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DETERMINING MAJOR RISK FACTORS IN CONSTRUCTION PROJECTS FROM THE VIEW POINT OF LIFE CYCLE AND STAKEHOLDER

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─Abstract ─

To accomplish a construction project successfully, it is important managing the risk in terms of cost, time, safety, quality and environmental sustainability. Yet, researches regarding the construction project until very recently has focused usually on different risk items instead of systematic approach to determine risks and to evaluate project as a whole. This paper intends to determine and analyze major risk related to the construction project from the standpoint of life cycle and stakeholder's wealth. Measuring the important risk factors, we use an ARCH Model to assess Turkish developers' stock exchange performance considering the risk management effectiveness from the view point of project schedule, owners, employers, and other related parties. One major REIT, ISGYO as well as REIT index is studied for this purpose. Finally the relation between construction project contractor and client, designer and other external parties are determined, in order to make sure the project goals maximization and eliminate the failure in design variation, abnormal approval procedures official administrative quality expectation and inadequate planning additionally.

Key Words: *Real Estate Development, Life Cycle, Stakeholder, Risk Management*

JEL Classification: G32, L74, 022

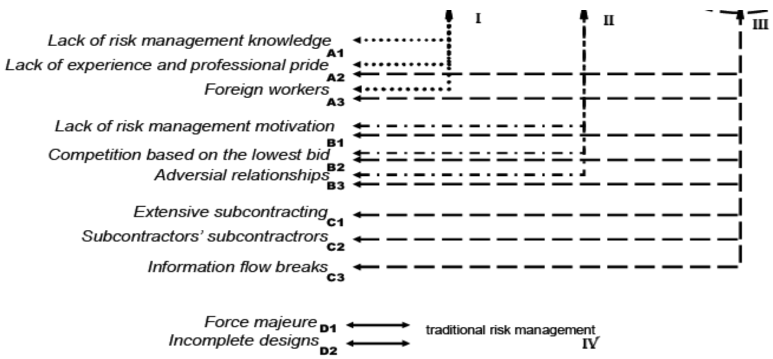
1. INTRODUCTION

Risk is known as the potential for unexpected consequences of an activity such as a combination of construction hazard and exposure. The probability of something happening that will have an impact on construction project objectives; may have either a positive or negative impact combination of "frequency" of occurrence of a defined threat or opportunity and the "magnitude" of the consequences of the occurrence in the construction project. This paper examines the decision making in construction projects risks from life cycle and the stand point of stakeholder analysis through an empirical research.

2. LITERATURE REVIEW

The construction risks include cost overrun, project life cycle risks, quality risks, safety risks as well as environmental sustainability. (Zou, Guomin, Jiayuan, 602-604). In the figure 1 integrated risk management model is presented.

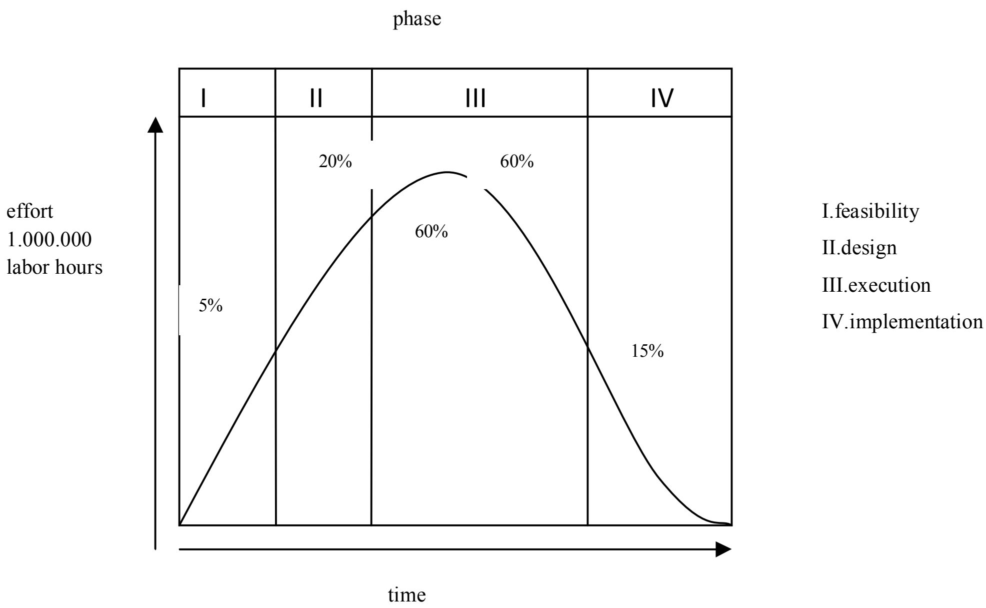
Figure 1: Integrated risk management model



Source: Klemetti: 2006: 98.

According to integrated risk management model, the group a risks should be managed by a soul decision maker. (Tserng, 2009:996) Empirical studies in strategic management have tried to identify the relationship between diversification and firm performance. (Kim, 2009: 6) In the below figure 2, an important risk element for the construction industry, construction life cycle analysis is presented. Accordingly construction project can be divided into 4 categories.

Figure 2: Construction life cycle



Source: Wideman: 2004: 5.

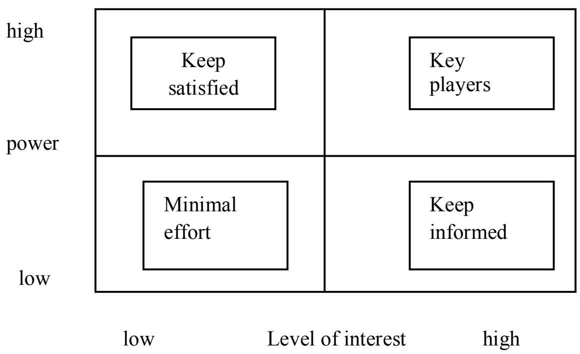
According to Wideman in the feasibility phase just 5% of labor hours is apprehended where accurate projection is important. In the design phase 20% of man hours is required. (Wideman, 2004: 3-5) The life cycle management of construction projects can be described as a management system for whole processes of a construction project. (Guo, Li, Skitmore, 2010: 42.)

Construction project net cash flows often involve gaps between expenses and owner payments owing to factors such as retain age, delay in client payments, credit arrangements with suppliers, and project extensions. (Varun, Abraham, Sinfield, 2011: 333) Life cycle method is an input-output analysis. Economic input-output analysis was developed by Wassily Leontief in the 1930s. (Bileç, 2007: 17) Stakeholders are the most a responsibility in the practice of construction project. (Terry, Thomas, Skitmore, 2012: 336) The final direction of influence is to locate and categorize the stakeholders according to their role. Figure 3 describes the directions of influence in the construction projects.

Factors affecting decision making in project risk and life cycle

Managing risk is a significant component of a project consequently persistent investment in this matter is unavoidable. Meanwhile factors affecting project executive is not mutually exclusive. Although it's not easy to imagine a condition in which all of these apply simultaneously, it's clear that in most cases, a subset of these is related, rather than just a single factor. Project sponsors and maintaining organisational commitment, competition and relationship with peers and communities of practice, customers, international partners of JV, unions, suppliers, the public, government, the efficient team management and shareholders are generall affecting factors. The company or project specific relevant factors determined in this study, regarding decision making in project risk management could be summarized as environment, emotion, risk tolerance, mood of project manager, spiritual motivation, perceived -and real risks, magnitude of downside loss, damage to the company, likelihood of various outcomes, positive and negative, reputation risk or benefit and pressure or support by third parties.

Figure 4: Stakeholder matrix



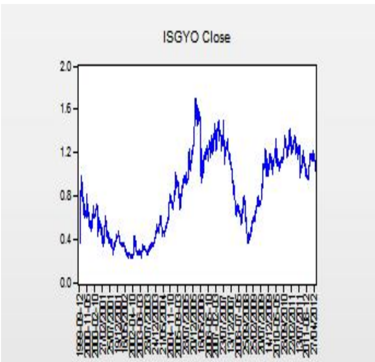
Source: Olander, Landin: 2005: 321–328.

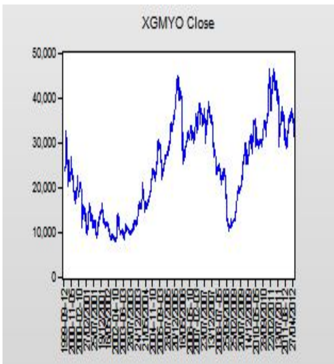
By categorising stakeholders into the power matrix, construction project management can produce a better picture of how relationships between stakeholders has influance the construction project and its implementation. The phases that will be used in the analysis are; the initial feasibility and conceptual design, the formal architectural planning, and the stage of concerns. (Olander, Landin, 2005: 321-328) There are different approaches to stakeholder relationship management. The first approach relates to the promotion of the relationships between different construction project participants and the analysis of the importance of relationship management in the construction site. (Yang, Shen, Qiping, 2010: 903). Construction lifecycle risk management study will expose delegates to the particulars of risk management structure implementation customized for the construction companies in terms of stage, form, and visibility of risk management that corresponding project value.

3. RESEARCH

In this research the REIT market of Turkey is examined. The analyzed firms are the largest REITs in Turkey namely ISGYO as well as the REIT index. These companies are important developers in construction projects. The data used in this analyze is daily closing price of ISGYO and REIT Index in ISE. Examined 3124 data covers the period of time between 12 September 1999 and 31 May 2012. The graphical presentation of the data is shown below.

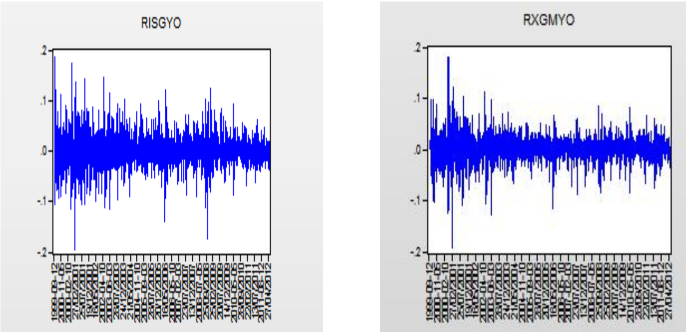
Figure 5: Presentation of data





In this research we are eagerly interested in modeling the stock market returns of REIT market in Turkey as an indicator as the success in risk decision making process of developers in the construction projects can occur both in project life-cycle and stakeholder. Therefore the log returns not the closing prices are used in this study. The log returns are presented in the following graph.

Figure 6: Presentation of data log returns



Most econometric models include a constant one-period forecast variance. To generalize this assumption, a new set of stochastic processes called autoregressive conditional heteroscedastic (ARCH) processes are introduced in this paper. These are mean zero, serially not correlated processes with non-constant variances conditional on the past, but constant unconditional variances. For such processes, the recent data gives information about the one-period forecast variance. (Engle, 1982:1) The data is tested whether it can be modeled with ARCH (Auto Regressive Conditional Heteroskedastisity) Conditional mean can be formulated as followed (Nielsen, 2005: 3)

$$yt = x'tθ + εt, t = 1, 2, ..., T$$

Often xt includes lags of yt as well as dummies for special features of the market. The ARCH (1) (Auto Regressive Conditional Heteroskedastisity) model has a widespread practice for different cases, also specifies an equation for the conditional variance:

$$\sigma^2 t = E[\varepsilon_t^2 \mid It-1] = w + \alpha \varepsilon^2_{t-1}$$

To verify that $\sigma^2_t \geq 0$, it is required $w \geq 0$, $\alpha \geq 0$. If ε^2_{t-1} is high, the variance of the next shock, ε_t, is large. In the presence of ARCH, OLS is consistent but inefficient. (Jack, Kleijnen, 1: 2006)

A process ε_t is called white noise if ε_t is a sequence of independent, equally distributed random variables. It is often assumed that the white noise variables ε_t are normally distributed although this is not strictly necessary. We also assume that ε_t has zero mean and variance $Var(\varepsilon_t) = \sigma^2$ (Burke, 2011: 4) In the appendix are the Correlogram Squared results for ISGYO one of the major developers in the Turkish REIT market and REIT index log returns.

Table 1: Residual analysis: Correlogram Squared index log return RXGMYO

Date: 06/02/12 Time: 10:52
Sample: 15 3124
Included observations: 3110

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
|*** |	|*** |	1	0.354	0.354	389.52	0.000
|** |	|* |	2	0.305	0.206	680.13	0.000
|* |	| |	3	0.206	0.057	812.79	0.000
|* |	| |	4	0.127	-0.009	862.76	0.000
|* |	|* |	5	0.202	0.135	989.35	0.000

Table 2: Residual analysis: Correlogram Squared index log return RISGYO

Date: 06/02/12 Time: 10:58
Sample: 2 3124
Included observations: 3123

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
|** |	|** |	1	0.280	0.280	245.75	0.000
|* |	|* |	2	0.195	0.126	364.73	0.000
|* |	|* |	3	0.183	0.110	469.85	0.000
|* |	|* |	4	0.190	0.109	583.32	0.000
|* |	|* |	5	0.204	0.112	714.03	0.000

In addition to the log return modeling of Turkish REIT market residuals are also modeled with ARCH (Auto Regressive Conditional Heteroskedastisity) the results are presented below. ARCH(1,0) is used for the model.

Table 3: ARCH result of RISGYO

Dependent Variable: RISGYO
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 06/02/12 Time: 11:05
Sample (adjusted): 2 3124
Included observations: 3123 after adjustments
Convergence achieved after 8 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(2) + C(3)*RESID(-1)^2

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.000401	0.000475	0.845081	0.3981
		Variance Equation		
C	0.000677	1.39E-05	48.57861	0.0000
RESID(-1)^2	0.302454	0.021206	14.26280	0.0000

R-squared	-0.000004	Mean dependent var	0.000343
Adjusted R-squared	-0.000004	S.D. dependent var	0.031152
S.E. of regression	0.031152	Akaike info criterion	-4.198251
Sum squared resid	3.029703	Schwarz criterion	-4.192443
Log likelihood	6558.569	Hannan-Quinn criter.	-4.196166
Durbin-Watson stat	2.015827		

Table 4: ARCH result of RXGMYO

Dependent Variable: RXGMYO
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 06/02/12 Time: 11:17
Sample (adjusted): 15 3124
Included observations: 3110 after adjustments
Convergence achieved after 10 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(2) + C(3)*RESID(-1)^2

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.000524	0.000349	1.501631	0.1332
		Variance Equation		
C	0.000385	8.12E-06	47.38651	0.0000
RESID(-1)^2	0.375401	0.022302	16.83287	0.0000

R-squared	-0.000313	Mean dependent var	8.97E-05

Adjusted R-squared	-0.000313	S.D. dependent var	0.024537
S.E. of regression	0.024541	Akaike info criterion	-4.711956
Sum squared resid	1.872434	Schwarz criterion	-4.706128
Log likelihood	7330.092	Hannan-Quinn criter.	-4.709864
Durbin-Watson stat	1.895252		

The Turkish REIT industry model is studied in this paper and the summary result for both index and ISGYO one of the largest REIT in Turkey are given below.

RISGYO = 0, 000401+ε_t ε_t = 0, 000677+0, 302454 (ε_t^2)

RXGMYO = 0, 000524+ε_t ε_t= 0, 000385+0, 375401 (ε_t^2)

4. CONCLUSION

The key elements for success in construction projects are life cycle management and stakeholders. This is controlled in order to minimize the risks of the project. Despite the steady growth in different markets, as a result of the economic and political instability in the surrounding countries, the Turkish construction sector encounters with a high volatility, which requires adopting reliable risk management strategies, techniques and tools from the shareholder's wealth and project life cycle perspectives. In this paper, the methodology for this process is analyzed. Furthermore a Heteroskedastic research is provided in order to measure the success of the Turkish construction developers that is correlated with construction risk management.

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