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The impacts of FOREX fluctuations on international construction projects

Mohd Amizan Bin Mohamed¹, Ayuniza Binti Ahmad² and Daud Bin Mohamad²

¹ Faculty of Civil Engineering, UiTM Shah Alam, 40450 Shah Alam, Selangor, Malaysia

² College of Engineering, Universiti Tenaga Nasional, 43000 Kajang, Selangor, Malaysia

Email: amizan8124@salam.uitm.edu.my

Abstract. The international construction project is a highly valuable market project and many of the contractors would like to be participate. This is because they are misled with the exchange rate (money) and instantly attracted with the profit they assumed will be gained after the project is completed. In fact, without noticing that they will be affected with the FOREX's fluctuations which might complicate the project further. In addition, many new vendors nowadays will try their luck in construction business without making a good judgement on the risks. So, the objective of this study is to identify the impacts of FOREX fluctuations on those perspectives at international level. This study also uses quantitative method through questionnaire survey that were distributed randomly, and the result obtained were from top management and non-top management in construction hierarchy with different level of experiences. The collected data were analysed by using two methods which are Statistical Package for Social Science (SPSS) and Microsoft Excel. The SPSS software is used to process the regression analysis for the impacts of FOREX data of the questionnaire. The Relative Importance Index then is applied to run the data for capability and mitigation actions in determining the ranking of priorities. Overall, the impacts of FOREX fluctuation on international construction projects have been identified with regards to three mechanisms which are business management, technical and financial. These outputs are useful as a guideline for international construction project companies when they are venturing into this challenging market especially in terms of managing/ expediting quality, completion period, and optimising cost of the projects.

1. Introduction

Currency FOREX fluctuations is a natural outcome of the fluctuation of exchange rate system that is the norm for most major economies. The exchange rate of one currency versus the other is influenced by numerous fundamentals and technical factors that are related indirectly without our notice. These include relative supply and demand of the two currencies, economic performances, outlook for inflations, interest rate differentials, capital flows, technical support and resistance levels. As these factors are generally in a state of perpetual flux, currency values fluctuate from one moment to the next. But although a currency's level is largely supposed to be determined by the underlying economy, the tables are often turned, as huge movements in a currency can dictate the economy's fortunes and indirectly will affect the industry involved and give huge impact to company that is related most to international business.

Implementing construction projects in a foreign country is a high-risk business activity [1]. International construction projects normally involve a high level of risks because of the differences in construction practices, working conditions, culture and political, legal, and economic conditions between domestic and overseas markets [2]. Foreign exchange rate (FOREX) risk is considered as



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significant challenge in the international construction business, as business is strongly affected by these fluctuations [3][4].

The objective of this research is to identify the impacts of FOREX fluctuations to international construction project based on business management, technical and financial perspectives.

2. Research methodology

The quantitative method is carried out to determine the impacts of FOREX fluctuations on international business performance. Quantitative methods aim to classify features, count them, and create statistical models to test hypotheses and explain observations of the data gained. According to Chang [5], basic quantitative descriptions can provide a valuable baseline background to help identify issues for a more in-depth, qualitative or quantitative study for an event. Hence, this methodology is suitable because the results and outcomes congruently the objectives of the study.

In this study, a flowchart containing problem statement and objective, literature review, questionnaire, pilot study, data collection, analysis and discussion, conclusion and summary and presentation is used to illustrate the steps of the research methodology. In this flowchart, it can determine where/when to start the research, identify the problems, how to collect data and analyse the data, make the right recommendations and summing up to the conclusions.

2.1. Methodology flowchart

The overall flow, the earliest phase until the final phase, of the methodology process applied in this study is illustrated as below.

The sample size for this study is 300 respondents in construction firms with projects at international level. The main requirement in selection of respondents is that they must be those in the top management group. They could be the contractors, supervisors, general managers, deputy general managers, managers, assistant managers and those involved in international construction projects related to the engineering fields especially at the top level. The reason for this action is because the objectives of this study can only be answered by those impacted or dealing with the impacts of FOREX fluctuations in the real field at international level. Only their experiences, knowledge, and past actions are valid to be utilised in answering the research questions / questionnaire successfully. This then would enable a solid framework to be established regarding to this issue. Presence of the surrounding stakeholders, i.e. top management, project management, project champion, software vendor, and consultants were identified as the root causes driving performance [6, 7]. In addition, the selected companies are those located in Selangor and Kuala Lumpur vicinity since most of the companies related to international projects are located here. Allegedly, the respondents must have had experiences in executing construction projects at the international level. If the respondents' prior knowledge and exposure of FOREX issues is non or low, the data cannot be relied upon them.

Referring to the table, by Krejcie and Morgan [8] and the Educational and Psychological Measurement, 30, 607-610, we can identify and determine sample size for this study based on the population size. Hence, using these guidance, with the population size of 300, the estimated sample size of 169 respondents is indeed sufficed.

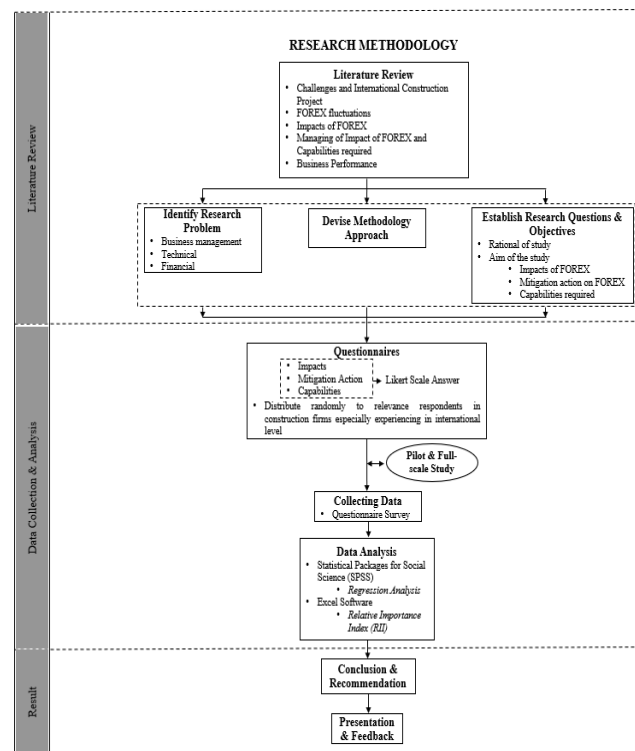


Figure 1. Flow chart.

2.2. Questionnaire design

The questionnaire is an effective way to obtain a data from respondents [9]. According to Saunders et al., questionnaires tend to be used for explanatory research where cause-effect relationships can be examined, or for descriptive studies which involve attitudes and opinions to enable the researcher to investigate the variability in different phenomena [10]. This indicates that questionnaire is a reliable way in getting information. The strategy in questionnaire distribution is to distribute randomly to respondents in construction firm especially those with experiences in construction project at international level possibly at the top management level. About 300 questionnaires survey were distributed to the respondents of the selected areas which are Selangor and Kuala Lumpur because of the arising development of construction industry at those areas. The required data are related to the project whether completed or on-going based on CIDB data. The respondents of the survey questionnaires include contractors, supervisors, general managers, deputy general managers, managers, assistant managers and who are involved in international construction project related to the engineering fields especially in top management. Stated by Akkermans and van Helden [6] and Boonstra [7] presence of the surrounding stakeholders, i.e. top managements, project managements, project champions, software vendors and consultants were identified as the root cause driving performance. They are considered to be the most suitable respondents for the research to explain the decision-making structure and strategic posture of their organisations [11].

Table 1. Sample size determination.

Sample size determination for most practical situations		Table for Determining Sample Size from a Given Population					
<i>Source: Krejcie, R. & Morgan D. (1970). Determining Sample Size for Research Activities, Educational and Psychological Measurement, 30, 607-610.</i>		<i>N</i>	<i>S</i>	<i>N</i>	<i>S</i>	<i>N</i>	<i>S</i>
<i>Where:</i>		10	10	220	140	1200	291
<i>N = Population Size</i>		15	14	230	144	1300	297
<i>S = Sample Size</i>		20	19	240	148	1400	302
		25	24	250	152	1500	306
		30	28	260	155	1600	310
		35	32	270	159	1700	313
		40	36	280	162	1800	317
		45	40	290	165	1900	320
		50	44	300	169	2000	322
		55	48	320	175	2200	327
		60	52	340	181	2400	331
		65	56	360	186	2600	335
		70	59	380	191	2800	338
		75	63	400	196	3000	341
		80	66	420	201	3500	346
		85	70	440	205	4000	351
		90	73	460	210	4500	354
		95	76	480	214	5000	357
		100	80	500	217	6000	361
		110	86	550	226	7000	364
		120	92	600	234	8000	367
		130	97	650	242	9000	368
		140	103	700	248	10000	370
		150	108	750	254	15000	375
		160	113	800	260	20000	377
		170	118	850	265	30000	379
		180	123	900	269	40000	380
		190	127	950	274	50000	381
		200	132	1000	278	75000	382
		210	136	1100	285	100000	384

N is population size.
S is sample size.

Next, the respondents chose to answer answer by tick or circle they feel the correct one. The questions must be related and reflect effect of the FOREX fluctuation in international construction projects. Then, actions that can mitigate the impacts by considering the possible capabilities and by reviewing relevant literature. This also had been admitted by Govindarajan [12] and Nandakumar et al. [13], they stated that the development of the questionnaire for the quantitative survey started with the review of relevant literature on competitive strategies, decision-making styles and organisational performance to identify the variables, and this was refined by researchers in construction and the built environment to evaluate the content validity. This questionnaire will be using the Likert Scale. Likert Scale falls within the ordinal level of measurement that is, the response categories have a rank order, but the intervals between values cannot be presumed equal, though, as Blaikie points out [14]. This method helps in describing the quantitative value to qualitative value efficiently and to make it amenable to statistical analysis. Generally, the method being used is to ease the researcher to analyse the data efficiently in the last phase of survey. The Likert Scale answers are rank as below:

- a) 1 for STRONGLY DISAGREE
- b) 2 for DISAGREE
- c) 3 for QUITE AGREE
- d) 4 for AGREE
- e) 5 for STRONGLY AGREE

2.3. Pilot study

Pilot study can be translated as a small preliminary study that being conducted to examine and evaluate the gaps in the questionnaire so some adjustments on the design can be done. This is very essential because every error or misunderstanding on the question that being used in real survey on selected population will cause invalidity in data and the objective will be unachievable. The pilot study also being conducted in advance to obtain expected result from the respondent in full-scale study. The expecting outcome then being used to forecast the future outcome from the population size. It allows the researcher to have initial hypotheses about the study.

For this research, the pilot study was conducted to 110 relevance respondents in construction firms on selected areas especially those who have experiences in international level at top management. The pilot study was conducted to a large number of respondents because the researcher was having a difficulty to get cooperations with the related companies. Hence, unfortunately the result of this pilot study was getting just 3 answered questionnaires from 2 different companies with each of the respondent has different positions in their company and all the respondents come from top management background.

2.4. Method of data analysis

This research is conducted to respondents who are involved in civil engineering field, to testing the questionnaires quality and to identify the feedback from the questionnaire either achieve the goals or not at the pilot study level. If the feedback gives a positive respond. So, after doing the pilot study, the questionnaires are distributed to selected population to get actual result for this study. The data gained will be analysing to get the exact output related to the study. So, data analysis is important part in achieving the objectives and in another meaning content analysis is 'a technique for gathering data, it involves codifying qualitative and quantitative information into pre-defined categories in order to derive patterns in the presentation and reporting of information' [15]. So, for this study there are few effective methods applied to analyse the data in effective and efficient way.

2.4.1. SPSS (Statistical Packages for Social Science. To assist in planning and carry out strategies that will improve the outcome of this study, the Statistical Packages for Social Science (SPSS) software was applied to predict and analyse the collective data. SPSS enables qualitative data to be organised, closely monitored, easily coded, retrieved through direct searching and interrogated to build propositions and theories, due to the systematic recording of the information and data [10]. This software is a comprehensive system for analysing data and aiding the data interpretation process more easily [16]. Using this software, the data transferred automatically from spread sheet into graphic in form as to present the data in a more attractive manner. This methodology is useful in investigating the combination of conditions and pathways that lead to a performance (outcome), and this is particularly relevant in the project-based construction field because such projects frequently involve complex relationships among the variables of interest [17]. The data gathered from the analysing process will be known as raw data and this will be used as our reference from here on.

2.4.2. Regression analysis. Regression is a well known method being used in quantitative research and often being applied to analyse and modelling numbers of variable with relationship. In easy way the regression analysis is to examine the relationship nature of both variables in an effective way. In this analysis the SPSS software was used to ease the process of analysing the variables in a systematic way. It allows multiple models in a single regression command to be specified. In this study the regression method was applied in questionnaire in Part C which explains on impacts of FOREX fluctuations to the international construction project as dependent variable based on three perspectives which is business management, technical and financial that will be independent variable. Thus, the regression analysis was applied to justify which of those ranked highly in terms of correlation to dependent variables and to test those relationship.

Regression model, basically, specifies the relation of dependent variable (Y) to a function combination of independent variables (X) and unknown parameters (β)

$$Y \approx f(X, \beta)$$

Regression equation can be used to predict the values of 'y', if the value of 'x' is given, and both 'y' and 'x' are the two sets of measures of a sample size of 'n'. The formulae for regression equation would be

$$y^* = a + bx$$

Where,

$$b = \frac{n \sum xy - (\sum x)(\sum y)}{n(\sum x^2) - (\sum x)^2}$$

$$a = \frac{\sum y - b \sum x}{n}$$

Figure 2. Regression equations.

2.4.3. Microsoft Excel. The raw data from the questionnaire in Part D and Part E are keyed-in to Microsoft Excel by using Relative Importance Index (RII) equation. The frequency of each question been determined from Likert scale rating, the formula of Relative Importance Index (RII) then keyed-in to the Microsoft Excel, the value of Relative Importance Index (RII) can be determined and it will be easy to rank the variables on Part D and Part E required that need to be enhanced by the company themselves. This ranking system actually helps to determine the elements in each variable that need to be emphasized strongly in FOREX issues. Last, the data are presented in the form of charts by Excel assist to illustrate the output more clearly.

2.4.4. Relative Importance Index (RII). The Relative Importance Index is the method in arranging the variables according to their relative prior to ranking. Once the ranking has been identified, it leads to knowing the relationship of the variables to the research. To know and rate the numerous causes of project becomes a failure; the RII is widely being adopted metric in AEC risk management in the literature [18-20]. According to those scholars, have been mentioned in their study that RII being adopted to knowing how relevance the impacts of numerous risks to project metrics such as cost, schedule, and performance. For instance, the RII method being was used by Gunduz et al. in their research on determining the essential relative causes of delay in construction project in Turkey [21]. Thus, it shows that the RII method is relevant to be used in this research in determining the significant mitigation actions and capabilities.

$$\text{Relative Importance Index} = \frac{\sum w}{AN} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{5N}$$

Where w is the weighting given to each factor by the respondent, ranging from 1 to 5. For example, n_1 = number of respondents for Little Important, n_2 = number of respondents for Some Important, n_3 = number of respondents for Quite Important, n_4 = number of respondents for Important, n_5 = number of respondents for Very Important). A is the highest weight (i.e. 5 in the study) and N is the total number of respondents. The relative importance index ranges from 0 to 1 (Tam and Le, 2006).

Figure 3. Relative Importance Index equation.

3. Result and discussion

In Figure 4, 11.2% of the respondents do not agree that companies will be affected with the impacts of FOREX meanwhile 88.8% respondents have contradicted answers with the minority opinions. In overall, majority of those companies agreed that their companies are affected by FOREX fluctuations when conducting their projects at international level. This finding is aligns with a statement by Dikmen et al., Han et al., Kim and Hur, and Ling and Hoi in their previous research that is foreign exchange rate (FOREX) risk is considered as significant challenge in the international construction business, as business is strongly affected by these fluctuations [3-4, 22-23]. Thus, it is clearly that FOREX plays a vital role in international market. So, a well preparation is crucial for any company that tends to venture the international market.

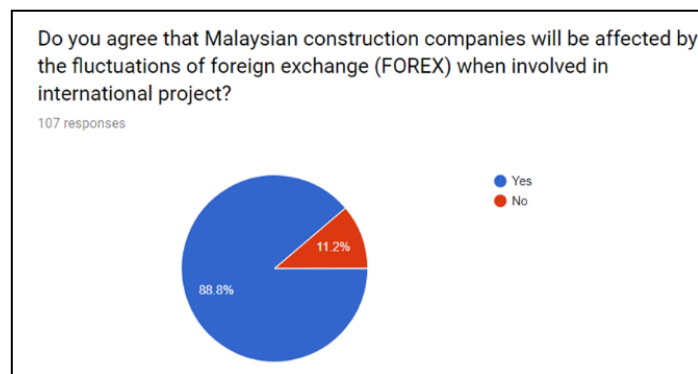


Figure 4. Impacts of FOREX toward Malaysian company.

3.1. FOREX fluctuations at company level

The question focused on the effect of FOREX fluctuations at the company level. It purposely asked to identify whether the FOREX issues can influence the company abilities and performance or not. For instance, foreign exchange exposure and economic exposure may be visualized as the overall impact of foreign exchange rate fluctuations on stockholders' wealth or i.e. the market value of the common stock [24, 25]. In this study, 107 respondents conferred different opinions depending on their wisdom and knowledge during executing the project at international level. The result is interpreted in the bar chart below:

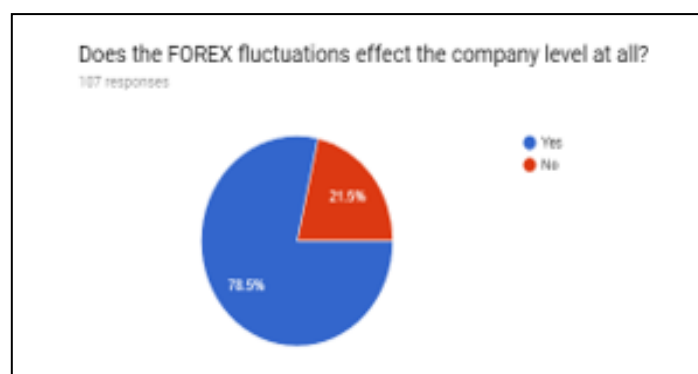


Figure 5. FOREX effect at company level.

Most of the respondents give positive feedbacks on the relationship between FOREX fluctuations and it impacts at the company level. While, the rest do not agreed with the justification. This is because each company has their own strengths and abilities in overcoming the problems occurred. More stable one company is, more easy for the company to cater to the problems. Hence, contradiction of answer in this question because their performance at company level is not affected by the FOREX fluctuations.

But majority of the respondents agreed with the statement that FOREX fluctuations effect their company level. So, it clearly shows that FOREX fluctuations inevitably give impacts at the company level and coincides with the statement stated by Menguturk and Karadagli [24, 25].

3.2. FOREX fluctuations at project level

The last question on the company background is related to the company performance at the project level while conducting the project abroad and when it is the FOREX fluctuations occurred. According to Shane et al., Ling and Hoang, and Zhi in their observations state that hierarchy for determination of risk in overseas project can be categorise to four stages which are country, industry, firm, and project stage [26-28]. From the data gathered in the full-scale study of this research, result similarly as previous question. This can be seen in the figure below.

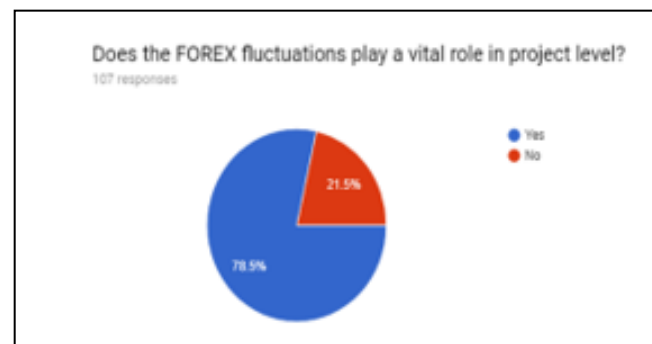


Figure 6. FOREX effect at project level.

Based on Figure 6, it can be interpreted that 74 out of 107 respondents agreed that their company are affected by the FOREX fluctuations at the project level. And this usually will involve high level of risk on the project if related to FOREX conflict. This higher risk causes larger project costs and losses in time compared with domestic projects [29]. Thus, proved that FOREX fluctuations will give bad influence on project level. But another opinion from the rest of the respondents in this research contradict with the figure shown and a justification from Xiang et al. in their previous research. This is because if the management can wisely tackle the problem at the project level properly, it will not affect any progress of the project. This is the ideology being applied by those respondents. Thus, it can be concluded that majority of the respondents gives positive feedback on the justification that FOREX fluctuations affect company at the project level.

3.3. FOREX fluctuation toward international construction projects

Based on the data obtained, it can be determined that the dependency of three perspectives which are business management, technical and financial toward the impact of FOREX fluctuations to the international construction project by using regression analysis in SPSS software. Meanwhile for section D and section E, the data can be tabulated in detailed arrangement based on the frequency of answer given by the respondents in the questionnaire by applying Relative Importance Index in Microsoft excel. The purpose of this action is to see clearly the parameters that the companies need to focus on in order to sustain in the international construction business. Besides, the data are ranked and analysed directly from the real industry's knowledge, wisdom and experiences during their past task in international level. Thus, the data is valid to be consider as lesson and catalyst for other players in construction industry to make improvement.

3.3.1. Impacts of FOREX fluctuations towards international construction projects based on business management, technical and financial perspectives (Top management level). Table 2 illustrates the output of this study after running the SPSS software under linear regression analysis method. The data obtained in the table are the result from 44 respondents that identified categorize in top management level about

the impacts of FOREX fluctuation that they figured will be the main factors that influence the international construction project in the terms of business management, technical and financial perspectives. This method being undergo because it is crucial in order to examine whether each set of independent variables is a separate for each subpart of the structural model [30]. In addition, by applying this method it allows opportunity to examine the dependency of independent variables toward dependent variable.

Table 2. Linear regression analysis (Top management).

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.641 ^a	.411	.400	.52207

a. Predictors: (Constant), Ave_Technical

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9.884	1	9.884	36.266	.000 ^b
	Residual	14.173	52	.273		
	Total	24.057	53			

a. Dependent Variable: Mean_Impact

b. Predictors: (Constant), Ave_Technical

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.553	.351		4.426	.000
	Ave_Technical	.537	.089	.641	6.022	.000

a. Dependent Variable: Mean_Impact

Excluded Variables^a

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics Tolerance
1	Ave_Management	-.079 ^b	-.433	.667	-.061	.348
	Ave_Financial	.168 ^b	.847	.401	.118	.291

a. Dependent Variable: Mean_Impact

b. Predictors in the Model: (Constant), Ave_Technical

Based on the research made by Hair et al. from his previous study he found out that the analogous to the assessment of formative measurement models must satisfy tolerance levels below 0.20 or lower with the value of VIF above 5.0 [30]. The summary table indicates that the values of R that represents the simple correlations shows a quite high degree of correlation at 0.641. Meanwhile the values of R² indicates 41.1% of total variation in the dependant variable which is the impacts of FOREX fluctuation can be explained by the independent variables which is technical capability. This shows that the technical capability can influence the impacts of FOREX fluctuation and the relationship between those dependant and independent variable during the execution of international construction projects.

The table with ANOVA tabulated data shows the dependant variable which is impacts of FOREX fluctuation is predicted well by the regression model. The regression model statistically predicts the significant outcome variable which the independent variable will has dependency relationship with dependant variable. It proves that the data fits to be applied through the come-out of significant column ‘Sig.’ with value of P is 0.000 which is less than 0.05. As mentioned by Tukur (2008) in his research where to quantify the strength of evidence against null hypothesis $P < 0.05$ (5% significance) is as a standard level for concluding that there is evidence against the hypothesis tested and the regression model valid to use. In addition, the third table, shows the technical capability contributes significantly to the regression model by looking at its significant column value. This coefficient table also provides information to forecast the in fluency of impacts of FOREX fluctuation through technical capability. It can be interpreted through regression equation as:

$$\text{Impacts of FOREX fluctuation} = 1.553 + 0.537 (\text{technical capability})_{(1)}$$

Finally, what can be concluded from the last table on the impacts of FOREX fluctuation as a dependent variable is a weak relationship with business management and financial capability as independent variables. This is caused by the expelled relay shown between those variables and somehow, it has strong dependency relationship with technical capability. It can be proved through result at Table 2 that shown strong agreed that the dependency of impacts of FOREX toward technical capability with synchronize P value 0.000 that less than 0.05 and regression equation established through that correlation.

Thus, from this research we can identify that the enhancement of technical capability among construction industry player will help them in countering the impacts of FOREX fluctuation. Dikmen et al. [31] mentioned the different sources of competitive advantage and identified technical capability as the top priority for construction firm. This capability is referred to as the ability of a company to perform a variety of direct activities in construction by defining the type, size, and complexity for completing projects [32, 33]. But the slightest degree of chances needs to be considered and be an enhance in order to fill the small gap that maybe become a vast leakage in future if we neglected. This is because it is being supported by previous scholar that mentioned to used resources in effective way and specialist in performing the project within time, cost and with good quality, the management capability is necessarily [34]. The primary factor to choose the management ability is by arranging all the resources through a proper plan which is planning, organizing, leading and controlling to achieving the purpose of study [35, 36]. As mentioned by Ozorhon et al. [37] performance was also measured using multidimensional measures at the financial and operational levels. This finding is parallel with previous studies that revealed Vietnamese and Chinese contractors lagging behind their competitors due to weak financial capacity [38]. Thus, its shown that those two capabilities need to be take concern too even though have low dependency relationship in mitigating impacts of FOREX fluctuations.

4. Conclusion

Based on the data analysed and findings, it can be concluded that the objectives and aims of this study have been achieved successfully. The impacts of FOREX fluctuations on international construction project have been identified and the three perspectives are business management, technical and financial. The correlation is based on their dependency and this is tested through regression analysis. In this research, those three perspectives are independent variables that can stand alone without any support meanwhile for the impacts of FOREX fluctuation that is classified as dependent variable it contradict because of its reliability on independent variables. Through SPSS and RII test, the result shows that technical mechanism has strong relationship with the impact of FOREX and yet weak dependency on business management and financial. Therefore, by knowing and identified these impacts, holistic overview on mitigation actions needed to be considered, to tackle the issue of impacts of FOREX fluctuations based on 3 mechanism highlighted.

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