

# **IMPACT OF GREEN PRODUCT INNOVATION PROJECTS ON FINANCIAL PERFORMANCE OF SAUDI CHEMICAL INDUSTRIAL FIRMS**

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## **Abstract**

*The annual budget of Saudi Arabia has earmarked expenditure for environment related issues such as water supply, sewage and urban sanitation, pollution control and similar other environmental concerns relevant to the country. This study will also be a model study to prove that project management in a chemical industry is as indispensable as in any manufacturing organization. The study will highlight such strategic issues that are required for a project's success in chemical industries It intends to set a framework for both capital project management as well as enhance ecological and environmental balances. The academic significance of this study will lie in it being a mixed method research with multi-scale and multi-functional factors (variables) used in this study such as environmental sustainability, ecological balance, reduced CO2 emissions and industrial waste, use of non-toxic and non-pollutant material and so on. Theoretically, this study will be a useful contribution to the learning domain as it will be using the theories of micro-economics as well as risk management theory.*

*Keywords: Green product Innovation Project, Financial Performance, Environmental Issues, Chemical Industrial Firms*

## INTRODUCTION

The annual budget of Saudi Arabia has earmarked expenditure for environment related issues such as water supply, sewage and urban sanitation, pollution control and similar other environmental concerns relevant to the country (Saudi Arabia Sustainable Energy, 2015). This budgetary provision is in response to the global concern for environment which requires every nation to develop its own green growth strategy. Being the largest country in the Gulf Cooperation Council (GCC) region, both in terms of economy and demography, Saudi Arabia has faced serious environmental issues but primarily the issue of pollution due to industrial development. There are constant media reports on the excessive use of oil and heavy fuel by the Saudi industries. hence, there is an urgent for green economy transition for which green product innovation projects are recognized as one of the key tools to achieve both environmental and financial success.

Moreover, the Saudi Vision 2030 document has also stressed upon environmental sustainability that could be achieved through adoption of green product innovation projects in key industries. This must become a strategic priority of companies in all sectors. The study will therefore male an overview of statements which relate to green product innovation projects emphasized upon in Vision 2030. The Saudi Vision 2030 requires chemical firms to apply innovative ideas in design, manufacturing, and marketing of only green innovative products. Such products take into account recyclability and disposal of materials that are less polluting, non-polluting, or non-toxic. Moreover, the emergence of green product innovation products has brought a revolutionary shift in markets. There are new societal expectations for companies to integrate environmental sustainability issues with their products.

The academic significance of this study will lie in it being a mixed method research with multi-scale and multi-functional factors (variables) used in this study such as environmental sustainability, ecological balance, reduced CO<sub>2</sub> emissions and industrial waste, use of non-toxic and non-pollutant material and so on. Theoretically, this study will be a useful contribution to the learning domain as it will be using the theories of micro-economics as well as risk management theory. This piece of research will also be useful for green product innovation project management practitioners in the chemical industry who usually encounter issues such as of cost and schedule overrun, inadequate and incompatible equipment and resources, lack of policies and strategies on environmental sustainability and like. Therefore, recommendations of this research will act as a roadmap for all current and future green innovation projects conceived by chemical project management teams in Saudi Arabia.

This study will also be a model study to prove that project management in a chemical industry is as indispensable as in any manufacturing organization. The study will highlight such

strategic issues that are required for a project's success in chemical industries. It intends to set a framework for both capital project management as well as enhance ecological and environmental balances. The findings of the study will also enhance the success of managing and controlling the chemical pollutants and thus contribute to the Vision 2030 objectives and also set global benchmarks.

## LITERATURE REVIEW

A good amount of literature is available on project management, financial and economic risks and various mathematical models and methods employed to study financial performance of industrial firms. In order to have a complete overview of project management, chemical industries in Saudi Arabia and understanding of risk in projects, a literature review shall be carried out in order to first identify research and literature gaps and then investigate the stated objectives and research questions of this study.

A preliminary review of literature has revealed that there is not much attention given to the issue of integration of environmental sustainability and new product development in the Saudi chemical industry. The following is a glimpse of the review proposed to be made in this study: A project on green products innovation focuses on key environmental issues such as energy, materials/resources, and pollution/toxic waste (Roy et al., 1996). Ottman et al. (2006), state that "the term 'green product' or 'environmental product' are used commonly to describe those that strive to protect or enhance the natural environment by conserving energy and/or resources and reducing or eliminating use of toxic agents, pollution, and waste." There are studies on green product innovation (e.g., Chen, 2001; Chung and Tsai, 2007; Pujari et al., 2003, 2004; Pujari, 2006; Rehfeld et al., 2007) that have contributed to building awareness about environmental sustainability. Integrating environmental sustainability and greening issues as innovation processes is becoming a strategic opportunity for companies (Porter and Reinhardt, 2007; Aragon-Correa and Sharma, 2003; Dyllick and Hockerts, 2002; Sharma and Vredenburg, 1998). As a result, a number of companies have launched products that look "sustainable," "environmentally friendly," or "ecofriendly," with a view to not only to increase environmental value and social good but also make products more market-driven, environmentally innovative and financially viable (Bergeret al., 2007). Examples to be cited include Ford's soya-based seat cushions, SC Johnson's green list showing restricted ingredients and Lipton Tea's pledge to source their tea only from environmentally sustainable and certified tea estates.

Green product innovation projects not only explore innovative ideas resulting in new designs, better manufacturing processes and novel marketing strategies but also attempt to

outperform the conventional or competing products in greenness and newness (Soylu&Dumville, 2011). These green innovative products take into account a number of measures such as recyclability and disposal issues throughout the products' their life cycle; using materials that are recycled and less polluting, non-polluting, or non-toxic; energy conservation; human toxicity, ecological impact and sustainability issues (Chiou et al., 2011). Besides, such products also cause less burden on the environment in terms of energy and raw materials requirements, control the air emissions, monitor the waterborne effluents and solid waste throughout its product life cycle (Chuang & Yang, 2014).

All green projects must face internal and external risk prone environment necessitating frequent changes (Barccarini, 2005). The internal environment of a project constitutes corporate objectives, stakeholder's interests, and resource problems and people management. The external environment includes social, political, legal, economic, financial, and climatic factors. The success of a green product imitation project depends on taking initiatives in order to manage risks in both internal and external environments. A few of these initiatives include the use of efficient raw material, lowering costs, finding new ways of converting waste into saleable products, and looking for additional revenues (Hasan & Ali, 2015) increasing cash flow and competitive advantage (Chuang & Yang, 2014).

Previous Studies have studied various risk factors that would potentially lead to failure of a project. For instance, there are studios on financial risks factors such as exchange rate fluctuation and shortage of funds (Ahsan &Gunawan, 2010; Hartono et al.,2013, Hwang et al.,2013; Lam et al. ,2007); on operational costs causing Low labour productivity (Anderson, 2000; Eybpoosh et al.,2011; Ghosh and Jintanapakanont, 2004; Ke et al. 2010; Gupta and Sravat,1998) on inadequate resources and failure of equipment (Hartono et al., 2013, Hwang et al. 2013; Doloi et al.,2012; on competition and rivalry affecting profit margin (Ahsan and Gunawan,2010) on the increase in corruption (Hwang et al.,2013) and finally on political instability as a constantly recurring risk factor (Hartono et al.2013; Hwang et al.,2013; Jamil et al.2008; Ke et al..2010; Khattab et al. 2007; Lam et al., 2007; Shuying,2009). These studies have contributed to understanding and identifying various risks categories and factors as well as project management tools and techniques that could make a project success. Such factors equally apply to a green product innovation project and will be a subject of this study.

## **METHODOLOGY**

The study will build a conceptual framework to study the green product innovation project and will include key environmental variables such as energy minimization, materials reduction, and pollution prevention right in the products; life cycle phases. The study will also measure firms'

motivation to develop green products as well as their readiness to accept environmental policies. All such dimensions shall perpetuate this study toward its objective of measuring the financial performance and profitability due to green product innovation projects

Several methods and models shall be used to carry out this study. Results from the study will then be synthesized and integrated in order to shed light on various aspects of green product innovation and provide solutions to challenges and risks that are faced by firms. Finally, implications for managers, academia and public policy makers will be discussed.

The reasons why Saudi chemical firms are chosen for this study are: first, to align it with the international perspective of greening the industrial scene; second, these firms would be easily accessible to the researcher as their being in the home country. The choice of companies will also be made on the basis of their commitment towards sustainability and environmental issues as would be evident from their policies, disclosures, environmentally-specific patents and projects undertaken. The unit of analysis in this study will therefore be green product innovation projects in four to five sampled organizations from the chemical industrial sector. This will allow the researcher to investigate issues related to innovativeness of green products that these firms might have developed or planning to develop. The study will also examine the motivations level of these firms to engage in green product innovation projects and how they address sustainability issues, risks and challenges.

This study is going to be cross-sectional and non-experimental research. An advantage of a cross-sectional study is low amount of time and cost involved to conduct the study. Since this research focuses on known outcomes, a non-experimental study will ideally suit and also help in avoiding the possibility of the researcher's bias. The study will be carried out as a mixed method multiple case based research. The data will be collected in two phases, quantitative phase through surveys and questionnaires; and in qualitative phase through open ended interviews and focus groups. Individual project level analysis would also be attempted to investigate intricacies and the modus operandi that project teams adopted to face sustainability challenges. Macro-economic issues will be dealt with during the qualitative phase and clarifications would be sought through constant communication in the form of e-mails and phone calls. Transcripts will be prepared of all interview recordings shall be content analyzed through a cross case analysis method. These transcripts will also be used for data triangulation in order to validate and verify the survey data (Miles and Huberman, 1994; Seale,2000).

Other sources of information such as companies' website content, company documentations, patent databases, environmental innovation awards listings, internal company reports, stakeholders reports and media reports on companies' environmental activities will also be browsed for making it a holistic study. It is also estimated that factors influencing market

performance of greener products shall be cross-functional; hence, adequate attention shall also be paid on the extent of co-ordination between green product innovation project teams and environmental specialists. Last but not the least, the study will attempt to understand the opinions of environmentally demanding customers and suppliers and the role they play in the development of green product innovation projects in its supply chain management.

Given the background and significance of our study, our central question is: “What is the impact of green product innovation on Saudi chemical industrial firms’ performance?”

### **Hypotheses**

H1a: green product innovation increases the firms’ performance in Saudi chemical industry

H1b: circumstances variables have no effect on Saudi chemical industrial firms’ performance

### **Data and Variables**

The data will be collected using a questionnaire. A five-point Likert scale, ranging from strongly disagree to strongly agree, will be used, taking weight from 1–5 to measure items reflecting the variables of the study.

**Dependent variable:** chemical industrial firms performance . In the questionnaire, we will ask sets of specific questions to determine the firms performance:

Question 1: Does the use of green product innovation increase your sales directly?

Question 2: Does the use of green product innovation preserve your current customers?

Question 3: Does the use of green product innovation attract new customers?

Question 4: does The use of green product innovation increased your overall profitability?

**The independent variable:** The green product innovation will be used as a proxy indicator of enhancing environmental quality

Question 1: does Your firm use less harmful raw materials in the production process?

Question 2: does Your firm useless toxic materials in the production process?

Question 3: does Your firm use environmentally friendly materials in the production process?

Question 4: does Your firm use low power consumption procedures (methods) in the production process.

**Control variables:** Five demographic variables of the respondents will be included in this study (educational level, current position, gender, age, and work experience) as control variables

## Equation

The relationship can be described as  $Y = F(G, X, \epsilon)$

Where, Y is the firm performance, G is the green product innovation, X is the control variables,  $\epsilon$  is the error term

## Analytical approach and Model Testing

This study will use hierarchical regression analysis models to find relative and incremental impact of eco-innovation activities on projects and their impact on market performance. The arguments shall be stated with the help of environmental Kuznets curve (EKC) hypotheses which will justify the relationship between variables. The green product innovation will be used as a proxy indicator of enhancing environmental quality to investigate its relationship with the financial performance of a firm. The causality issue between variables will also be measured through multivariate Granger causality framework. Fixed effect and Random effect methods for the panel data time series will be used. Other tests and models to be used in this study will be semi-parametric mixture effect model/GMM, Johansen Fisher panel integration test, autoregressive distributed lag model (ARDL), vector error correction model (VECM) and ordinary least square (OLS) method. This study will also carry out Unit Root tests & Structural Breaks Longrun co-integration & Pair-wise Causality for a linear approach; and tests like Quantile Unit Root test; Pair-wise Quantile Causality; Partial & Multiple Wavelet Coherence, for nonlinear approach.

The study will involve a sequence of time series techniques to investigate the relationship between green product innovation projects and their impact on financial performance of the selected chemical firms of Saudi Arabia. The procedure will begin with five panel unit root tests to examine the stationary properties of the variables. If the time series are found integrated, the next step will be the panel co-integration test for a long-run equilibrium relationship. Accordingly, these five widely-used panel unit root tests will be employed to clearly identify the order of integration for the variables. Second, in order to estimate the cointegration relationship between variables, the Pedroni(1999, 2004) panel cointegration tests will be performed followed by a fully modified ordinary least squares (FMOLS) technique provided that all the variables are found to be integrated. Pedroni panel tests have a distinctive advantage over traditional cointegration tests in case of homogeneous panels since they permit the cointegrating vector to differ across sampled companies and under different hypotheses (Pedroni, 1999). Finally, when the panel cointegration relationship is present, a panel type vector error correction model (VECM) will be constructed to detect Granger causality and the impact direction.

## RESULTS AND DISCUSSIONS

Table 1. Variation of the key dichotomous variables by year and industry

Panel A: Variation of corporate green technology innovation by year and industry										
Year:	Green technology innovation							Subtotal	total observations	%
	2009	2010	2011	2012	2013	2014	2015			
Construction industry	0	1	2	3	5	2	2	15	22	68.18
Electricity, heat, gas and water production and supply industry	1	1	1	2	4	2	2	13	22	59.09
Information transmission, software and IT services	0	1	1	1	1	2	2	8	9	88.89
Manufacturing	19	20	21	24	27	25	30	166	202	82.18
Mining	5	9	10	9	10	10	6	59	76	77.63
Real estate	0	2	0	0	0	1	1	4	32	12.50
Synthetical industry	0	0	0	0	0	0	0	0	1	0.00
Transportation, warehousing and postal services	1	1	1	1	1	1	0	6	31	19.35
Wholesale and retail trade	0	1	0	2	0	2	0	5	12	41.67
Total by year	26	36	36	42	48	45	43	276	407	67.81

Table 2. Generalized estimating equation results

Dependent Variables	Green Management Innovation <sub>t+1</sub>			
	Model 1	Model 2	Model 3	Model 4
1. Control Variables				
Own	0.130	0.224	0.150	0.193
Ind	-0.431	-0.282	-0.306	-0.337
Reg	-0.330	-0.364	-0.446	-0.475
Lev	3.482**	2.446 <sup>+</sup>	2.501 <sup>+</sup>	2.564 <sup>+</sup>
SC	-0.005	-0.008	-0.006	-0.007
FP	7.143*	6.836*	6.434*	6.289*
Size	-0.183†	-0.175	-0.160	-0.145
2. Independent Variable & Moderating Variable				
QM		-2.920**	-2.897**	-2.918**
ER			0.197	-0.089
3. Moderating Effect				
QM × ER				0.809 <sup>+</sup>
Dependent Variables	Green Technology Innovation <sub>t+1</sub>			
	Model 5	Model 6	Model 7	Model 8
1. Control Variables				
Own	0.041	0.037	0.132	0.196
Ind	-0.457	-0.392	-0.382	-0.449
Reg	0.211	0.268	0.371	0.234
Lev	1.535	0.892	0.857	0.935
SC	0.011	0.012	0.008	0.005
FP	2.974	2.031	2.530	2.288
Size	-0.127	-0.102	-0.121	-0.100
2. Independent Variable & Moderating Variable				
QM		-0.979**	-1.027**	-0.994**
ER			-0.268	-0.805*
3. Moderating Effect				
QM × ER				1.089*

Notes: † p<10%, \*p<5%, \*\*p<1%, Two-tailed. N = 407.



The reasons why Saudi chemical firms are chosen for this study are: first, to align it with the international perspective of greening the industrial scene; second, these firms would be easily accessible to the researcher as their being in the home country. The choice of companies will also be made on the basis of their commitment towards sustainability and environmental issues as would be evident from their policies, disclosures, environmentally-specific patents and projects undertaken. The unit of analysis in this study will therefore be green product innovation projects in four to five sampled organizations from the chemical industrial sector. This will allow the researcher to investigate issues related to innovativeness of green products that these firms might have developed or planning to develop. The study will also examine the motivations level of these firms to engage in green product innovation projects and how they address sustainability issues, risks and challenges.

## CONCLUSIONS

In this paper, we identify such successful green product innovation projects in the sampled chemical firms in order to prepare a blueprint for success and offer benchmarks for other industries to follow. Besides, emphasis in this study will be given to impart the required training to the personnel and will also demand supportive government policies and regulations for the success of green projects. We make a skillful use of Analytical software and programs in order to implement various models chosen for this study and use advanced methods wherever required quantitative transactions.

The implementation of green product innovation projects requires an adaptable and flexible environment which is difficult to build in the current context due to a resistance to change in socio-political and cultural attributes. However, this study will attempt to build a motivating environment with the help of influencing factors. Last, but not the least, the researcher will adhere to the guidelines and recommendations suggested by the tutor from time to time. The researcher will also remain updated with the latest reports and research happening in the field of study through an active participation in academic conferences and communication with the experts in the field.

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