management

1 INTRODUCTION

The Mobile Satellite services Industry or the MSS industry as it is more commonly known, is an industry that supports telecommunications beyond usually permissible terrestrial range by using Space satellites. The S-band and L-band services come under the MSS industry. The S band_involves satellite communication using between 2-4 Ghz. in the communication spectrum. Applications of this spectrum involve digital satellite radio & satellite TV in some countries. The L band industry generally consists of satellite communication using between 1-2 Ghz. in the communication spectrum. This spectrum can be utilized for voice, fax and data communications. In this paper, however, we are delving into new product development of the hardware variety. Many companies and entrepreneurs are involved in the creation or new hardware across a wide spectrum of industries, and this is generally a costly process which would encompass everything from idea conception to final manufacturing of the product in a factory. However, there are huge benefits to be gained from this creation of a new product, since in a consumerist society, people generally look forward to purchasing the latest technology when it comes to products, since these products would usually have a technological or design edge over older outdated products. Since NPD is such a complicated process, multiple teams may work together on the creation of a single product, and this may take a time period of anywhere from a couple of weeks to a couple of years.

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So project managers usually have to account for a project plan. As with any large endeavor, project delays and schedule variances are common. Now given that competitors exist in most industries, there is a race to be the most innovative, and come out with a new product before other competing firms since technology keeps improving by the day, and the company that come out with new products using innovative technology ahead of their competitors are seen as innovative. For the purposes of this study we shall be focused only on L band MSS operators since their NPD activities have an effect on their revenue. There are multiple companies who are active in the field of L Band NPD such as RedPort, Scotty, Beam Communications, etc. This is because L band products are generally not inter-operable or configurable to work with multiple providers due to technical differences such as polarization type. So, the products are generally either developed directly by the operator or monitored or outsourced to third party manufacturers, within the control and oversight of the satellite operator who provide guidance for production. And since more products in use equals more airtime revenue, NPD processes and their schedules are very important events for any such satellite operator. NPD is a process which is also prevalent in the MSS industry. The entire industry operates on the basis of satellite services being used by consumers using specialist terminals, similar to the cellular phone industry (where consumers rent cellular network resources such as voice and data with the help of their personal mobile phone terminals), there exists a need to constantly innovate and create new satellite terminals which can operate on any certain network. However, compared to the cellular industry, these satellite products are mostly seen as a functional purchase, and are often expensive, so consumers (usually businesses) will not upgrade a product so often. Compared to say, the cellular industry where consumers are encouraged to upgrade their products every two years on account of improvements in technology. In the MSS industry the functionality offered by the products are usually defined by the services provided by the operator's satellite which usually do not change across the satellite's lifespan. Therefore, product innovations which utilize NPD are usually in terms of form factor, size or power efficiency. Therefore, we can see that all major MSS have an incentive to develop products on time in order to corner the market with an innovative product, since consumers do not upgrade quite often. Which leads to NPD being an important part in an MSS operator's revenue model.

2. PROCEDURE FOR PAPER SUBMISSION

2.1 Problem Statement

The L band satellite services industry consists of a few major players and their primary source of revenue is from selling satellite airtime. This airtime can only be generated when customers use specialist hardware equipment on their network to make calls or use data. Most satellite providers provide the same type of services (voice, data, GPS) with similar performance/speeds, so service differentiation is difficult. This is because there are standards for satellite services as defined by the ITU (International Telecommunications Union) and deviation from an established standard is difficult. The providers usually generate their revenue from usage of voice and data services, along with the provision of AMC contracts to support customers who use these services. The kinds of equipment are usually locked to a particular L band satellite systems provider, since each provider would have a particular frequency range and polarization for its radio frequency waves. (Ex. Inmarsat phones will not work on the Iridium network since their technical network specifications are different.) Therefore, it is usually hard for a consumer to switch between satellite networks without investing in another device. And once a customer purchases such a device, they would not upgrade too soon. So, statistically, the more devices that are out in the field for a operator, the more the chances are that at least some of these devices will be online at any given point. This will generate revenue for the company. So to attract the customer to purchase these devices, the MSS providers would need to be innovative and attract the customers' attention, before their competitors do. Therefore, successful products delivered with quality and on time, are one of the major drivers for MSS airtime revenue. NPD projects usually cost a lot of money, especially the NRE (Non-Recurring Engineering) costs. Therefore, there is always a degree of risk when attempting to design and implement new products in the MSS industry, the same as with any other industry. Identifying these risks will help product managers mitigate them better, leading to more products being developed on time, leading to minimization of potential loss of resources for the company.

3. SECTIONS

As demonstrated in this document, the numbering for sections upper case Arabic numerals, then upper case Arabic numerals, separated by periods. Initial paragraphs after the section title are not indented. Only the initial, introductory paragraph has a drop cap.

Simplifying this for an MSS industry manufacturer, the NPD process involves the following simple stages. [2]

1. Fuzzy Front End
2. Product Design
3. Product Implementation
4. Fuzzy Back End

3.1 Fuzzy Front End

This is the stage before the formal definition of requirements have been completed. It would involve multiple meetings to align product specifications with the projected organization goals and requirements. It would try to meet a specific targeted goal, or a particular customer demand or niche that the product is supposed to occupy. A market research might be conducted, or previous documented information from the organization might be analyzed to find existing customer requirements or feedback.

3.2 Product Design

This is the stage which would involve the processes which would help develop the initial technical specifications document. The requirements collected from the fuzzy front-end analysis would be combined and collated to arrive at a detailed design model for the future product and necessary approvals will be taken. It is an iterative process which will continue until the pre-commercialization of the product.

3.3 Product Implementation

This stage would involve the preparation of prototypes. And finalizing of high-level design. This would also involve the testing and internal validation stage where the prototypes created would be tested and finalized to ensure that the final production model meets the desired specifications and requirements expected of it. At the end of this stage, the prototype is ready for production, having satisfactorily met all the requirements expected of it envisaged in the product design and fuzzy front-end phases.

3.4 Fuzzy Back End

After the product implementation stage, the product is ready for production, and in the Fuzzy back end stage, the product finally undergoes production. This also involves activity from the commercial teams for the market launch of the new product which will involve marketing activities, research studies and collection of feedback from the market, distribution activities etc. Therefore, a post launch plan is also very critical and is to be developed in parallel with product development. [3] Once the cycle is complete, the process is repeated either immediately for the next product launch, or after a period of time once ROI has been obtained on the initial product launch. This is a continuous process in most organizations in order to stay competitive. Now projects involving NPD are usually handled in a manner as to ensure a quicker time to market for the products in question in order to preserve competitive advantage, and this is usually done with a shorter iterative process. [4] Project Risk is essentially anything that can interfere with the typical project management triangle constraints of quality, cost and time. And this can affect organizations to a large extent since quality affects the organizations image, cost affects its budget, and time affects its speed to market in order to stay competitive. It is very difficult to ascertain any risk to certainty; hence one must attempt to predict risk or conduct adequate risk assessment before proceeding with any venture. Although risk assessment is simply a prediction, it would help organizations better account for, or deal with any hiccups that may occur along the way. This would indirectly help save cost, time and effort – all of which are finite resources in a business environment. Risk management is a million-dollar affair in some large MNC's since it can save multiple times the invested amount when it comes to having a risk management system in the company.

According to Gosnik [5], a lack of time for properly testing solutions, as well as improper definition of technical requirements were credited as the main risk factors involved in most NPD related projects. These two factors alone can affect the viable lifespan of a product produced as a result. Now there are two kinds of risk which would affect our NPD projects – Internal Risk, and External Risk [6]

- Internal Risk is defined as risks which are internal to the organization, such as those involving internal teams and decisions.
- External Risks are defined as risks which are external to the organization, such as market forces and governmental regulation related risks.

In terms of this study, in an MSS organization, specifically for the NPD process, we can divide the Internal and External Risks into:

3.5 Internal Risk:

Internal risks related to teams more specifically related to the technical and commercial teams within the organization. Gosnik states that some of the major risks involved in NPD projects comprise of those arising from internal teams.

1. Lack of time for testing solutions
2. Technical requirements for the product are not defined
3. Lack of knowledge in the field of management
4. Lack of time for development of solutions
5. Insufficient control over research and development (R&D) department
6. Lack of human resources
7. Lack of know-how for testing
8. Lack of know-how in R & D

Therefore, we can see that many of the factors considered in this study concern the effect of internal technical teams when it comes to Risks involved in the NPD process. Risks have been broken down into the following within the context of this study and applicable data gathering template, as per Mansor, Yahaya et al. [7]

1. Internal Technical Team Risks: (since these teams have a critical function in the development and implementation of these projects)

2. Risks arising from other Internal Organizational Departments: (since other auxiliary arms of the organization such as budgeting teams, marketing teams and project scheduling teams which have an effect on schedules as well)

3.6 External Risk:

1. This would be anything related to the customer base and the external market. We have grouped these under Market based risks in this study. Market risk is the least controllable risk factor in NPD. [8]
2. Since MSS Industry products also involve substantial manufacturing and production of products, we would need to look into manufacturing risks as well, with a focus on the actual manufacturer of the product, who might deal with supply side and logistical issues from their end [9]

According to Issariya Sirichakwal [10], the time to market is a very important contributing factor in the Telecommunications Industry, of which MSS is a part. Therefore, adhering to schedules can ensure that product launches, and market releases happen on time, thereby minimizing any effect that can occur due to time delay. As we can see with technology majors in the telecommunications industry, companies like Apple was able to capitalize on their first mover advantage due to some innovations although the technology used in mobile phones evolved at a constant rate with 3G and LTE being common standards available for a wide variety of phone manufacturers. Apple was able to capitalize on the iOS App store as a revenue generator and now commands an enviable position in that regard. Apple was even able to pioneer some features in the Phone market when it comes to touchscreen technology due to which it maintains legions of dedicated fans that continue to use its product in spite of cheaper alternatives. Therefore, in the MSS industry, there is an aim to keep a first mover advantage, since the offered services are similar across all major industry players (voice, data, fax). Several studies have been conducted on the impact of NPD project delays. Project risks, if they materialize can lead to delays in the overall timeline of the project. The major ones would be the impact on project costs and quality of deliverables. The project management triangle by Atkinson [11] demonstrates that projects have to abide by the triple constraints of Cost, Quality and Time if scope is constant. So, if a time delay occurs, we can see the following impacts on cost and quality. As mentioned by Kessler and Bierly, [12], a rapidly proceeding product development process ensures more intense levels of information being shared between departments and this leads to more efficiency as everyone is on the same page. This is also emphasized by Brown & Eisenhardt [13], who talk about a better level of inter departmental communication. This reduces errors and redundancy and rework which results in reduction in costs required over the time frame of the project. The corollary would be that a delayed project would result in overall increased costs to the organization which would either be more resources and time that would be needed to complete this project, escalating costs for raw material, or lost opportunity costs in the market. There are some alternative viewpoints however, that also point towards increased costs when projects are rushed to market while adapting to strict timelines. A study proposing this view would be the work of McNally, Akdeniz & Calantone [14] which showed that the developmental expenses supported speed to market in association with shorter manufacturing phases. Which would mean that in the majority of projects, additional resources are poured into the project to support completion on schedule, which might not normally be the case in case of open timelines. Even Kessler and Chakrabarti [15] in their study which showed that an increase in speed, which is expected in an efficiently managed project can require more resources, which translate to increased costs. Anything that affects the final deliverable with respect to the initially planned scope of deliverables can be considered a project quality impact. This may mean:

1. Reduction in testing/certification processes in order to meet schedules
2. Reduction in quality control checkpoints in factory manufacturing
3. Reduction in product/packaging quality
4. Supply chain changes

All of which can result in a reduction in product deployment time at the cost of quality. According to Calantone & Di Benedetto [16], the relation between speed and quality is positive. As the speed increases, as in the case of a project on schedule, the performance on the project is improved. This means that projects on schedule have a lesser stress on cost cutting/ quality deterioration in order to meet missed deadlines. Again, there are contradicting opinions here, since Sethi [17] clearly shows that due to existing time pressure in a project on schedule team members may sometimes be forced to work with fewer alternatives in order to maintain project momentum and meet the next stage-gate. Also, quick decisions may need to be made in critical phases of the project to ensure continuity.

4. METHODOLOGY

Variables Identified

Independent Variables

Internal Risk

IV 1 - Internal Technical Team related risk

IV 2 - Market based risk

External Risk

IV 3 - Manufacturer related risk

IV 4 - Organization related risk

Dependent Variables

DV 1 - Degree of Impact of Risk (Delay) for these factors, and Overall Project Delay.

4.1 HYPOTHESIS:

H1: Internal Risks have significant cause on project delays in the MSS industry

H2: External Risks are significant cause on projects delays in the MSS industry

H3: Internal Technical Team Risks are significant cause in project delays in the MSS industry

H4: Organizational Risks are significant cause in project delays in the MSS industry

H5: Market Risks are significant cause in project delays in the MSS industry

H6: Manufacturer Risks are significant cause in project delays in the MSS industry

4.2 DATA COLLECTION & QUESTIONNAIRE DESIGN

Data collection for this research was conducted by means of a survey questionnaire circulated amongst industry professionals working across all aspects of NPD in the field of MSS in UAE. The questionnaire divides risk into internal & external risk, further divided into subcategories, each surveyed via its impact on project delay. Questionnaire includes questions related to delayed project impact on project cost and quality & impact. This questionnaire was drafted based on the information obtained from Literature Review. Relevant questions based on categorized risks were compiled. After that a discussion with a panel of industry experts was conducted which helped to further refine the questionnaire to gather relevant data. The questionnaire consisted of 33 questions designed to gauge risk importance in this industry. The risks were categorized into 4 categories viz internal Technical Team related risk market based risk, manufacturer related risk, organization related risk.

5. RESULTS AND DISCUSSIONS

Due to the nature of the study and the context in which the study is set, we were able to get 54 responses from the NPD teams. In the total data set we gathered, responses around 15% from female and 85% from male. Majority of the respondents were in the 30-39 age group and most respondents had more than 15 years of work experience. Some critical inputs were also received from the respondents based on product quality and cost impact because of project delay.

5.1 RELIABILITY ANALYSIS

A Cronbach's Alpha value was calculated in order to establish the reliability of the data analysis model.

(Insert 5.1)

5.2 Hypothesis 1: Internal Risks are significant factors when it comes to project delays in the MSS industry.

(Insert 5.2)

Here we took Q5 in the survey as a representative of project delay. We then conducted a Linear Regression in SPSS, with Q5 as the depended variable and all the Risks corresponding to Internal Risks were summarized as the Independent Variables. (Q6, Q7, Q8, Q9, Q10, Q18 , Q19, Q20, Q21, Q22). The R Square Value shows that 37.4% of the data present accounts for 22.8% of the variance when it comes to project delay in this industry. We can also see that the significance factor F is 98.98% which means that the IV (Internal Risk) is significant factor when it comes to project delay. When we look at the coefficients for significance, we notice that Q6, Q9, Q19, Q20 are significant (Value <0.05), which means that these are important Internal Risks when it comes to project delay.

(Insert Table 5.2.1)

Q6: The time required by the internal project teams to refine the initial product prototype can affect project schedules.
Q9: Time taken for the training of auxiliary teams such as customer care and product support teams (to effectively support the product upon release) can affect product release schedules.
Q19: Manpower availability for internal processes/logistics can delay projects
Q20: Changes to project funding by the organization can delay or affect project schedules.

(Insert Table 5.2.2)

Internal Risks are significant causes of project delay in the industry therefore H1 accepted Hypothesis 2: External Risks are significant cause when it comes to project delays in the MSS industry.

(Insert Table 5.3)
(Insert Table 5.3.1)

Here we took Q5 in the survey as a representative of project delay. We then conducted a Linear Regression in SPSS, with Q5 as the dependent variable and all the Risks corresponding to External Risks were summarized as the Independent Variables. (Q12, Q13, Q14, Q15, Q16, Q24, Q25, Q26, Q27, Q28) Conclusion: Here we see that the findings are not significant, since the significance is <4%. External Risks are not significant causes of project delay in the industry and therefore H2 stands as rejected. Hypothesis 3: Internal Technical Team Risks are significant cause when it comes to project delays in the MSS industry.

(Insert Table 5.4)
(Insert Table 5.4.1)

Here we took Q5 in the survey as a representative of project delay. We then conducted a Linear Regression in SPSS, with Q5 as the dependent variable and all the Risks corresponding to Internal Technical Team Risks were summarized as the Independent Variables. (Q6, Q7, Q8, Q9, Q10). The R Square Value shows that 25.5% of the total data present accounts for 17.7% of the variance when it comes to project delay in this industry. We can also see that the significance factor F is 99.987% which means that the IV (Internal Technical Team Risk) is significant factor when it comes to project delay. When we look at the coefficients for significance, we notice that Q6, & Q9 are significant (Value <0.05), which means that these are important Internal Technical Team Risks when it comes to project delay. This matches with our earlier analysis of data for all Internal Risks combined.

(Insert Table 5.4.2)

Conclusion: Internal Technical Team Risks are significant causes of project delay in the industry and therefore H3 is accepted.

5.1 Hypothesis 4: Organizational Risks are significant cause in project delays in the MSS industry.

(Insert Table 5.5)

Here we took Q5 in the survey as a representative of project delay. We then conducted a Linear Regression in SPSS, with Q5 as the dependent variable and all the Risks corresponding to Organizational Risks were summarized as the Independent Variables. (Q18, Q19, Q20, Q21, Q22)

(Insert Table 5.5.1)

Here we see that the findings are not significant, since the significance is <4%. Conclusion: Organizational Risks are not significant causes of project delay in the industry, therefore H4 rejected.

5.2 Hypothesis 5: Market Risks are significant cause when it comes to project delays in the MSS industry.

(Insert Table 5.6)

Here we took Q5 in the survey as a representative of project delay. We then conducted a Linear Regression in SPSS, with Q5 as the depended variable and all the Risks corresponding to Market Risks were summarized as the Independent Variables. (Q12, Q13, Q14, Q15, Q16)

(Insert Table 5.6.1)

Result: Here we see that the findings are not significant, since the significance is <4%. Conclusion: Market Risks are not significant causes of project delay in the industry. H1 rejected.

5.7 Hypothesis 6: Manufacturer Risks are significant cause in project delays in the MSS industry.

(Insert Table 5.7)
(Insert Table 5.7.1)

Result: Here we see that the findings are not significant, since the significance is <4%. Conclusion: Manufacturer Risks are not significant causes of project delay in the industry. H1 rejected.

6. CONCLUSION AND FUTURE SCOPE OF WORK :

In our research we looked at the issue of project delays when it comes to hardware product development in the MSS industry. We were able to analyze several risks comprising of both Internal and External Risk categories. We have found based on collected data that Internal Risks play a very important role when it comes to project delays in NPD. These risks fall under two categories - the Internal Team & Organizational Based Risk Categories. This means that the most significant cause of project delay in NPD in the industry would be concerning Internal Project Teamwork at the prototype stage. The prototype stage is the stage where the team tries to refine the initial designs and plans to achieve the final product. This is followed by schedule overlaps that happen when projects are not very inclusive of auxiliary teams that are required to support the project, and when training activities/handover documentation is left to the last minute, delays often happen. Finally, under Organizational based risks we see that changes to funding is often an important factor when it comes to NPD project delay. These projects that involve manufacture of a product are usually very capital intensive, and depending upon market conditions, funding can sometimes be pulled from a project, or reduced, leading to delays and project quality impairments. Suggested avenues of risk mitigation for the discovered significant risks would involve: Ensuring quick turnaround times for iterative refinement of the prototype by ensuring adequate resources being involved during the process, or perhaps by Agile methodology or other established Project Management technologies. Training plans/handover schedules for auxiliary teams /stakeholders should be included in all project plans irrespective of the complexity of the project. Organizational funding changes must be taken with a full view of impact on projects in progress. Adequate manpower planning must be done for all NPD projects underway, and contingency / secondary resources can be assigned for assisting with any unexpected shortages / unavailability in manpower. Knowing the significant risks involved in NPD from this research would help implement risk assessment and mitigation plans for these specific grouped risks well in advance, reducing the changes of a project delay, and being ready for it if and when it happens. Also, above mentioned findings can be utilized by other organizations involved in the NPD process such as corporations and even entrepreneurs who wish to make their own products. This would be a good reference for project managers working on hardware NPD projects in general. Hardware NPD is an interesting topic with multiple avenues for research, and as for future research, perhaps a more in-depth study can be conducted with respect to additional factors involved in manufacturer processes and internal team processes for refinement of this Risk Management Model. This would help manage these processes better.

8. END SECTIONS

APPENDICES

Table 5.1. Reliability Statistics

Cronbach's Alpha	No. of Items
.712	20

Table 5.2 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.611a	.374	.228	.915	.374	2.565	10	43	.016

a. Predictors: (Constant), 22. , 10. , 6. , 21., 18. , 7. , 19. , 8. , 20. , 9.

Table 5.2.1 ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	21.482	10	2.148	2.565	.016b
	Residual	36.018	43	.838		
	Total	57.500	53			

Table 5.2.2 Co-efficient

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	6.590	1.723		3.824	.000
6. The time required by the internal project teams to refine the initial product prototype can affect project schedules.	-.743	.254	-.392	-2.924	.005
7. The time taken for quality control processes followed by the internal project teams during the product development phase can affect project schedules.	-.111	.150	-.113	-.740	.463
8. The degree of the team's technical knowledge on how to implement a project can impact project schedules.	.156	.224	.109	.696	.490
9. Time taken for the training of auxiliary teams such as customer care and product support teams (to effectively support the product upon release) can affect product release schedules.	-.415	.166	-.440	-2.506	.016

10. Time required for gathering the necessary regulatory approvals (by concerned internal teams) to release the product in certain markets can impact deadlines.	.251	.168	.282	1.493	.143
18. Sudden changes to management teams guiding the project can delay projects.	-.082	.137	-.082	-.601	.551
19. Manpower availability for internal processes/logistics can delay projects.	.450	.214	.344	2.106	.041
20. Changes to project funding by the organization can delay or affect project schedules.	-.671	.289	-.390	-2.321	.025
21. Internal disagreements/conflict between stakeholders within the company, especially within aligned teams can delay projects.	-.024	.158	-.023	-.151	.881
22. Change in organizational direction/strategy can delay or indefinitely halt projects.	.322	.301	.178	1.071	.290

Table 5.3 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.283a	.080	-.134	1.109	.080	.375	10	43	.951

a. Predictors: (Constant), 28. , 13. , 24. , 14. , 25. , 27. , 16. , 26. , 12., 15.

Table 5.3.1 ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.607	10	.461	.375	.951[b]
	Residual	52.893	43	1.230		
	Total	57.500	53			

a. Dependent Variable: 5. As per your assessment, how often do the projects you work on meet their initial deadlines?

b. Predictors: (Constant), Q28, Q13, Q24. Q14, Q25, Q27, Q16, Q26., Q12. Q15.

Table 5.4 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.505a	.255	.177	.945	.255	3.283	5	48	.013

a. Predictors: (Constant), 10., 6., 7., 8., 9.

Table 5.4.1 ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	14.652	5	2.930	3.283	.013b
	Residual	42.848	48	.893		
	Total	57.500	53			

Table 5.4.2 Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	6.027	1.146		5.257	.000
	6.	-.745	.250	-.393	-2.983	.004

7.	-.146	.146	-.148	-.998	.323
8.	.205	.210	.144	.974	.335
9.	-.360	.159	-.382	-2.262	.028
10.	.304	.155	.342	1.960	.056

a. Dependent Variable: 5.

Table 5.5 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.314a	.099	.005	1.039	.099	1.051	5	48	.399

a. Predictors: (Constant), 22. , 18. , 19. , 21., 20.

Table 5.5.1 ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.674	5	1.135	1.051	.399b
	Residual	51.826	48	1.080		
	Total	57.500	53			

Table 5.6 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.182a	.033	-.068	1.076	.033	.329	5	48	.893

a. Predictors: (Constant), 16. , 14. , 12., 15. , 13.

Table 5.6.1 ANOVAa

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.907	5	.381	.329	.893b
	Residual	55.593	48	1.158		
	Total	57.500	53			

Table 5.7 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.259a	.067	-.030	1.057	.067	.689	5	48	.634

a. Predictors: (Constant), 28. , 24. , 25. , 27. , 26)

Table 5.7.1 ANOVAa

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.850	5	.770	.689	.634b
	Residual	53.650	48	1.118		

Total	*57.500*	*53*			

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