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The impact of strategic intelligence on firm performance and the mediator role of strategic flexibility: An empirical research in biotechnology industry

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Abstract
The main objective of this paper is to investigate the impact of strategic intelligence and its dimensions of (foresight, visioning, and motivation) on firm performance, and to examine the mediating role of strategic flexibility and its dimensions of (production flexibility, marketing flexibility and competitive flexibility) on such an impact in biotechnology industry firms. The statistical package for social sciences (SPSS) program and AMOS software were used to analyze and examine the hypotheses. After executing the analysis to test hypotheses; the research concluded that there are significant positive impacts of strategic intelligence on firm performance, positive impacts of strategic intelligence, on strategic flexibility, and positive impacts of strategic intelligence on firm performance in the presence of strategic flexibility as a mediator variable.

1. Introduction

Organizations are living in the era of changing environment that are characterized by globalization, computerization, information technology, and changing purchasing patterns. Competitive advantages are hard to be sustained and nothing is stable for long any more. Therefore organizations need to be flexible and act more intelligently with their environment; high firm performance comes from not only having timely and needed information about changing markets but understanding the implications or actions that are necessary as a consequence of this knowledge, (Javalgi, et al, 2005).

Strategic flexibility is an approach that allows organizations to deal effectively with a future they can predict, and to stake out a defensible market position in this uncertain and volatile marketplace. By this approach organization stay nimble in this environment.

The use of competitive intelligence can provide a differentiated and competitive focus for all areas of an organization, (Raynor, 2005).

Organizations need strategic intelligence to enhance and maintain their performance in the current information age in which knowledge is power (Haag, et al, 2007). Gathering information, and turning this raw data into intelligence through an exercise of human judgment is a fundamental aspect of business. By adopting flexible strategies in the

process of generating knowledge and intelligence, this will allow organizations to achieve competitive advantage and constant innovation to survive and prosper in the long term, (Laudon & Laudon, 2007)

2. Statement of the Problem and Questions

Due to the turbulent environment, globalization, changing purchasing patterns, and rapid changing environment, (Javalgi, et al, 2005); the problem of this research has been raised to study the impacts of strategic intelligence on firm performance in the presence of strategic flexibility as a mediator variable in biotechnology industry that is considered one of the industries that has very dynamic and turbulent environment.

Based on above, the main research question is would there be an impact of strategic intelligence on firm performance directly through strategic flexibility? Would it be the same as indirect relations?

3. Theoretical Review

This section describes the concepts of strategic intelligence, strategic flexibility, firm performance, and gives a clear mage about their dimensions and measurements.

3.1. Strategic Intelligence

Intelligence Levels**, (**Intelligentsia**),** is a collective term incorporating the various forms of intelligence that are identified for use within an organization, and include artificial intelligence, business intelligence, competitive intelligence, strategic intelligence, and knowledge management (Liebowitz, 2006). Liebowitz was so intrigued that many new forms of intelligence were emerging (artificial intelligence, business intelligence, competitive intelligence) that he sought a way to consolidate and synthesize the various types of intelligentsia into a meaningful framework.

Strategic Intelligence is the gathering, analysis, and dissemination of data relevant to strategic decision making, (Fleisher and Bensoussan, 2007).

Strategic intelligence is a system that consists of several dimensions that are essential to create clearer image about the future; these dimensions can be summarized as per (Maccoby, 2011) by the following dimensions, (Foresight, Visioning, Motivation)

Pellissier René, (René,2011) conducted a research with a title of " Study of strategic intelligence as a strategic management tool in the long-term insurance industry in South Africa", and the purpose of the research is to explore the extent to which strategic intelligence is utilized within the South African long-term insurance industry and whether it could be used to identify opportunities or threats within the global environment to remain competitive, create greater innovation, and corporate advantage.

The approach of this paper is to obtain the qualitative views and opinions of strategic decision makers, on an executive managerial level within the South African long-term insurance industry, on their organizations' use of strategic intelligence.

The findings of this research that there are marked differences in the conformity and usage of strategic intelligence and its components between the organizations surveyed, with a measurable difference between large and small organizations, however, it is generally viewed that the use of a strategic intelligence framework could greatly enhance decision making.

3.2. Strategic Flexibility

The concept of strategic flexibility is manifested in several disciplines .Although the definitions of strategic flexibility vary from researcher to researcher, they are not markedly different.

(Sanchez, 2000) defines strategic flexibility as "firm abilities to respond to various demands from dynamic competitive environments". (Lau, 1996) defines strategic flexibility as follows: "Strategic flexibility refers to a firm's ability to respond to uncertainties by adjusting its objectives with the support of its superior knowledge and capabilities".

(Abbott & Banerji, 2003) measure strategic flexibility by three subcategories: marketing flexibility, production flexibility, and competitive flexibility, This classification has been used throughout this paper.

3.3. Firm Performance

Significant problem happens during the measurement of firm's performance outcomes to reach consensus on suitable measures of performance. In this paper, we confine our attention to performance at the level of the firm. While a range of financial indicators have been suggested as measures of performance. The most common financial measurements may include return on assets, return on investment, return on equity, sales growth, gross profit, and new wealth creation. Non-financial performance measurements may include market share, customer retention and sales growth, (Kroeger, 2007).

Sales growth

The amount a firm derives from sales compared to a previous, corresponding period of time in which the latter sales exceed the former. Sales growth is considered positive for a firm's survival and profitability.

Profitability

Profitability is universally recognized as a measure of business success. Given that entrepreneurship has been defined as the creation of gains through innovation where rents are defined as above average earnings relative to competitors (Gitman and Zutter, 2012), then profitability measures are particularly appealing.

4. Hypotheses Development

The following hypotheses are developed:

H_{01}: There is a statistically significant impactof strategic

intelligence, (foresight, visioning, and motivation) on firm performance at biotechnology industry.

H_{02}: There is a statistically significant impactof strategic intelligence on strategic flexibility in biotechnology industry.

H_{03}: There is a statistically significant impact of strategic flexibility on firm performance, (sales growth and profitability) at biotechnology industry.

H_{04}: There is a statistically significant impact of strategic intelligence on firm performance at biotechnology industry through the presence of strategic flexibility.

5. Research Methodology

This section will review the research methodology, and delineate how it will be undertaken.

5.1. Research Model

The strategic flexibility is named as a mediator variable in this model, although it has been tested also as dependent and independent variable in testing the hypotheses, but it was called mediator as the main objective is the impact of strategic intelligence on firm performance through strategic flexibility, as depicted in Figure (1).

5.2. Research Population and Sample

Biotechnology industry is a technology based on biology - biotechnology harnesses cellular and bimolecular processes to develop technologies and products that help improve our lives and the health of our planet. We have used the biological processes of microorganisms for more than 6,000 years to make useful food products, such as bread and cheese, and to preserve dairy products, (Greenwood, 2013).

Functional managers in biotechnology industry are responsible to control the resources and have the authority over the organization to ensure that goals and objectives are aligned with the organizations overall strategy and vision.

The population of interest for this research is the 19 biotechnological firms in China, Spain, Jordan, Germany, and USA comprises of the purposive sample of five functional managers as a unit of analysis to form 95 managers as shown in Table (1), and by using the equation of Uma Sekran, (Sekaran, 2003, P194). We got simple random sampling of 78. A total of 65 completed questionnaires have been returned back at a response rate of 68%

5.3. Research Tools

For the sake of collecting data that are needed to accomplish the research objectives, the researcher collects the Secondary data from the records of previous studies, theses, articles, Journals, and the specialized books. Questionnaires have been used as a tool to gather primary data. Primary data and secondary data were needed to complete the empirical side of the research.

In the questionnaire the researcher aims to let the respondents aware of the research objectives, clearness, homogeneity, and its precision in order to assure that questions and answers were more accurate and free of ambiguity.

5.4. Statistical Treatment

In the data analysis, the researcher discuss how the data will be analyzed, and give a clear answers about the research questions and testing hypotheses, in order to satisfy all of these requirements the following statistical techniques:

- Cronbach's (alpha) coefficient to measure the internal consistency.
- Standard deviation and means have been used to answer the research questions.
- Simple and multiple regression analysis with F test using ANOVA tables to modeling the relationship between a scalar dependent variable and one or more explanatory variables and in the same time to test the variances.
- Percentage and frequency to test importance and weight.
- Path analysis: using AMOS software to describe the directed dependencies among a set of variables, in order to identify the impact of strategic intelligence on firm performance through strategic flexibility.
- Relative importance, assigning due to:

$$\text{Class Interval} = \frac{\text{Maximum Class} - \text{Minimum}}{\text{Number of Intervals}}$$

$$\text{Class Interval} = \frac{5-1}{3} = 1.33$$

Therefore, we can specify the ranges of relative importance as per Table (2)

5.5. Validity and Reliability

The questionnaire has been built into 58 items; 17 items for the independent variables, 27 items for the mediator variables, 8 items for the dependent variables and 6 items for demographic variables. The items have been reviewed by a group of selected committee in variety of management sciences in order to add value from their endure expertise to validate that it measures what it designed to measure, that make the questionnaire valid and objective.

Cronbach's α (alpha) was used as a coefficient of internal consistency. It is commonly used as an estimate of the reliability of a psychometric test for the respondent. Cronbach's alpha test was conducted, at a minimum acceptable level (Alpha ≥ 0.67). As shown in Table (3).

6. Results

6.1. Descriptive Statistics of the Demographic Characteristics

The questionnaire tool that was used in the research comprised demographic characteristics in the first section which include: Age, Gender, Education Level, Specialty, Years of experience in current position, and Years of experience in biotechnology.

As shown in Table (4), the results of the descriptive

analysis for the demographic variables of respondent sample which shows that (73.3 %) of respondents age varies between 39 to 49 which is an indication that young age is an area of focus in biotechnology industry. If we have a look also to the gender statistics we found that (84.6 %) of respondents are male which is very logical result due to the nature of work in biotechnology industry, since it is required to spend more than (50 %) of the time travelling. Whereas (50.8 %) of respondents had master degree, that is considered as an indication of the high education level which is required in such kind of industry. With regards to the years of experience in biotechnology industry, it was noticed that (47 %) of respondents have above 15 years which is an indication of the stability in this industry and if we compare this demographic with the years in the current position we realized that the highest contribution percent to less than 5 years and this is an indication of the number of opportunities and the diversity of job offerings in this industry.

6.2. Descriptive Statistics of the Research Variables

The researcher here analyze the importance level of research dimension in biotechnology industry and that by examining the mean, standard deviation, item importance, and level of importance for each dimension.

Table (5) shows the highest mean for the dimension of strategic intelligence is visioning with arithmetic mean (4.10) and standard deviation (0.81). While foresight takes the second rank at arithmetic mean (4.05) and standard deviation (0.88). while , motivation get the lowest rank at arithmetic mean (3.96) and standard deviation (0.93).whereas for strategic flexibility dimension, the marketing flexibility score the first rank at arithmetic mean (4.37) and standard deviation (0.62), production flexibility at arithmetic mean of (4.30) and standard deviation (0.76), and then competitive flexibility at arithmetic mean of (4.10) and standard deviation (0.70). Finally, Firm performance is considered high at arithmetic mean (3.87) and standard deviation (0.91).

6.3. Hypotheses Testing

Hypotheses One

In order to test this main hypothesis, multi regression has been used to ensure the significant impact of strategic intelligence, (foresight, visioning, and motivation) on firm performance, as shown in table (6) the multiple correlation coefficient, R, and its square, R^2. Multiple correlation coefficient $R = 0.81$ indicates that there is a strong correlation between the observed firm performance and those predicted by the regression model. In terms of variability in firm performance accounted for by our fitted model, this amounts to a proportion of $R^2 = 0.67$ that means 67 % of firm performance changeability result from the changeability in strategic intelligence dimensions.

The "ANOVA" part in Table (6) provides an F-test for the null hypotheses that is there is no impact of strategic intelligence, (foresight, visioning, and motivation) on the firm performance, or in other words, that R2 is zero. Here we can clearly reject this null hypothesis (F = 41.302, Sig = 0.00 at level $\alpha \leq 0.05$), and so conclude that at least one of foresight, visioning, and motivation is related to firm performance, in other word accept the hypothesis:

There is an impact of strategic intelligence, (foresight, visioning, and motivation) on firm performance in biotechnology industry at level ($\alpha \leq 0.05$).

Hypothesis Two

As shown in Table (7) the multiple correlation coefficient, R, and its square, R^2. Multiple correlation coefficient $R = 0.90$ indicates that there is a strong correlation between the observed firm performance and those predicted by the regression model. In terms of variability in strategic flexibility accounted for by our fitted model, this amounts to a proportion of $R^2 = 0.82$ that means 82 % of strategic flexibility changeability result from the changeability in strategic intelligence dimensions.

The "ANOVA" part in Table (7) provides the F-test for the null hypothesis that is there is no impact of strategic intelligence, (foresight, visioning, and motivation) on the strategic flexibility, or in other words, that R^2 is zero. Here we can clearly reject this null hypothesis ($F = 96.325$, Sig = 0.00 at level $\alpha \leq 0.05$), and so conclude that at least one of foresight, visioning, and motivation is related to strategic flexibility, in other word accept the alternative hypothesis:

There is an impact of strategic intelligence, (foresight, visioning, and motivation) on strategic flexibility in biotechnology industry at level ($\alpha \leq 0.05$).

Hypothesis Three

As shown in Table (8), the multiple correlation coefficient, R, and its square, R^2. Multiple correlation coefficient $R = 0.84$ indicates that there is a strong correlation between the observed firm performance and those predicted by the regression model. In terms of variability in strategic flexibility accounted for by our fitted model, this amounts to a proportion of $R^2 = 0.71$ that means 71 % of firm performance changeability result from the changeability in strategic flexibility dimensions.

The "ANOVA" part in Table (8) provides an F-test for the null hypothesis that is there is no impact of strategic flexibility, (marketing flexibility, production flexibility, and competitive flexibility) on firm performance at biotechnology industry, or in other words, that R^2 is zero. Here we can clearly reject this null hypothesis ($F = 49.742$, Sig = 0.00 at level $\alpha \leq 0.05$), and so conclude that at least one of marketing flexibility, production flexibility, and competitive flexibility is related to firm performance, in other word accept the alternative hypothesis:

There is an impact of strategic flexibility, (marketing flexibility, production flexibility, and competitive flexibility) on firm performance in biotechnology industry at level ($\alpha \leq 0.05$).

Hypothesis Four

In order to test this hypothesis, the researcher used path analysis to investigate the impacts of strategic intelligence, (foresight, visioning, and motivation) on firm performance, (sales growth and profitability) at biotechnology industry

through the presence of strategic flexibility as a mediator. Bootstrapping in Amos software has been used to study the effects of the mediator variable.

Figure (2) and Table (9) show the unmediated effect of strategic intelligence impacts on firm performance, to see if there are direct effects between strategic intelligence dimensions on firm performance and wither these paths in Figure (4.3) are significant or not.

Table (9) shows the p values ($\alpha \leq 0.05$), which are basically told us about the significant between strategic intelligence dimensions on firm performance, so it is clearly shown that all paths in Figure (4.3) are significant, and that is important in order for us to establish wither there is a mediation or not, we need to have direct effect to be mediated so it is like precondition.

Figure (3) shows the mediation analysis for the presence of strategic flexibility variable, and here we can study indirect effect of the strategic flexibility variable on firm performance.

As shown in Table (10), we have p values again that are significant ($\alpha \leq 0.05$) for the indirect effect of strategic intelligence dimensions on firm performance though the strategic flexibility variable, in other word we can say that we have mediation and this will reject the null hypothesis and accept the alternative hypothesis that is:

There is an impact of strategic intelligence, (foresight, visioning, and motivation on firm performance, (sales growth and profitability) at biotechnology industry through the presence of strategic flexibility as a mediator, ($\alpha \leq 0.05$).

7. Conclusion and Implications

Successful integration of strategic intelligence to the firm's strategic flexibility is essential to improve biotechnology industry ability to grow and create wealth. The managers increasingly perceived importance of foresight, visioning, motivation, production flexibility, marketing flexibility, and competitive flexibility to search for opportunity as drivers head to increase business performance and value creation. Thus, throughout this research, we sought to explore whether each of these dimensions is valuable in securing improved performance in biotechnology industries.

This research reveals the firm performance of biotechnology is very good in term of units sales growth and market share growth due to the high investment, viability of resources, and the strong demand on its products. Further, political and security instability can create positive impact on the existing and potential entrepreneurs since most of biotechnology products have an essential role in the forensic application.

The firms under the research have shown difficulties in monitoring the external environment changes to encourage the effective communication among managers and formulating team works.

The firms face challenges to introduce new products and in the same time keep the rapid response to customer needs, and adjusting prices to suit the international requirements.

The firms enjoy the ability to use the strategic intelligence dimensions, (foresight, visioning, and motivation) in facing future complications, the direction of business and to encourage employees to contribute in decision making and bear on responsibilities.

Top management in the companies under the research have shown an importance of dynamism in the current international market, and have several approaches to produce different types of products to be more flexible with the quantity of the finished goods inventory.

Proceeding from conclusions that we have extracted from the theoretical model and the statistical results, the researcher come up with the following recommendations:

1 Firms should focus more on the strategic intelligence concept in the top management level and that by performing specific courses to reinforce the culture of strategic intelligence in decision making and improve firm performance.
2 Firms should promote and encourage all initiative employees and emphasize on utilizing new technology.
3 Fast response to customer needs in terms of quantity and quality to make the competition irrelevant.
4 Perform SWOT analysis to be sure that they are in the right strategic position.
5 Develop several pricing strategies that suit the international requirements and take in consideration the economical, technological, social and political factors.

Appendices

Appendix A: List of Figures

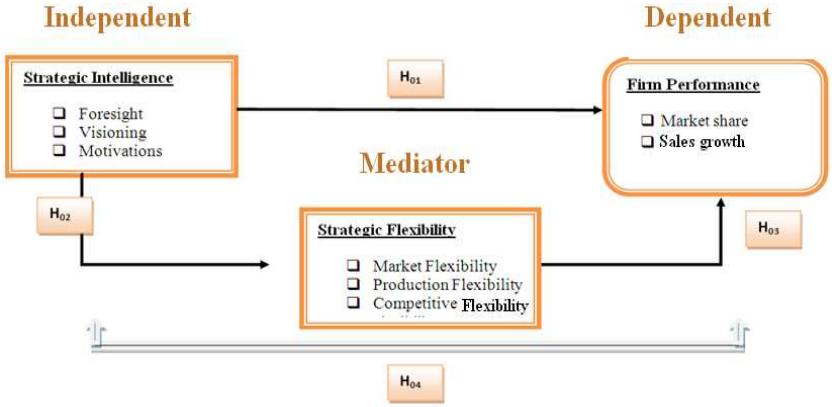

Figure (1). *Research Model*

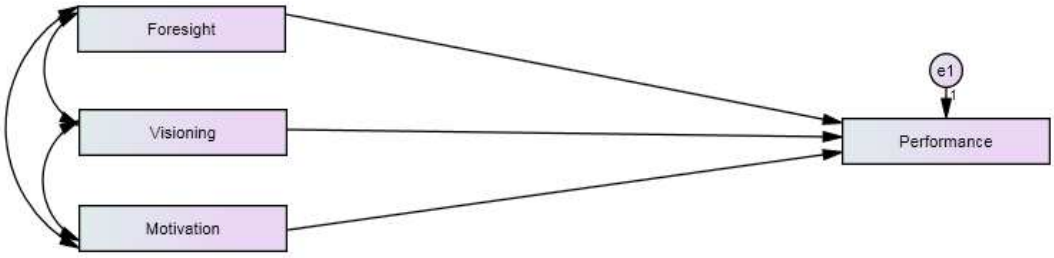

Figure (2). *The unmediated analysis of strategic intelligence on firm performance*

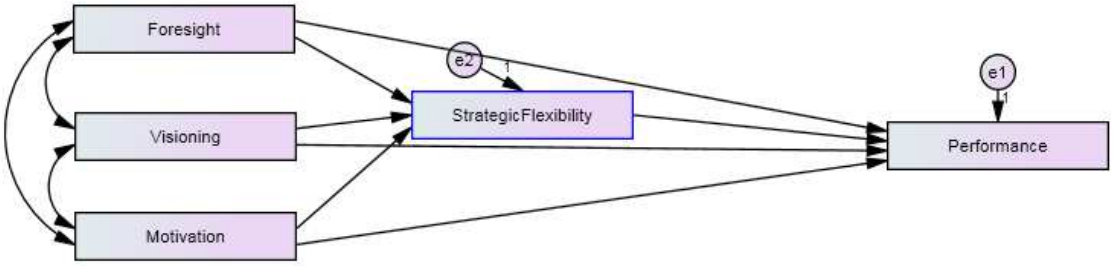

Figure (3). *Mediation effect of strategic flexibility between strategic intelligence and firm performance*

Appendix B: List of Tables

Table (1). *Research Population*

#	Firm Name	Website	Country of Origin	Number of respondents
1	Qiagen	www.qiagen.com	Germany	5
2	Lifetechnologies	www.lifetechnologies.com	USA	5
3	Kern	www.kern-sohn.com/en	Germany	5
4	Axygen	www.corning.com	Germany	5
5	Seratic	www.seratic.com	Spain	5
6	Retsch	www.retsch.com	Germany	5
7	AmniSure	www.amnisure.com	USA	5
8	Cellistis	www.cellistis.com	Germany	5
9	Ibsogen	www.ibsogen.com	France	5
10	Gene	www.nx-gene.com	Jordan	5
11	Al taawon	www.taawon.me	Jordan	5
12	Al Faiha	www.sahoury.com	Jordan	5
13	Dragon	www.dragon.com	China	5
14	Applichem	www.applichem.com	Germany	5
15	Scharlau	www.scharlau.com	Spain	5
16	Promega	www.promega.com	USA	5
17	IntegenX	www.integenx.com	USA	5
18	EviScan	www.eviscan.com	Germany	5
19	Rose	www.rose-gentec.com	China	5
Population				95

Table (2). *Relative importance*

Degree Level	Importance Level
Low Degree	1 – Less than 2.33
Medium Degree	2.33 – 3.66
High Degree	3.67 – above

Table (3). *Cornbach's Alpha test*

	#	Dimension	Cornbach Alfa value
Strategic Intelligence	1	Foresight	0.86
	2	Visioning	0.88
	3	Motivation	0.93
Strategic Flexibility	4	Production Flexibility	0.91
	5	Marketing Flexibility	0.87
	6	Competitive Flexibility	0.89
Firm Performance			0.92
Total			0.89

Table (4). *Demographic variables of the sample*

#	Dimension	Category	Frequency	Percent
		20-29	12	18.5
		30-39	23	35.4
1	Age	40-49	24	36.9
		Above 49	6	9.2
			Total= 65	Total= 65
		Male	55	84.6
2	Gender	Female	10	15.4
			Total= 65	Total= 65
		Bachelor	24	36.9
		Master	33	50.8
3	Education	High Diploma	7	10.8
		Doctorate	1	1.5
			Total= 65	Total= 65
		Management Sciences	5	7.7
		Financial Sciences	15	23.1
4	Specialty	Biotechnology Sciences	36	55.4
		Engineering Sciences	9	13.8
			Total= 65	Total= 65
		Below 5	23	35.4
		5-9	18	27.7
5	Years of experience in current position.	10-14	8	12.3
		Above 15	16	24.6
			Total= 65	Total= 65
		Below 5	4	6.2
		5-9	14	21.5
6	Years of experience in biotechnology	10-14	16	24.6
		Above 15	31	47.7
			Total= 65	Total= 65

Table (5). *Summary of arithmetic mean, SD, and importance level of all dimensions*

#	Dimension	Mean	Std Deviation	Importance Level
1	Foresight	4.05	0.88	High
2	Visioning	4.10	0.81	High
3	Motivation	3.96	0.93	High
4	Production Flexibility	4.30	0.76	High
5	Marketing Flexibility	4.37	0.62	High
6	Competitive Flexibility	4.10	0.70	High
7	Firm Performance	3.89	0.91	High

Table (6). *Multiple regression analysis to test the results of the impacts of the strategic intelligence on firm performance*

Model	Dimension	R	R^2	β	ANOVA	
					F	Sig*
Strategic Intelligence	Foresight	0.81	0.67	0.338	41.302	0.000
	Visioning			0.498		
	Motivation			0.015		

Table (7). *Multiple regression analysis to test the results of the impacts of the strategic intelligence on strategic flexibility*

Model	Dimension	R	R^2	β	ANOVA	
					F	Sig*
Strategic Intelligence	Foresight	0.90	0.82	0.304	41.302	0.000
	Visioning			0.553		
	Motivation			.094		

Table (8). *Multiple regression analysis to test the results of the impacts of the strategic flexibility on firm performance*

Model	Dimension	R	R^2	β	ANOVA	
					F	Sig*
Strategic Intelligence	Marketing flexibility	0.84	0.71	0.323	49.742	0.000
	Production flexibility			0.392		
	Competitive flexibility			0.185		

Table (9). *Direct effect of strategic intelligence on firm performance*

	Foresight	Visioning	Motivation
Performance	0.00	0.007	0.032

Table (10). *The indirect effect of strategic intelligence on firm performance*

	Foresight	Visioning	Motivation
Strategic Flexibility	…	…	…
Performance	0.004	0.001	0.028

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