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CONTINGENCY FACTORS AND PERFORMANCE OF RESEARCH AND DEVELOPMENT (R&D): THE MODERATING EFFECTS OF GOVERNMENT POLICY

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ABSTRACT

The empirical studies investigating a direct relationship between Strategy, Organizational structure, Financial aspect and Performance of Research and Development (R&D) have attracted criticisms, including the use of a bivariate methodology. While this relationship is critical to organizations using Strategy, Organizational structure, Financial aspect, the critics suggest that other factors will effect on the relationship between Strategy, Organizational structure, Financial aspect and Performance of Research and Development (R&D). In this article, the authors propose that dimensions of Government policy are important moderators on relationship between Strategy, Organizational structure, Financial aspect and Performance of Research and Development (R&D).

Keywords: Strategy, Organizational structure, Financial aspect, Performance of research and development (R&D), Government policy.

1. INTRODUCTION

After the first elections in Iraq 2005, the new government started new programs for reconstructions of higher education with special assistances from World Community. There has been an increased interest in providing all potentials in drawing a new policy for R&D in all higher education sectors to be consistent with the present stage being the reconstruction phase [1, 2]. In addition, this program led to activating a new draft of law for the scientific research, and the mechanism of contracting with production and service institutions. They also promoted agreements

on development and cooperation with developed universities besides twinning with universities in developed countries such as; the USA, UK, EU countries, Russia, China, Japan and several other countries. Thus, according to the data General Directorate of R&D in Iraqi Ministry of Higher Education, the number of R&D units in higher education in 2010 is 267 units, number of patents from 2003 -2010 is 95, number of pioneering projects was 113 in 2004 and in 2008 is 160, the number of journals is 273 in 2009, the number of researchers was 5645 in 1990 and in 2007 is 7420 [3].

The government later allocated substantial financial grants from developed countries to the R&D in Iraq. Universities were given freedom for making joint research and project in any field of R&D activities inside and outside of the country to develop and reconstruct Iraq. Despite all the efforts to restore normalcy and important R&D, it is only below the required level commensurate with the importance of research and development in the modern history of higher education. With regard to spending on research and development, we note a clear fluctuation in spending due to the instability of the Iraqi situation for example in 1990 was 4.0 Milan ID, and in 2000 was 321 Milan ID, in 2005 was 1167.2. There are also many researchers and academics whose involvement in the affairs of scientific research confirmed that R&D in Iraq has a great deal of importance in the development of not only universities, but the joints of all life, and there must be additional efforts to give the strategic role to the R & D system [2, 4]. This demonstrates the importance of studying the factors affecting the performance of research and development.

2. CONTINGENCY FACTORS

A few studies gave explicit attention to the contingency perspective for R&D activities [5]. Consequently, the present research will review the previous studies by taking into consideration the factors that have been contented. It is worth mentioning here that some studies discussed only two factors or more at once.

2.1. Strategy

The direction and scope of an organization over the long-term: which achieves advantage for the organization through its configuration of resources within a challenging environment, to meet the needs of markets and to fulfill stakeholder expectations [6]?

Johnson, et al. [6] defined strategy as the direction and scope of an organization over the long-term: which achieves advantage for the organization through its configuration of resources within a challenging environment, to meet the needs of markets and to fulfill stakeholder expectations [6]. Cockburn, et al. [7] pointed out that strategy refers to top management's plans to develop and sustain competitive advantage [7]. However, these definitions have many implications related to the concept of strategy, generally the implications stress on the following: what is the organization trying to do and get to in the long -term (this point refers to direction and plan)? Which fields or markets is the organization focusing on and what types of activities are involved in markets or fields (refers to markets, scope)? What are the organizations' needs to stay, develop and to be able to compete (this refers to physical and human resources)? What are the external, environmental factors that affect organizations ability to compete the rivals (this refers to environment)? What are

the values and expectations of those who have power and influence in and around the organization (this already refers to the stakeholders). The Contingency Theory especially in research of management accounting showed the effects of environmental factors (that Contingency Theory tries to interpret) on the strategy of the firm and the relationships between strategy and other variables like structure, uncertainty, size, performance, etc., in the shadow of Contingency Theory [8-14]. The relationship between strategy and R&D, consequently have been discussed by many studies, Hofer [13] pointed out that when the rate of change in environment is rapid, firms should focus on R&D efforts (strategies) to increase the new product designs and product improvements. When it decreases, they should focus on process implementation improvements. In this regards, the firms have four broad R&D strategies which to pursuer successfully, these are: fits to market, following the leader, application engineering and me too Hofer [13].

Linking R&D performance with the strategy determines the position and future of any organization through the fulfillment of competitive advantage, irrespective of the type of an organization. Thus, R&D has a strategic role and must be aligned and linked to the components of strategy and the performance of R&D in the level of organization as a whole [15-18].

2.2. Organizational Structure

Formal relations for reporting, levels of management, and the span of control in the organization as well as showing the departmentalization of work in an organization from an individual through departments to the organization as a whole [19]. Miles [20] defined organizational structure as follows; 'structure is generally expressed in terms of the division and specialization of work and the methods of coordination and control' [20]. Miles thought this definition tried to show that the terms of division and specialization indicate as to how the organization divides the work and allocate resources of the activities of these units.

At the same time, coordination and control refer to the way the working parts are articulated to accomplish both general and specific organizational goals [20]. Nedelko and Potocan [19] stated the implications of organizational structure in organizations as the following: organizational structure defines formal relations for reporting, levels of management, and the span of control in the organization as well as showing the departmentalization of work in an organization from an individual through departments to the organization as a whole.

Organizational structure has a crucial role in R&D performance and management. Therefore, many studies tackled the subject from myriad angles, including the macro and micro economic levels of the firm, unit or project [21]. Researchers pointed out that the structure is a major driver of R&D success [5, 17]. The type of structure has a basic role in the performance of R&D for example: Brown, et al. [22] stated if the organizational structures are less hierarchic and less rigid than the traditional type; the structure will be more supportive for the improvement of R&D performance.

According to Brock [23], autonomy can be defined as " the degree to which one may make significant decisions without the consent of others and can treated as individual autonomy or organizational autonomy " (P. 58). In that context to measure the organizational structure of R&D units, Birkinshaw, et al. [24], used autonomy as the dimension to measure the organizational

structure of R&D units. For this purpose, they developed the scale by using four items to measure the structure beside the dimension of integration in the organizations of 15 large Swedish multinational firms. Chung, et al. [25] referred to the significant influence of the organizational structure on the performance of R&D. They found that the Australian universities were subjected to environmental changes. The latter consisted of globalization pressure, acceleration of modern technology service, commercialization and innovation. Such developments were imposed on universities to focus on the suitable organizational structure that meets the needs and that reflects the diversity and changes in the environment. Thus, the structure is assumed to be of greater (lesser) autonomy to academic units. The study found a weak relationship between the organizational structure in terms of autonomy and performance.

2.3. Financial Aspect

This factor has many dimensions in effecting R&D, one is related to the investment and expenditure of R&D, second is related to the system of incentives and compensation structure of R&D and the third tackles the controls of R&D. The expenditure on R&D represent a fundamental engine for productivity and growth both at the macro and micro economic level, in other words, the improvement of R&D performance by interested financial side will reflect in the performance of the firms (making competitive advantage or in terms high productivity and growth). In this context, R&D investment plays an important role to determine the future of firms by creating competitive advantage; this role has paid a huge attention to the funding and investment of R&D activities [26, 27].

Hambrick and Macmillan [28] referred to five factors that affected the innovation (the outcomes of R&D performance) (1) technological opportunity, (2) scale and R&D experience of business, (3) market linkages, (4) manufacturing suitability, and (5) organizational structure and culture. They determine the problem of investment in R&D and the payoff, they referred that the nature of R&D has urged the inventers in R&D to have risk and the lag between pay off and investment. However, Ortega-Argiles and Voigt [29] pointed out that the changes of environment and changes strategies like economic crises play a big role to increase or decrease of R&D expenditure and investments. They claimed that spending on R&D is almost always suffering from recession periods, as well as the impact of controversy by the literature.

They referred to the report issued by OECD that showed spending on R&D and innovation is often one of the first investments to be cut in a recession. The facts of funding and investments in R&D activities are continuous, whether in the level of state, firms, universities and individuals due to the important R&D in the life of society. For instance, according to the annual R&D Scoreboard, by the British government's Department of Trade and Industry, the top 600 international companies raised R&D spending by 4 per cent to \$300bn (£193.5bn) in 2000, while their combined operating profits fell by 52 per cent to \$368bn. In spite of industries that suffered poor market conditions, such as information technology, telecommunications and media, increased spending on R&D in 2001 [30]. Moreover, in 2000s, global R&D expenditure totaled \$729 billion and R&D has millions of workers in the activity worldwide, with the U.S.A alone employing 1

million R&D workers. These numbers refer to the significance of R&D activities throughout the world [31-33].

Concerning the relationship between funding and R&D performance in universities, a few studies have discussed this relation; these include the following: Payne and Siow [34] showed the effects of federal research funding on 68 research universities. They referred to the role of government agencies for supporting and funding R&D in universities, taking into account the positive results of R&D activities in universities. The results of their study showed that the causal effect of the federal R&D funding on universities is difficult to detect.

So, the study of Sutton and Brown [35] represents a good attempt to study in depth the relationship between controls and performance in universities. Such has rarely been researched by many scholars; especially, in the context of universities. Moreover, much of the studies focused on private sector even though they used R&D activities in their application, such studies include the following; [8, 36-38]. Furthermore, in the developing countries, such a subject has been tackled very rarely whereas no attempt has applied to the Iraqi research units. Consequently, the present research tries to bridge the gap by focusing on the financial aspects and on the influence on performance.

3. PERFORMANCE OF RESEARCH AND DEVELOPMENT (R&D)

The performance is the result of strategies the firm employs to achieve market-oriented and financial goals [39]. The R&D can be defined as: A set of activities resulting from the use of mental abilities which are used in a scientific and logical way to create necessary knowledge to sustain and develop various organizations. This requires three stages: first, creating ideas (basic research); second, transferring ideas into action (applied research), and third, developed practice (development). Thus the scope R&D in Iraqi education system involved the three basic of R&D types (Basic, Applied, and development) and most of the R&D activities in terms of projects are control and managed by the General Directory of R&D in the system of Ministry of Higher Education and Scientific Research [3].

Universities have a vital role in R&D activities, and it's a main source of knowledge in all disciplines. Thus, subject of performance of R&D in universities and research centers has been of a great importance and there a lot of attempts have been tested to determine R&D activities in universities; for example: Payne and Siow [34] offered an example to measure activities of R&D in American universities. They depended on output of universities as indicators to measure R&D [34]. Carayol and Matt studied the performance of R&D activities depending on production of university researches [40].

Many studies have been conducted in different countries by using several techniques. See for example: [41-45], especially in developed and developing countries [46-49] and a few belong to Iraq [2, 50, 51]. In addition, many studies focused on the concept of knowledge as a source to R&D activities in universities and research centers [52, 53].

The results of R&D activities mostly appear in the long run due to the factor of uncertainty that is accompanied with the nature of R&D [54-59]. The problems of performance measurements are related to the main part of the measurement system that is controlled. However, one should know

how to use a suitable control to ensure the proper performance measurement to R&D by the system [16, 37, 54, 60]. Moreover, these studies were regarded as cornerstone for next studies that focused on the methods of research related to R&D research. These trends can be seen in study of [Driva, et al. \[61\]](#). They showed that a gap does exist between the measures recommended by the academics and those used in practice. The main difference lies in the fact that companies use basic time, cost and quality measures, whereas academics would like to see an increased use of customer-related measures at the design and development stages.

The final results and considerations referred to the use of BSC and study of measurement of R&D allowed the researchers to the evaluation of intangible concepts, necessarily composed of more than one indicator, that provide information on both quantitative and qualitative aspects of R&D; in the case, one aspect that could bear a certain relationship not only to economic and financial resources, but also with variables of human resources, personal attitudes, behavior and aptitudes in the organization, in respect of the performance of R&D activities [59] (see also the same line of study, [Bremser and Barsky \[62\]](#). From the discussion of the literature of performance R&D, one can see many trends and attempts to show performance measurement foundations, systems, related design problems and best means to obtain desirable measurement and assessment results in various industries. Also these efforts have not reached acceptable method or suitable system of performance for all states. This indicated the problems about performance measurement of R&D and the nature of R&D [16]. Therefore, many approaches or methods have shortcomings.

Thus, the current study is a modest contribution to finding some sort of solutions for the problems of performance of R&D activities in universities and the variables that affect it. It indicates the gap in that literature, especially the limited and unique studies that have discussed and tackled the measurement of R&D performance and the effect of contingency factors on the performance of R&D in universities in developed countries and in Iraq [63] even in developed countries [40].

4. GOVERNMENT POLICY

Government policy, positions and guidelines of government, schemes and incentives and support systems for the different sectors, and particularly for the Universities in Higher Education [3, 64, 65].

Many recommendations have emerged from the studies deliberate efforts are still needed on the part of governments, through its series of efficient policies affecting Universities to nurture a climate that is conducive to successful operations of Universities [64, 66].

Previous empirical studies on the relationship between government policy and Performance of Research and Development (R&D) have mainly concentrated in developed countries. These studies provide strong evidence that suggests government policies are associated with the Research and Development (R&D) of developed countries.

Although most of the empirical studies have centered in developed countries, findings of an increasing number of studies have suggested that government policy also influenced the Performance of Research and Development (R&D) in developing countries [3, 64, 65]. For example government policy can behave an entrepreneurial role to impact the creation of a

sustainable R&D factors. It also can act an entrepreneurial role to impact the creation of a land infrastructure conditions to support Universities [67].

The results of previous studies [68, 69] indicate that countries in transition (Iraq, for example) need to take some specific measures to establish the conditions to promotion of Research and Development (R&D) activities and for Universities to create opportunities to R&D in different sectors. The results of studies [3, 65-67] also indicate that in the absence of sturdy promotion of Research and Development in these countries transitional, the Government must to play a decisive role to create those conditions.

In addition, the previous studies underlined that government policies have an impact on Research and Development (R&D) activities, linkages and networking in order to cooperation and utilizing resources [70-73]. Theoretical and empirical studies [65, 74, 75] have shown government policy that seems to be more consistent in influencing the activities of the Research and Development (R&D).

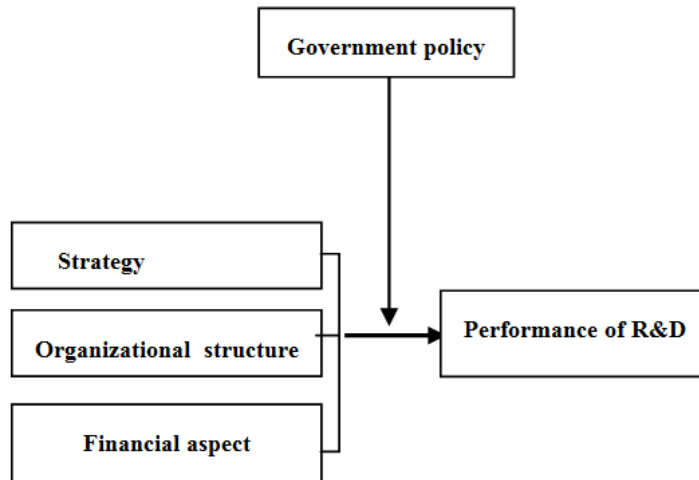
In developed and developing countries, government policies that provide support are a critical factor for Research and Development (R&D) activities [67]. Although the relevance of the government policies few studies have examined them in the context of Research and Development (R&D) activities in Universities.

Although no empirical test of the moderating role or government policy in relationship between Contingency factors and Performance of Research and Development (R&D) is found in the literature, the available empirical evidence shows that the effects of Contingency factors on Performance of Research and Development (R&D) might be moderated by the turbulent environment. This indicates that government policy can be a unique resource that supports Contingency factors directed at achieving superior Performance of Research and Development (R&D) in Universities. As to the direction of this relationship i.e. whether government policy leads to better Performance, evidence exists which demonstrate that it is the development of government policy that contributes to the Universities's Performance of Research and Development (R&D) and not the other way round. Within this framework, the previous studies provide evidences to support perceived government policy as a moderator for the relationship between Contingency factors and Performance of Research and Development (R&D). As well as it provides a solid ground those support the existence of a relationship between government policy as a moderator adoption Contingency factors, and Performance of Research and Development (R&D).

5. CONTINGENCY FRAMEWORK

Figure (1) depicts the research framework investigated in the current study. The model describes the influencing mechanism of Contingency factors on Performance of Research and Development (R&D) and considers the role of Government policy in the mechanism. It shows how the dimensions of Contingency factors (i.e., Strategy, Organizational structure, Financial aspect) influence the aspects of Performance of Research and Development (R&D), and how the Government policy moderate these relationships. Based on their underlying rationale, the following sections present the detailed hypotheses related to these relationships

Figure-1. Proposed Theoretical Framework



In order to exam the proposed relationships between Contingency factors such as Strategy, Organizational structure Orientation, and financial aspect, and Performance of Research and Development (R&D), current study developed the following propositions:

- 1: The Performance of Research and Development (R&D) will vary with the choice of Contingency factors adopted.
- 2: The government policy complexity of product will moderate the relationship between Contingency factors and the Performance of Research and Development (R&D).
- 3: The government policy complexity of process will moderate the relationship between Contingency factors and the Performance of Research and Development (R&D).

6. CONCLUSION

This study was found the Relationship between relationship between Contingency factors and the Performance of Research and Development (R&D). Conceptually, the study indicate the Performance of Research and Development (R&D) vary with the choice of the Contingency factors (i.e., Strategy, Organizational structure, Financial aspect) they adopted. This is significant for at least three parties, i.e. customers, companies and the relevant authorities' bodies, to strategize on containing the existence of the effect in Universities by accordingly controlling the selected factors.

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