The Impact of Structural Capital on Product Innovation : An Empirical Study on Dental Technology Laboratories in Capital Amman.

Prepared by

Laila Wael Hamad

Supervisor

Dr. Younes A.A Megdadi

Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Business Administration

Faculty of Business
Middle East University

2011

DELEGATION

I hereby "Laila Wael Hamad" entrust the Middle East University (MEU) to provide copies of this thesis for university libraries or institutions or bodies concerned with research and scientific studies upon request.

Name: Laila Wael Hamad

Signature: 

Date: 26 / 7 / 2011

DISCUSSION COMMITTEE DECISION

This thesis was discussed with a title of:

"The Impact of Structural Capital on Product Innovation: An Empirical Study on Dental Technology Laboratories in Jordan"

It was approved in 26/07 / 2011

Dr. Yunes A.A Megdadi	Head and Supervisor	Middle East University
Dr. Daher Al-Qurashi	Memebr	Middle East University
Dr.Reyad Ahmad Abazid	External Examiner	Amman Arabic University

GRATITUDE AND APPRECIATION

Praise be to God for inspiring me with ambition and patience, and giving me strength and will to complete this thesis.

I would like to express my sincere and heartfelt thanks for my supervisor Dr. Younes A.A Megdadi, who did not spare his effort or advice for the enrichment of my work, and for the distinguished members of the discussion committee, for sparing time to read this thesis.

I also extend my thanks and gratitude for my distinguished university "Middle East University", represented by the officials and the members of teaching staff, and to all who helped me during the time of preparation of this modest work.

"Gratitude is when memory is stored in the heart and not in the mind"

DEDICATION

I dedicate this modest work to.....

The man who guided me with his wisdom,…my example of all times…*FATHER* …

The woman who overwhelmed me with her love and affection… my inspiration of all times…*MOTHER*...

My biggest treasure… my most precious source of pride… and the soul of my existence…*LAITH*…

The best thing that ever happened to me… my soul mate … *MOHAMMED* …

And to all who helped and inspired me throughout this journey….

Table of contents

Subject	Page
Delegation	B
Discussion Committee Decision	C
Gratitude and Appreciation	D
Dedication	E
Table of Contents	F
List of Tables	H
List of Figures	J
List of Appendixes	J
Abstract	K
Chapter One: Study General Framework	1
(1-1): Introduction	2
(1-2): Study Problem Statements	4
(1-3): Study Objectives	5
(1-4): Study Significance	6
(1-5): Study Hypothesis	7
(1-6): Study Limitations	8
(1-7): Study Difficulties	9
(1-8): Study Terminology	10

Chapter Two: Theoretical Framework and Previous Studies	13
(2-1): Introduction	14
(2-2): Knowledge	14
(2-3): Knowledge Management	18
(2-4): Intellectual Capital	22
(2-5): Structural Capital	26
(2-6): Innovation	29
(2-7): Arabic and Foreign Previous Studies	30
(2-8): Differences Between Current Study and Previous Studies	43
Chapter Three: Method and Procedures	44
(3-1): Introduction	45
(3-2): Study Methodology	45
(3-3): Study Population and Sample	46
(3-4):Study Model	47
(3-5): Demographic Variables of the Study Sample	48
(3-6): Study Tools and Data Collection	50
(3-7):Statistical Methods	52
(3-8): Reliability and Validity	52
Chapter Four: Analysis Results and Hypothesis Test	54

(4-1): Introduction	55
(4-2): Study Variables Descriptive Analysis	55
(4-3): Study Hypotheses Testing	62
Chapter Five: Results and Recommendations	73
(5-1): Introduction	74
(5-2): Results	74
(5-3): Recommendations	79
List of References	81
First: Arabic References	82
Second: Foreign References	83
Appendixes	88

List of Tables

Chapter/ Table No.	Subject	Page
(3-1)	**Description of demographic variables of sample members**	48
(3-2)	**Reliability coefficient for the study factors(α)**	53
(4-1)	**Means and standard deviations for the study sample responding for the Database factor**	55
(4-2)	**Means and standard deviations for the study sample**	57

	responding for the information system factor.	
(4-3)	**Means and standard deviations for the study sample responding for the patents factor.**	58
(4-4)	**Means and standard deviations for the study sample responding for the product innovation strategy factor.**	60
(4-5)	**Model Summary for structural capital and product innovation**	63
(4-6)	**ANOVA test for structural capital and product innovation**	63
(4-7)	**Coefficients test of structural capital and product innovation**	64
(4-8)	**Model summary for database and product innovation**	64
(4-9)	**ANOVA test for database and product innovation**	65
(4-10)	**Coefficients test for database and product innovation**	65
(4-11)	**Model summary for information systems and product innovation**	66
(4-12)	**ANOVA test for information systems and product innovation**	67
(4-13)	**Coefficients test for information systems and product innovation**	67
(4-14)	**Model summary for patents and product innovation**	68
(4-15)	**ANOVA test for patents and product innovation**	69
(4-16)	**Coefficients test for patents and product innovation**	69
(4-17)	**ANOVA analysis for the differences in impact of structural capital on product innovation strategy due to experience**	70

(4-18)	ANOVA analysis for the differences in impact of structural capital on product innovation strategy due to education	71
(4-19)	ANOVA analysis for the differences in impact of structural capital on product innovation strategy due to career center	71

List of Figures

Figure No.	Subject	Page
(1-3)	Study Model	47

List of Appendixes

Appendix No.	Appendix Title	Page
1	Questionnaire Arbitrators	89
2	Study Tool (Questionnaire)	90

The Impact of Structural Capital on Product Innovation Empirical Study on Dental Technology Laboratories in Capital Amman

Prepared by
Laila Wael Hamad

Supervisors
Dr.Younes A.A Megdadi

Abstract

The main objective of this study was to analyze the impact of structural capital on product innovation strategy in the Jordanian dental technology laboratories in Amman. The study sample consisted of (450) dental technicians working in Jordanian dental technology laboratories, which included senior technicians, their assistants, and trainees.

In order to achieve the objectives of the study, the researcher developed a questionnaire consisting of (43) paragraphs to gather the primary information from study sample.

The statistical package for social sciences (SPSS) program was used to analyze and examine the hypotheses. The study used many statistical methods. After executing the analysis to study hypotheses; the study concluded a number of results, mainly the following:

1- The major aspect of database can be summarized as knowledge accumulation environment, and the database can contribute in the high level of accuracy, and high speed of work accomplishment with low cost.

2- Information systems are highly functional in human capital, which could be determined by the pathway of information processing within the labs to direct and organized the day work activities, in order to speed up the work and achievement in the laboratory.

3- There is a limited amount of patents used, this lack is related to culture and organizational factors , which can summarize the lack of believes in human ability and capacity to contribute and innovate in the personal level. Besides, there is a lack of opportunists for financial support, and a limited ground to conduct development researches.

4- The dental Technology industry has obvious limitations because of its nature , and the high costs of conducting development research to invent new material.

5- Existence of a significant impact of structural capital on the product innovation strategy.

6-There was no significant impact of structural capital on product innovation strategy of dental technology laboratories in Jordan, due to demographic variables.

After finding these results, the researcher recommended the following:

1- Conducting further research in the area of dental technology, to find the relationship between the leadership style and innovations.

2- The importance of sustaining human capacity building in laboratories, to create human infrastructures which could contribute to the innovation process.

3- The importance of experience exchange with leading international companies, in the dental technology industry, to find-out creative potentials and develop the skills of employees.

Chapter One
Study General Framework

(1-1): Introduction

(1-2): Study Problem statements

(1-3): Study Objectives

(1-4): Study Significance

(1-5): Study Hypothesis

(1-6): Study Limitations

(1-7): Study Difficulties

(1-8): Study Terminology

(1-1): Introduction

Knowledge being the new engine of corporate development has become one of the great clichés of recent years, but there is no doubt that successful companies tend to be those that continually innovate, relying on new technologies and the skills and knowledge of their employees rather than assets such as plants or machinery. Value can be generated by intangibles not always reflected in financial statements and forward-looking companies have realized that these are an integral part of fully understanding the performance of their business **(Marr, Schiuma and Neely, 2002)**

Intellectual Capital is a broad concept which is often split into different categories, most commonly human, relational and structural capital **(Marr, Schiuma and Neely, 2003).**

Structural capital is defined as the knowledge that stays within the firm. It comprises organizational routines, procedures, systems, cultures and databases. Examples are organizational flexibility, a documentation service, the existence of a knowledge centre, the general use of information technologies and organizational learning capacity. Some of them may be legally protected and become intellectual property rights,

legally owned by the firm under separate title. **(Carmeli, and Tishler, 2004)**

Innovation is about responding to and creating change. It is about evolution and revolution, evolving into higher and newer planes, and leaping onto another wave of technology. Innovative organizations are futuristic, daring, and pioneers of social change.

Innovation management is a key core competency in an economy where cycles of change are more recurrent. As a core competency, it involves the ability to embrace and create change, take risks, accept failure as part of the experimentation process, and get from product concept to market in the shortest time. **(Castiaux, 2007).**

The proposed study aims *to discuss the tendency of the Jordanian dental technology laboratories for using structural capital as an essential asset to improve their innovation strategy and the impact of it on their success and superiority.*

(1-2): Study Problem statements

Due to the practical experience in the dental technology field, the researcher noticed that only few dental technology laboratories tend to really understand the importance and the role of structural capital in the process of product innovation. The problem of this study can be explained by answering the following questions:

Question One: To what extent do the Jordanian dental technology laboratories practice structural capital in the overall process and operations?

Question Two: Do Jordanian dental technology laboratories use structural capital as a vital asset in their product innovation process and what improvements occurred as a result of that?

Question Three: Do the Jordanian dental technology laboratories realize the real benefits and importance of structural capital in their product innovation strategies?

Question Four: Does structural capital asset really improve the product innovation strategies and how?

Question Five: What are the barriers of using the structural capital as an essential asset?

(1-3): Study Objectives

This study seeks to:

1- Change traditional concept and come to realize the importance of investment in structural capital in dental technology laboratories.

2- Carry out the strategy of structural capital for later-developing dental technology laboratories and to obtain later-developing profit by investment and transfer of structural capital.

3- Integrate educational resources, reinforce educational investment and optimize initial stock of structural capital in Jordanian dental technology laboratories.

4-Enhance the appreciation and significance of investment in structural capital to revitalize old industrial bases.

(1-4): Study Significance

The importance of this study stands on the fact that structural capital should be practiced by Jordanian firms especially the dental technicians in dental technology laboratories because the actual manufacture of dental prosthesis is the last stage in a lengthy process that begins with scientific research to discover new products and to improve or modify existing products and techniques that have effect on millions of people, by fixing many dental health problems, and permitting many people to lead normal lives. The importance of this study consists of the following issues:

1st: Scientific prospect: appears in the lack of research and studies that explain the impact of investment in structural capital on product innovation strategies specifically in the domain of dental technology practice. The results of this study will act as a very important convincing factor for investment in structural capital as an essential asset.

2nd: Practical prospect: appears in examining interrelationships among structural capital components (databases, information systems, patents) and product innovation that will support believing in structural capital as a competitive differentiator in the dental technology domain. Thus

understanding the Relationship between structural capital and superior products, where it plays an important role in innovation that leads to success.

(1-5): Study Hypotheses

Based on the study problem and the literature review, the following research hypotheses are:

NHo1: There is no significant impact of structural capital (databases, information systems, patents) on product innovation strategy at a significant level of (α=0.005).

The researcher constructed the following sub-hypothesis :

NHo1-1 :There is no significant impact of databases on product innovation strategy at a significant level of (α=0.005).

NHo1-2: There is no significant impact of information systems on product innovation strategy at a significant level of (α=0.005).

NHo1-3 :There is no significant impact of patents on product innovation strategy at a significant level of (α=0.005).

NHo2: There is no significant impact of structural capital on product innovation strategy due to demographic characteristics (years of

experience, qualification, career center) at a significant level of (α=0.005).

(1-6): Study Limitations

This study underwent the following determinants:

Scientific limits:

This study was limited to determine the current reality about structural capital as an essential success tool, and the role structural capital plays in the product innovation in Jordanian dental technology laboratories. This was done through the identification of the importance of employment of structural capital, determination of the structural capital concept definition, and determination of the degree of practice for structural capital management processes in Jordanian dental technology laboratories in Amman.

Human limits:

This study was limited to Jordanian dental technicians in Amman , senior and trainees, who are working in the registered dental technology laboratories in Amman.

Spatial limits:

This study was limited to Jordanian dental technology laboratories in Amman, the capital city of Hashemite Kingdom of Jordan.

Time limits:

The collection of data for this study was during the second and summer semesters of the academic year 2010/2011.

(1-7): Study Difficulties

The following difficulties were determined as obstacles through the process of preparing this study:

1- Difficulty of obtaining specific confidential information from the selected sample.

2- Difficulty of getting sample cooperation in the process of filling the questionnaire.

(1-8): Study Terminology

The following is a review of different definitions of terms in the current study:

Intellectual capital:

(Baxter and Matear, 2004) states that intellectual capital is the group of knowledge assets that are attributed to an organization and most significantly contribute to an improved competitive position.

Structural capital:

Thomas (2008) defined structural capital as the knowledge that stays within the firm. It comprises organizational routines, procedures, systems, cultures and databases. It belongs to the company as a whole and can be reproduced and shared.

Innovation:

Oslo manual (2007) states that innovation is the implementation of a new solution aiming at enhancing its competitive position, performance, or its know-how. It may refer to incremental, emergent, or radical and revolutionary changes in thinking, products, processes, or organizations.

Patents:

According to the definition of the **World Intellectual Property Organization (WIPO)**, It is the right to entrust grants for invention, which is a product or process in which a new way for the work of something, or provide a technical solution to a new problem where it refers to an exclusive right granted to anyone who invents any new, useful, and non-obvious process, machine, article of manufacture, or composition of matter, or any new and useful improvement thereof, and claims that right in a formal patent application. Patent is the right to prevent others from making, using, selling, or distributing the patented invention without permission.

Database:

According to **(Coombs and Bierly ,2006)** databases are applications that manage data and allows fast storage and retrieval of that data when needed. The term database implies that the data is managed to some level of quality (measured in terms of accuracy, availability, usability, and resilience).

Information Systems:

LEV (2001) defined information systems as the means by which people and organizations, utilizing technologies, gather, process, store,

use and disseminate information, in a way that allows maximum use of knowledge and data.

Knowledge:

(Davenport and Prusak, 2000), defined knowledge as, "a fluid mix of framed experience, contextual information, values and expert insight that provides a framework for evaluating and incorporating new experiences and information and expert insight that provides a framework for evaluating and incorporating new experiences and information."

Knowledge management:

Bhatt (2001) states that knowledge management is a process which enables organizations to learn, create, develop and apply necessary knowledge.

CHAPTER TWO
THEORETICAL FRAMEWORK AND PREVIOUS STUDIES

(2-1): Introduction

(2-2): Knowledge

(2-3): Knowledge Management

(2-4): Intellectual Capital

(2-5): Structural Capital

(2-6): Innovation

(2-7): Arabic and Foreign Previous Studies

(2-8): Differences between Current Study and Previous Studies

(2-1): Introduction

With increased competition at the present time, many firms seek to gain competitive advantage that enables them to compete and survive in the market, In order to achieve this objective, there is an urgent need to develop structural capital and its components That can be used by the firm, according to the capabilities and resources and the market you are in.

Of course, the production of local dental technicians suffers from competition in the domestic and external markets which requires them to evaluate each of the requirements and drivers of structural capital, which is used in order to strengthen its competitive position or at least maintain the same level, and develop new affective innovation strategies. In order to enable the researcher to configure and build a clear picture on the subject of study, it will take up in this part of the study to clarify the concepts of the study and related literature

(2-2): Knowledge

Chatzkel (2003) suggested that using knowledge in business isn't necessarily about thinking up clever new products and services, or devising ingenious new ways of selling them. It's much more straightforward.

Useful and important knowledge already exists in your business. It can be found in:

- The experience of the workforce.
- Designs and processes for goods and services.
- Files or documents (whether held digitally, on paper or both).
- Plans for future activities, such as ideas for new products or services.

Chatzkel also clarified that knowledge is not detached from the people, processes, or infrastructure of an organization and its network. It is part of all of these things, and progressively a more pivotal part. The ability to mobilize knowledge resources has become even more critical than the ability to control and amass physical and financial resources.

According to Mokyr (2003), useful knowledge can be partitioned into two subsets: one is the knowledge that catalogues natural phenomena and regularities, which he calls propositional knowledge. The other is the knowledge that prescribes certain actions that constitute the manipulation

of natural phenomena for human material needs, which is called perspective knowledge.

Propositional knowledge contains what people usually call “science” as a subset, but at the same time it contains a great deal more than science. Propositional knowledge also contains practical informal knowledge about nature; an intuitive grasp of basic mechanics; regularities of nature and even things as informal as folk wisdoms etc.

Perspective knowledge has the form of techniques or instructions. They reside either in people’s brains or in storage devices. They consist of designs and directions for how to adapt means to a well-defined end. They can all be taught, imitated, communicated, and improved upon. A “how-to” manual is a codified set of techniques. An addition to the perspective knowledge set of a society would be regarded as an “invention”.

Gupta (2000) stated that communication tends to emphasizes simply making it easier to send information from person to person. The people still need to organize the communication links in ways that fit in with their work practice.

Communication system thus provides access to known sources of knowledge. Thus a person must know both the kind of knowledge needed and where to get it and then choose the communication system to do this.

Knowledge sharing goes beyond communication as it provides additional support by ensuring that people have just-in-time access to the latest information, and that communications systems are specialized in ways that make it easy to use this information.

The most common quoted advantages for knowledge sharing include:

1- **Creating newer and better products and services**: Here ways of combining information are evaluated to see if new products and services can be easily produced.

2- Experience transfer: Here information is stored as to how individual tasks were done in the past.

3- **Organizational learning**: Here information is kept about how things were done in the past.

4- **Transactional knowledge**: This is knowledge about where knowledge is. Here directories are developed on where to find knowledge.

Kurdi (2004) , suggested that The efficiency in the exercise of professions and jobs is a composite work of a mixture of skill, experience, knowledge and behavior control within the limits of the required controls in the work and Monitor the efficiency of follow-through in the work force, which results in obtaining management satisfaction and acceptance , and since the other phase is the conduct of the organization with such efficiency through encouragement and support, that will lead to motivation and development of continuity and creativity that will lead the individual to perform his work in good form because of having the skill, experience and knowledge.

(2-3): Knowledge Management

Knowledge management is an impressive, multidisciplinary and controversial concept. Knowledge Management enables the existing individual knowledge to be captured and transformed into organizational knowledge, which in turn must be diffused and shared by many employees. These employees use this knowledge but they also create new individual, which becomes organizational and so on. Knowledge Management is also the management of organization s knowledge that

can improve many features of organizational performance so as to be more intelligent acting . Gupta *(*2000).

One of the annoying trends in the current practice of knowledge management arena is that the concepts of knowledge, information and even data tend to be used almost interchangeably throughout the literature and praxis. For example, the management of information captured on organization's databases is often considered as an example of organizational knowledge and knowledge management. Information and data management are important pillars of knowledge management. However, knowledge management encompasses broader issues, in particular, such as creation of processes, environment and behaviors that allow people to transform information into the organization and create and share knowledge.

Thus, knowledge management needs to encompass people, process, technology and culture. Moreover, organizational databases and connectivity do not guarantee the sharing of information over time (K.Kakabad,2001).

Typically, as Davenport and Prusak (1998) have explained, data is a simple observation of states of the world Information and endowed with relevance and purpose, where knowledge is valuable information from the human mind. Knowledge builds upon information that is extracted from data. In contrast to data that can be characterized as a property of things, knowledge is a property of agents predisposing them to act in particular circumstances. Information is that subset of the data residing in things that activates an agent through the perceptual or cognitive filters. In contrast to information, knowledge cannot be directly observed. Its existence can only be inferred from actions of agents.

A comprehensive survey of the German TOP 1000 and European TOP 200 companies showed that knowledge capital, in all of its forms (human, relational and structural) helps to achieve the goals of a company. Structural capital can best be used to increase innovation ability, increase of product quality, reduction of goals, increase of effectiveness and customer satisfaction (Mertins , 2001). According to Battersby (2004), most firms have recognized that the key benefits of KM are increased efficiency and quality. They realized that the work will be carried out faster and more cheaply due to the re-use of knowledge by appropriate methods.

Ng (2005) mentioned that KM could achieve operational excellence. This is because all the employees can share their knowledge and this will translate lessons learnt for internal as well as global application, for example, sharing mistakes made to avoid the similar mistakes in the future. Besides that, KM can enhance customer responsiveness such as providing consistent and professional service standards to the customers. Moreover, KM can make employees to be more innovating when they are sharing their knowledge. A number of new ideas will be generated in their knowledge - sharing sessions which will lead to superior structural capital possession.

In designing a KM strategy, there are quite a few different approaches and tools depending on the resources (human, financial, technological) ,and the type of knowledge wanted to be captured and shared.

Often referred to as a knowledge inventory, a knowledge audit assesses and lists an organization's knowledge resources, assets and flows. It is a critical component of any KM strategy, and often the first step in designing one.

There is a saying that "you can lead a horse to water, but you cannot make it drink". Successful KM requires the development of a "grass root

desire among employees to tap into their company's intellectual resources" (Hauschild et al., 2001). In order to build a knowledge-based enterprise, incentive systems should be focused on criteria such as knowledge sharing and contribution, teamwork, creativity and innovative solutions. (Yahya, and Goh, 2002) stated that such systems should reward risk-taking attitudes and emphasize group-based compensation to build a strong infra structure of structural capital.

(2-4): Intellectual Capital

Since the 1980s the creators of the intellectual capital discipline have grappled with the significance of growing value of intangibles in organizations, in proportion to the traditional factors of production, financial capital and tangible resources. This growing gap in value could no longer be easily ignored. They tried to answer the question as to why organizations with basically the same financial, physical, and labor resources could produce quite different levels of value.

As the information age dawned, these gaps grew far more pronounced as new companies -with very little financial and physical resources began to have market capitalization value at much greater levels than other organizations that were heavily invested in equipment, had vast workforces, and sizeable financial capital reserves. All of the buildings,

desks, computers, and even cash reserves of companies like Microsoft accounted for only a small fraction of market value and did not explain the discrepancy between the book value of organizations and their market value. This raised major issues about, firstiy, how to determine valuations for these organizations, and secondly, how to manage these changing organizations in our rapidly changing times. (Marr, Schiuma, and Neely, 2003)

Sullivan (1998) mentioned that intellectual capital is comprised of human capital and structural capital. Its supplements include organizational capital, customer capital, supplier capital, and more. These terms are not new. What is new is the energy and commitment of organizations trying out the concepts surrounding intellectual capital to leverage ideas into value. Terms like intellectual asset management, intellectual property management, and knowledge management are frequently being interchanged as firms describe their new management focus. The cross-company confusion created by this emerging taxonomy does not prevent the advancement of the discussion of intellectual capital management or any of the other focused discussions regarding these terms. Though each of these terms is unique, they all concern the intangibles of an organization and how to better leverage and manage them for value.

According to Huseman and Goodman, (1997), intellectual capital creates the high market value in recent markets, and it has the top level impact in building the organization`s position and reputation. Structural capital in particular presents the explicit knowledge that is kept in the structures, systems, and procedures of the organization, and it holds all the values that stay in the organization when all the worker leave.

Skyrme (2003) , created the (ABBA) measurement system for measuring intellectual capital, the four approaches used in this system were as follows:

- Asset - valuing knowledge as an asset, potentially tradable.
- Benefits - focusing on the benefits of a KM program.
- Baseline - assessing KM effectiveness as a basis for year-on-year comparison.
- Action - focusing on performance measurement.

There are variants on such a classification. One is to separate out those assets protected by law . This includes trade-marks, patents, copyrights, licenses.

The point of classifying is to develop a set of measures that can be used to assess progress.

Whichever approach is adopted, a starting point is to divide intellectual capital into several categories. A typical classification is as follows:

1. Human Capital - that in the minds of individuals: knowledge, competences, experience, know-how etc.
2. Structural Capital - "that which is left after employees go home for the night": processes, information systems, databases etc.
3. Relationship (or Customer) Capital - customer relationships, brands, trademarks etc.

Structural capital is the most rigid one over all the other components of the intellectual capital, and that is referred to its non-dynamic variables which include: information systems, databases, and patents. (Gigg, 2002).

(2-5): Structural Capital

Structural capital is the most rigid one over all the other components of the intellectual capital, and that is referred to its non-dynamic variables which include: information systems, databases, and patents. (Gigg, 2002)

Examples of structural capital include the assets of the organization of information and accumulated experience, capabilities and innovative structural and technological and administrative skills.

Brynjolfsson, Hitt and Yang (2002) present evidence that production, in addition to capital and labor, depends on intangible assets like skills, organizational structures and culture. They also find that investments in these intangible assets are often large and provide benefits over very long horizons. All of these papers focus on complementariness between organizational capital and physical capital or labor.

Investments in structural capital seem likely to benefit the workforce because workers are unlikely to contribute in the manner these practices require unless they are assured a share of the gains (Osterman, 2000).

Knowledge Economy (Grant, 1996; Dean and Kretschmer, 2007) including structural capital is characterized by the economic globalization, advances of the technological domains, the progressive primacy of services sector, accelerated product cycles, and changes in the customer's needs and preferences. Hence, a new competitive dynamic is appearing (Johnson, Neave and Pazderka, 2002; Leitner, 2005; Díaz-Díaz, Aguilar-Díaz and De Saá-Pérez, 2008), in which firms give

increasingly importance to intangible resources and capabilities when they face competitors, recognizing that new knowledge and its effective implementation are key factors in achieving and maintaining competitive advantages (Galende, 2006). In this competitive arena, one of the best ways for reaching firm competitive advantage position comes directly from continuous technological innovations.

Structural capital includes such traditional things as buildings, hardware, software, processes, patents, and trademarks. In addition, structural capital includes such things as the organization's image, organization, information system, and proprietary databases. Because of its diverse components, structural capital can be classified further into organization, process and innovation capital. Organizational capital includes the organization philosophy and systems for leveraging the organization's capability. Process capital includes the techniques, procedures, and programs that implement and enhance the delivery of goods and services. Innovation capital includes intellectual properties and intangible assets.

Intellectual properties are protected commercial rights such as copyrights and trademarks. Intangible assets are all of the other talents and theory by which an organization is run. (Maddocks & Beaney, 2002).

Therefore, it can be said that the innovative capability of a certain firm depends very closely on the intellectual assets and knowledge that it possesses, as well as on its ability to deploy them, viewing the innovation process as intensive knowledge management process (Nonaka and Takeuchi, 1995). Nevertheless, as Galende and De la Fuente (2003) point out, a good piece of research is devoted to address the innovation processes from an external perspective, leaving aside the internal complexity that characterizes the innovation dynamic. In this sense, even though the basic link between firm knowledge and innovation is on the whole so persuasive, more remains to be understood about its precise and complex nature (Subramanian and Youndt, 2005).

(2-6): Innovation

Innovation is the primary instrument of competition for many firms, especially in technology and knowledge-based industries. Generally speaking, the innovation process can be understood as a complex activity

in which new knowledge is applied for commercial ends. (Galende, 2006; Escribano, Fosfuri and Tribó, 2009).

Innovation is generally viewed as one of the most important sources of sustainable competitive advantage because it leads to product improvements that increase the value of the product portfolio (Coombs and Bierly, 2006); helps firms survive; makes continuous advances (Liu, Chen, and Tsai, 2005); allows innovators to grow faster, being more dynamically efficient, and ultimately more profitable than non innovators (Mansury and Love, 2008).

In fact, innovation has also been defined as the most knowledge-intensive organizational process that depends on a firm's individual members and collective knowledge (Adamides and Karacapilidis, 2006).

As (López-Cabrales et al. ,2008) emphasize, the key role of intellectual capital has for firm's innovation capability remains to be understood about its precise nature.

Although the basic link between intellectual capital and firm innovation is on the whole persuasive, additional efforts for understanding this causal relation are worthwhile. Hence, we analyze innovation performance through its novelty degree, because this becomes necessary for a firm's survival, as well as sustained competitive advantage (Hsu and Fang, 2009).

Based on the above, the researcher believes that it can be argued that structural capital is the intangible assets owned by the organization, processed and kept inside it, and knowledge-related that is expected to be used in achieving ongoing benefits, generation and achieving competitive advantages of the organization, and development of wealth.

The efforts of researchers indicate to believe that there is a correlation between the performance of innovation strategies and the knowledge economy, that correlation has been expressed as an important focus for the growth of companies.

(2-7): Previous Studies

The researcher revised some Arabic and foreign studies that are to some point relevant to the subject of this study.

(a) Arabic Studies

Obaid (2000) "The Impact of Investment in Human Intellectual Capital on Organizational Performance". This study Aimed to determine the impact of intellectual capital, and it`s reflections on organizational performance. An empirical study in (6) Iraqi industrial organizations. The sample of the study contained (130) individuals. The most important result was that there is a significant strong relationship between intellectual capital and organizational performance.

Saleh (2001) "Patterns of Strategic Thinking and its Relationship with the Factors of Maintaining the Intellectual Capital: An Empirical Study on Socialist Industrial Companies". This study Aimed to determine the extent of intellectual capital availability in the chosen sample, and the level of interest in obtaining it. An empirical study on (5) industrial Iraqi companies, the sample contained 195 individuals. The most important result revealed that the studied sample

contained intellectual capital that can be divided into two categories: an effective intellectual capital that is able to perform, and an intellectual capital that has Fundamental constituents but unable to perform.

(Al-Jagob, & Al-Ameen, 2002) "Knowledge Based Economy: Will it Be the Future for Developing Countries: Case Study of Jordan" study strengthened the trend towards knowledge-based economy. Their study suggested that the future will be owned by the developing countries dependant on knowledge and its intangible components.

Al-Sabbag (2002) "Knowledge Management and its Role in Establishing the Information Society". The study objectives were to define the concept of knowledge management and determine the components of it. He tried to identify the distance between knowledge management and information management, the study also aimed to explain the strategic role of knowledge management in organizing societies. Methodology of the study was a descriptive screening for the scientific published papers, and a survey to find out what periodicals published about the topic. The study population was a random sample of attendees of Qatar University Library for males, and the researcher used a

questionnaire as a study tool. The most important results of this study were as follows:

a) Knowledge management needs new ways and skills to apply it.

b) Knowledge management contributes to lay the foundations of the information society through better exchange of thoughts ,allowing greater use of mental resources available and the best possibility for innovation and development.

Hejazi (2004) "The Extent of Employing Knowledge Management in Jordanian Organizations". This study Aimed to determine whether Jordanian firms started to implement knowledge management in their strategies or not, and what are the domains that would make the best out of knowledge management in their operations. The study also aimed to work on the development of the knowledge management system in Jordan. The tools of the study were interviews and a questionnaire for a random sample of 380 individuals. The most important results were:

a) Jordanian firms limitedly implement knowledge management in their systems and in varying degrees.

b) Rare economical and natural resources in Jordan affected achieving comprehensive development that's considered the main nerve for knowledge and knowledge management.

Momani (2005) "Attitudes of managers towards the implementation of knowledge management in public institutions in Jordan: a field study". This study Aimed to identify the attitudes of managers towards the application of knowledge management and its programs in public institutions in Jordan. The results found a weak to moderate, inverse correlation , between the obstacles and difficulties, and between the level of readiness to apply the elements of knowledge management.

(Al-Nuaimi & Najem, 2006) "Towards a Conceptual Framework for Study and Evaluation of Human Intellectual Capital in Universities". This study Aimed to develop a conceptual frame work for the human intellectual capital and its components in universities, and to develop a significant tool for its measurement and rationalizing its administration process. The most important results were:

a) There is a direct correlation between education in general and economic performance.

b) University education that directly contributes in the economic growth, indirectly and positively effects other sectors performance.

c) Intellectual capital still suffers lack of interest in Arabic universities.

Qatarneh (2006) "The availability and functions of knowledge management and its impact on the effectiveness of managers in the ministries of Jordan." The study aimed to analyze and examine the impact of knowledge management in the effectiveness of managers in the ministries of Jordan. The study sample contained (131) manager, and (336) emplyee of ministries in Jordan. The Study found a set of results, notably that the level of availability of knowledge management in the ministries from the viewpoint of managers came to a fair degree.

Abdel –Menem (2008) " The Impact of Intellectual Capital on Organizations: A Case Study of Jordan's Ready-Made Clothes". This study Aimed to search in the concept of intellectual capital and its impact on raising the value and effectiveness of Jordanian industrial companies. The main results were:

a) There is ambiguity in the concept and importance of intellectual capital in Jordan`s ready-made clothes, and a confusion between this concept and the concept of intellectual property.

b) Lack of clarity of the impact of intellectual capital on the efficiency of the company and its market value.

c) Absence of a vision of how to measure and declare the intellectual capital in the financial statements.

Al-Hawajra (2009) "The correlation between the investment in knowledge capital and the competitive performance of the Jordanian insurance firms". This study Aimed to analyze the correlation between knowledge capital and the performance, using a questionnaire on 213 individuals. The most important result of the study was that there is a significant relationship between knowledge capital and the competitive performance depending on learning development, knowledge integration, and development of the knowledge capital.

(b) Foreign Studies

Bontis (2000) "Intellectual Capital and Business Performance in Malaysian Industries". This study Aimed to examine the relationship between the elements of intellectual capital (human, structural, customer), through the development of a questionnaire for this purpose, and the study was conducted on the Malaysian industries.

The most important results were:

a) Human capital is important regardless of industry or business.

b) Structural capital has a significant impact on the business structure in the non-governmental business sectors.

c) The customer capital has a significant impact on business structure regardless of type.

Nakahara (2001) "innovation management using intellectual capital". This study Aimed to Highlight the importance of intellectual capital to become one of the vital resources that enable the organization to develop a business model that is characterized by the efficiency and effectiveness. The most important result was that organizations must shift the organizational philosophy from pride in the achievements of the past,

to focus on a future strategy that focuses on the importance of intellectual capital, because of its effect on the development of the innovation process of the organization.

Egan (2002) "Learning Organization Dimensions and Motivation to Transfer Learning in Large Firm Information Technology" This study Aimed to identify dimensions of the learning organization and the stimulation of transfer of learning for workers in firms, he also studied some variables related to learning organizations and the motivations for learning. The most important result of the study was that there are significant effects for organizational learning dimensions, with relatively few correlations with the knowledge transfer stimulus.

(Hansen, and Hass, 2002) " Different Knowledge, Different Benefit: Toward a Productivity Perspective on Knowledge Sharing in Organizations" . This study Aimed to specify the impact of knowledge sharing on the productivity of firms, the results were as follows:

a) When tacit knowledge is shared, the function of the organization improves.

b) The personal participation improves the job quality and gives efficiency signals to the customer.

c) Knowledge sharing between content and operations positively effects the organizational performance.

Choo (2003) "Knowledge Creation Using a Structural Improvement Approach: Towards an Integration of Quality and Knowledge" . This study Aimed to study knowledge creativity using the entrance of improving organizational structure. The most important result was that organizations should make integration between quality and knowledge and develop a framework proposal for the creativity of knowledge, and motivation, by focusing on work teams and membership structures.

(Firer and Williams, 2003) "intellectual capital and traditional measures of corporate performance" . This study Aimed to examine the relationship between the efficiency of value added to the base of the organization's resources of natural capital and human capital and structural capital and the effects of performance and productivity, profitability and market value. The study sample consisted of (75) Organization working in the financial market in South Africa. The most

remarkable result was that natural resources had the greatest impact on the performance of organizations, more than human resources.

Marr (2003)," Why Do Firms Measure Their Intellectual Capital" . This study Aimed to review the theoretical importance of measuring intellectual capital, and the amount of benefits to organizations as a result. It also highlights some approaches that researchers must test in order to contribute to the development of field measurement of intellectual capital in business organizations. the most important result was that most researches in this area are still in the conceptual stage.

Egbu (2004) "Managing Knowledge and Intellectual Capital for Improved Organizational Innovations in the Construction Industry: an Examination of Critical Success Factor". In the study the researcher aimed to investigate the incoherent and lack of ownership of knowledge vision. The most important results were as follows:

a) There was a prevalent lack of appreciation of knowledge as an important asset.

b) The reasons of knowledge lack include the insufficient promotion on information-sharing culture by organizations, and lack of appropriate methods and tools for measuring in valuing knowledge.

Boekestein (2006) "The Relation between Intellectual Capital and Intangible Assets of Pharmaceutical Companies". This study Aimed to evaluate intangible assets in the pharmaceutical organizations, and show how these assets interrelate with the cultural capital to effect organizational performance. The sample of this study contained (52) international pharmaceutical company. The most important results were as follows:

a) Most of the sample organizations determine the intangible assts.

b) There is a significant interrelation between intangible assets and the cultural capital.

c) There is a positive correlation between intangible assets and organizational performance.

Martinez (2006) "A Procedure To Design a Structural and Measurement Model of Intellectual Capital: An Exploratory Study". This study Aimed to understand the effective way of using intellectual capital in a knowledge-based organization. The study suggested a proposed model connecting intellectual capital components. The most important results were as follows:

a) Intellectual capital components contain the significant assts in the organization.

b) Intellectual capital contains the human capital, structural capital, and relational capital.

(Isaac, Herremans & Kline, 2009) "Intellectual Capital Management: Pathways to Wealth Creation" . This study Aimed to examine the effects of organizational, structural and cultural climates on increasing the effectiveness of intellectual capital management, and the study revealed many results , the most important were:

a) There is an essential need for building membership structures.

b) Managers should establish confidence in their staff.

c) It's important to encourage innovation in the organization.

d) Establishment of a participatory process for administrative and regulatory decision-making.

(Nazari, Herrmans, Isaac, and Manassian, 2009) "Organizational Characteristics Fostering Intellectual Capital: Canada and the Middle East" . This study Aimed to examine the correlation between organizational characteristics associated with intellectual capital, the most important results were:

a) Organizational culture, organizational climate and organizational characteristics are closely linked with the intellectual capital.

b) Organizational culture, organizational climate and organizational characteristics vary according to the regulatory and cultural environment.

(2-8): Differences between the current study and previous studies

In relation to the population of the study:

Most of the previous related studies were implemented on manufacturing organizations and ministries and schools, whereas this study reached the sector of Jordanian dental technology laboratories.

In relation to the study objectives:

The most important distinguishing characteristic of the current study is that it reaches out the three dimensions of structural capital (data bases, information systems, and patents), whereas most of the previous study studied Intellectual Capital as a package without specifying any of its variables in precise.

CHAPTER THREE
METHOD AND PROCEDURES

(3-1): Introduction

(3-2): Study Methodology

(3-3): Study Population and Sample

(3-4): Study Model

(3-5): Demographic Variables of the Study Sample

(3-6): Study Tools and Data Collection

(3-7): Statistical Methods

(3-8): Reliability and Validity

(3-1): Introduction

This study aimed to identify the impact of structural capital on the innovation strategy in the dental technology laboratories in Jordan.

To achieve these objectives, this chapter describes the methodology, the population and sample, and the model of the study , it also describes the demographic variables for members of the study sample, as well as the tools of the study and sources for obtaining information, statistical treatments used, and the reliability and validity of the study tool.

(3-2): Study Methodology

The researcher in this study used an empirical approach due to the relevance of the nature of this study ,to determine the relationship and impact between the independent variable "Structural Capital (databases, patents, and information systems)" and the dependent variable "Product Innovation Strategy".

Through the questions that the current study seeks to answer, the researcher used the descriptive and analytical approach, as she also used

the questionnaire in data collection, analysis and test hypotheses, which applies to the nature of the study.

(3-3): Study Population and Sample

(3-3-1): Study Population

The population of the study consists of (150) Jordanian dental technology laboratories, registered in the Jordanian Federation of Dental Technicians and operate in the field of dental technology, in Amman.

(3-3-2): Study Sample

The study sample consists of (450) dental technicians working in Jordanian dental technology laboratories, and registered in the Jordanian Federation of Dental Technicians in the Capital Amman, chosen by the simple random method.

(3-4): Study Model

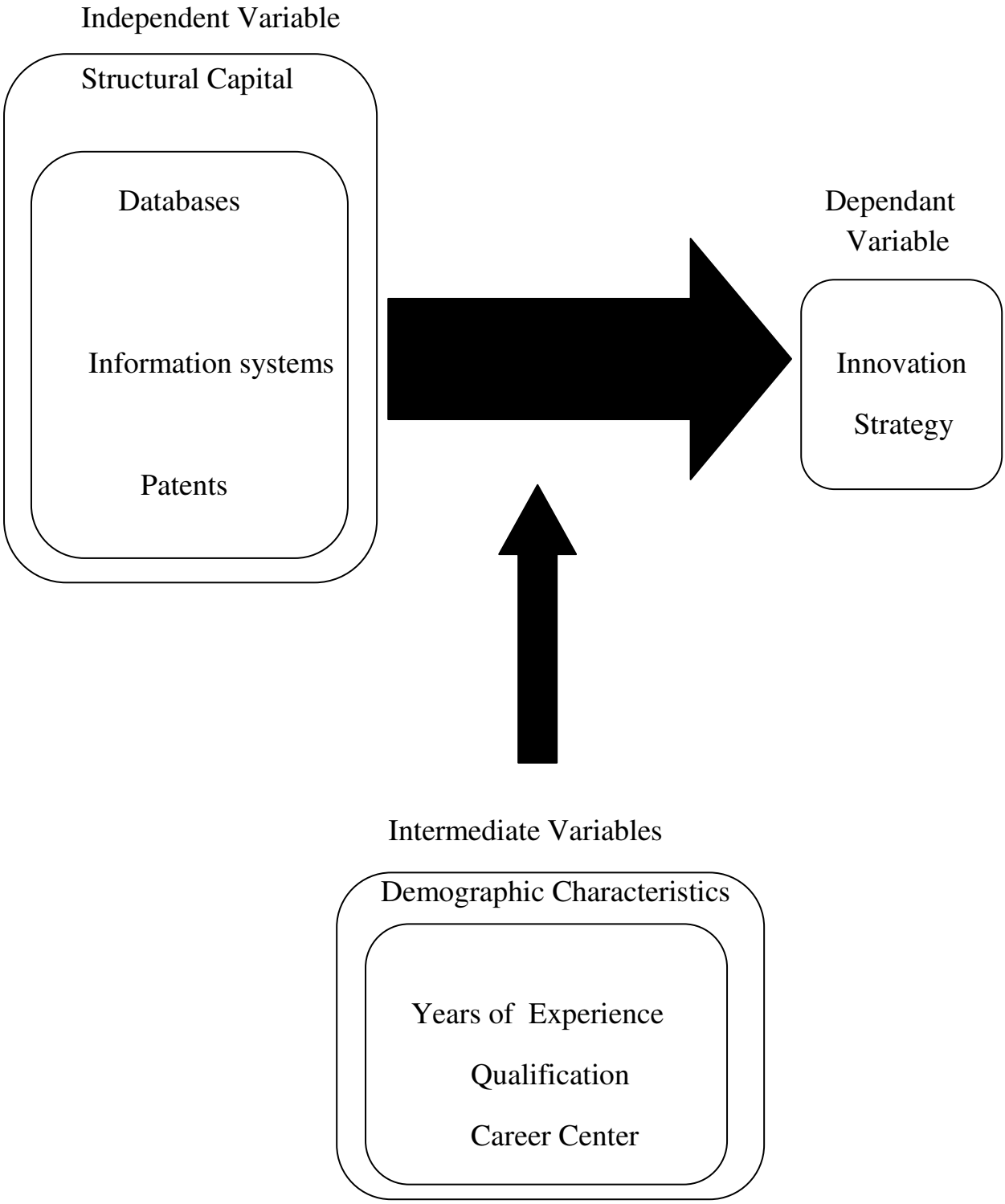

Figure (1-3): Study Model prepared by the researcher

(3-5): Demographic Variables of the Study Sample

Table(3-1)Description of demographic variables of sample members

Variable	Category	Frequency	Percent
Gender	Male	241	60.3
	Female	159	39.8
Experience	Less than 5	122	30.5
	5- 10	139	34.8
	More than 10	139	34.8
Education	Diploma	131	32.8
	BA	157	39.3
	MA	64	16.0
	PhD	48	12.0
Position	Director	112	28.0
	Head of department	125	31.3
	Employee	163	40.8

Table (1-3) shows the demographic variables of the sample (sex, years of experience, career center, and qualification). It describes the results of the descriptive analysis to the demographic variables of the respondents of the study sample.

In terms of the number of years of experience, results have shown that (34.8%) of the sample respondents have more than ten years of experience, (34.8%) have five to ten years of experience, and (30.5%) have less than five years of experience in the practical field. These percentages clarify that (69.6%) of the sample respondents have good experience in the field of dental technology, leaving them in a search site for developments and improvements in their centers as workers in the functional and leadership positions in dental technology laboratories.

With concern to the qualification, the results showed that (39.3%) of the studied sample are bachelor degree holders, (28%) are after graduate certification holders, including master and PhD degrees, (32.8) were diploma holders.

Previous percentages indicate the importance of the educational level in the study sample which is reflected on their answers towards the right direction.

(3-6): Study Tools and Data Collection

The study consisted of two aspects; the theoretical and applied in the theoretical side, has been addressed most of the scientific concepts and principles relevant to the subject, but in the practical side the researcher has adopted the descriptive and analytical approach that aims to determining the impact of structural capital on the product innovation strategy in Jordanian dental technology laboratories by data collection and analysis, and testing hypothesis.

To achieve the objectives of the study and test the hypotheses, the researcher based her work on primary and secondary sources. The primary source is based on developing a questionnaire that was distributed on the sample chosen, in order to gather the data needed to test hypotheses, which included a number of paragraphs that reflected the objectives and questions of the study. And for the purpose of analysis, the statistical solution (SPSS) was used.

The questionnaire was divided into three parts after being translated to arabic:

First: Part One

This part included variables concerning the demographic characteristics of the study sample using four paragraphs (sex, years of experience, qualification, and career center)

Second: Part Two

This part included independent variables related to structural capital, (databases, information technology, and patents), using (22) paragraphs.

Third: Part Three

This final part included variables related to the dependent variable "Product Innovation Strategy", using (21) paragraphs.

Likert Five-Scale was used to give each answer a value of (1-5). The questionnaire included (43) paragraphs in total, where the answer ranged from (1) to (5) as follows:

Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
5	4	3	2	1

Secondary resources included, books, journals and previous studies, used to build a rich theoretical framework.

(3-7): Statistical Methods

The researcher used the following methods:

1- Cronbach -Alpha Coefficient to assure the degree of validity of the used scale.

2- Arithmetic means and standard deviations to answer the questions of the study and acknowledge the relative importance.

3- Simple regression analysis in order to measure the impact of one independent variable on one dependent variable .

4- Multiple regression analysis in order to measure the impact of several independent variables on several dependent variables.

5-Relative importance, determined by the following measure:

$$\text{Length of category} = \frac{\text{Upper limit of the alternative} - \text{Lower limit of alternative}}{\text{Number of Limits}}$$

(3-8): Reliability and Validity

(a) Validity

To verify the validity of the scale , the researcher consulted a group of faculty members, belonging to the management department, in order to benefit from their expertise and scientific process, the number of

arbitrators was (6), and the despondence reached (100%) "see Appendix (1)" , which has increased confidence in the validity of the results reached.

(b) Reliability

Reliability is obtaining stable results over time. In this study, the researcher used Cronbach's Alapha to validate the data. Accordingly, to Sekaran (2003), Cronbach's Alapha is a popular test for reliability to measure the correlation of scale with the sum of remaining variables.

Cronbach's Alapha was used to test the reliability of the scale and (α) was ranged between 0.85 for information system to 0.92 for database, and all the (α) was acceptable because it was more than (0.60) as i shown in table (3-1).

Table (3-2) Reliability coefficient for the study factors(α)

Factor	Reliability (α)	No. of item
Database	0.92	9
Information system	0.85	9
Patents	0.89	4
Product innovation strategy	0.91	21

Chapter Four
Analysis Results and Hypotheses Testing

(4-1): Introduction

(4-2): Study Variables Descriptive Analysis

(4-3): Study Hypotheses Testing

(4-1): Introduction

This chapter aims to demonstrate the results of analyzing the attitudes of the sample chosen members, towards the study variables.

After the data collection, it was entered to the computer using the Statistical Package for Social Sciences (SPSS). Means and standard deviations were calculated. In addition to, conducting many of the statistical tests (e.g. simple regression, ANOVA).

Results were demonstrated by two main categories that cover the study variables, according to the following:

Fisrt: Study Variables Descriptive Analysis

Second: Study Hypotheses Testing

(4-2): Study Variables Descriptive Analysis

First: Database Factor

Table (4-1) Means and standard deviations of the study sample responding to the Database factor

No	Items	Means	standard deviations	Level
1	Databases available in the laboratory and include interactive models to display the basic information in an easy and simple way	3.96	1.07	High

3	The use of databases in the laboratory provide basic information for decision-making	3.68	1.11	High
2	Databases provide information in the laboratory with a high degree of accuracy and reliability	3.62	1.04	Medium
5	Use of databases in the laboratory contributes to the provision of information at lower cost and higher speed	3.59	1.24	Medium
7	The database covers all areas and applications available	3.59	1.10	Medium
4	Databases contribute in the delivery of information without conflict and duplication	3.55	1.11	Medium
8	There is a capability of the database for change and adjustment as needed by workers in the laboratory	3.55	1.12	Medium
9	Database can retrieve data and information in the case of loss	3.53	1.24	Medium
6	Database in the modern laboratory is being developed continuously to keep up with changes and developments in and outside the institution	3.47	1.18	Medium

From table (4-1) its noticeable that item means ranged from (3.47 – 3.96), the highest mean was for item (1) which mentioned to “Databases available in the laboratory and include interactive models to display the basic information in an easy and simple way" with a mean of (3.96) and a standard deviation of (1.07). While the lowest mean was for item (6) which mentioned to “Database in the modern laboratory is being developed continuously to keep up with changes and developments in and outside the institution" with a mean of (3.47) and a standard deviation of

(1.18). The overall mean for the factor was (3.59) with a standard deviation of (0.88) which indicated **medium level of database availability.**

Second: Information System Factor

Table (4-2) Means and standard deviations for the study sample responding for the Information System factor.

No	Items	Means	standard deviations	Level
14	Administrative decisions are made on the basis of information contained in periodic reports	4.07	1.03	High
16	Information system is updated periodically and continuously in the laboratory	3.92	1.06	High
10	Information system works to direct efforts and employ them for the purposes of the speed of achievement in the laboratory	3.88	0.88	High
15	There are basis for the classification and arrangement of information within the information system available in the laboratory	3.82	0.98	High
17	Information system provides information and useful help in solving business problems	3.77	1.01	High
18	The information provided by the information system is characterized by a high degree of detail, which helps to make decisions during the innovation process	3.76	1.18	High
13	Decision of product innovation is based on the data provided by the information system in the laboratory	3.71	1.16	High
11	Information systems provide clear guidance for staff on how to work	3.68	0.88	High

12	Information system applications match the size of the work to be done	3.67	1.10	Medium
Overall means		3.78		High

From table (4-2) its noticeable that the item means ranged from (3.67-4.07), the highest mean was for item (14) which mentioned to "Administrative decisions are made on the basis of information contained in periodic reports" with a mean of (4.07) and a standard deviation of (1.03). While the lowest mean was for item (12) which mentioned to "Information system applications match the size of the work to be done" with a mean of (3.67) and a standard deviation of (1.10). The overall mean for the factor was (3.78) with a standard deviation of (0.72) which indicated **high level of information system availability.**

Third: Patent Factor

Table (4-3) Means and standard deviations for the study sample responding for the Patent factor.

No	Items	Means	standard deviations	Level
19	There is documentation of ideas reached by the staff at the concerned authorities to ensure their intellectual property rights	3.49	1.10	Medium
20	There is documentation of the achievements of workers in the laboratory to the bodies and regional institutions	3.29	1.17	Medium

22	Staff in the laboratory meet with personnel and professional bodies to discuss their contributions in product development	3.19	1.36	Medium
21	There is documentation of the achievements of staff in the development area ,at the institutions of international bodies	3.16	1.19	Medium
Overall means		3.27		Medium

From table (4-3) its noticeable that the item means ranged from (3.16 – 3.49), the highest mean was for item (19) which mentioned to "There is documentation of ideas reached by the staff at the concerned authorities to ensure their intellectual property rights " with a mean of (3.49) and a standard deviation of (1.10). While the lowest mean was for item (21) which mentioned to "There is documentation of the achievements of staff in the development area, at the institutions of international bodies" with a mean of (3.16) and a standard deviation of (1.19). The overall mean for the factor was (2.27) with a standard deviation of (1.05) which indicated **high level of patent availability.**

Forth: Product Innovation Factor

Table (4-4) Means and standard deviations for the study sample responding for the Innovation Strategy factor.

No	Items	Means	standard deviations	Level
7	The laboratory adapts with the changes that occur in the external environment through new products	4.09	1.01	High
8	Innovation in products contributes in increasing profits of production	3.93	0.95	High
21	There is an obvious interest in the management of the laboratory in the availability of appropriate educational and training conditions that encourage employees to develop their ideas	3.89	1.12	High
10	Innovation in products contributes in improving product quality and efficiency	3.85	0.99	High
11	Workers in the laboratory use their own designs in the manufacture of their products	3.83	1.09	High
1	Workers can put new ideas in the laboratory without limitations	3.81	0.96	High
6	workers in the laboratory seek to innovative their products	3.81	1.14	High
9	Innovation in products contributes in production time reduction	3.81	0.99	High
3	Products in the laboratory are developed and produced in a new way	3.79	1.09	High
12	Workers in the laboratory use methods they innovated in the manufacture of their products	3.79	1.10	High
5	Workers in the laboratory are heavily interested in the development of their products	3.78	1.19	High

14	There is a further innovation of new tools, used in the manufacture of products within the laboratory	3.77	1.12	High
16	There is an innovation in the products of the laboratory to service different requirements	3.77	1.09	High
2	workers in the laboratory has groups of new ideas that aim to develop products at the laboratory	3.76	0.97	High
18	There is cooperation between the laboratory and a leading foundation at the global level, that supervises the creative and entrepreneurial work of the laboratory	3.76	1.14	High
17	There is an innovation in the processes used in the laboratory to develop new products	3.75	1.12	High
4	Developed tools and services are used in the laboratory to develop the ideas of the workers	3.74	1.10	High
19	Workers in the laboratory encourage the creative ideas of their colleagues and provide support in their implementation	3.74	1.20	High
13	There is a further innovation of new materials, used in the manufacture of products within the laboratory	3.73	1.14	High
20	There is a continuous renewal of the tools and equipment used in the laboratory, which contributes to test new ideas	3.73	1.05	High
15	Workers in the laboratory seek to know the needs of customers and convert them into products	3.68	1.19	High
Overall means		3.77		High

From table (4-4) its noticeable that the item means ranged from (3.68-4.09), the highest mean was for item (7) which mentioned to “The

laboratory adapts with the changes that occur in the external environment through new products" with a mean of (40.09) and a standard deviation of (1.01). While the lowest mean was for item (15) which mentioned to "Workers in the laboratory seek to know the needs of customers and convert them into products "with a mean of (3.68) and astandard deviation of (1.19). The overall mean for the factor was (3.77) with a standard deviation of (0.66) which indicated high level of Innovation availability.

(4-3): Study Hypotheses Testing

The purpose of this section is testing the study hypotheses. Simple and Multiple regression analysis was used due to its fitness with the data assumption, and the following tables show the results.

NHo1: There is no significant impact of structural capital (databases, information systems, patents) on product innovation strategy at a significant level of (α=0.005).

To test this hypothesis multiple regression was used and the following tables show the result.

Table (4-5): Model Summary for Structural Capital and Product Innovation

Model	R	R^2	Adjusted R Square	Std. Error of the Estimate
1	.258(a)	.067	.062	13.34090

(a) Predictors: (Constant), Structural Capital

From the table, the R coefficient between structural capital and product innovation strategy is (.258). as in ANOVA table the f value is 14.14 with Sig level less than (0.05) with an indication for a significant effect of structural capital on the product innovation strategy . The R^2 value is (0.067), which shows a little amount of explained variance in the product innovation by structural capital.

Table (4-6): ANOVA test for structural capital and product innovation

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2516.639	1	2516.639	14.140	.000(a)
	Residual	35239.956	198	177.980		
	Total	37756.595	199			

(a) Predictors: (Constant), Structural Capital

(b) Dependent Variable: Product Innovation

Table (4-7): Coefficient test of structural capital and product innovation

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	58.478	5.592		10.457	.000
	Structural Capital	.261	.069	.258	3.760	.000

(a) Dependent Variable: Product Innovation

Furthermore, as it has been shown in coefficient table, the standardized beta coefficient value is (0.258), which shows the positive relationship between structural capital and product innovation.

The researcher constructed the following sub-hypotheses :

NHo1-1 :There is no significant impact of databases on product innovation strategy at a significant level of (α=0.005).

To test this hypothesis multiple regression was used and the following tables shown the result.

Table (4-8): Model Summary for database and product innovation

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate
1	.143(a)	.020	.016	13.66693

(a) Predictors: (Constant), Database

From the table, the R coefficient between database and product innovation strategy is (0.143). As in ANOVA table the f value is (4.139) with Sig level less than (0.05) with an indication of a significant effect of database on the product innovation . The R^2 value is (0.02), which shows a very little amount of explained variance in the structural capital by database.

Table (4-9): ANOVA test for database and product innovation

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	773.157	1	773.157	4.139	.043(a)
	Residual	36983.438	198	186.785		
	Total	37756.595	199			

(a) Predictors: (Constant), Database

(b) Dependent Variable: Product Innovation

Table (4-10): Coefficient test for database and product innovation

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	71.182	4.060		17.533	.000
	Database	.248	.122	.143	2.035	.043

(a) Dependent Variable: Product Innovation

Furthermore, as it has been shown in coefficient table, the standardized beta coefficient value is (0.143), which show the positive relationship between database and product innovation. Furthermore, as it has shown in coefficient table, the standardized beta coefficient value is (0.143), which shows the positive relationship between structural capital and database.

NHo1-2: There is no significant impact of information systems on product innovation strategy at a significant level of (α=0.005).

To test this hypothesis multiple regression was used and the following tables shown the result.

Table (4-11): Model Summary for information system and product innovation

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate
1	.328(a)	.108	.103	13.04355

(a) Predictors: (Constant), Information System

From the table, the R coefficient between Information System and product innovation strategy is (0.328). As in ANOVA table the f value is (23.92) with Sig level less than (0.05) with an indication of a significant effect of information system on the product innovation . The R^2 value is

0.102 which shows a little amount of explained variance in the structural capital by information system.

Table (4-12): ANOVA test for information system and product innovation

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4070.015	1	4070.015	23.922	.000(a)
	Residual	33686.580	198	170.134		
	Total	37756.595	199			

(a) Predictors: (Constant), Information System

(b)Dependent Variable: Product Innovation

Table (4-13): Coefficient test for information system and product innovation

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	55.014	5.031		10.935	.000
	SYSTEM	.710	.145	.328	4.891	.000

(a) Dependent Variable: Product Innovation

Furthermore, as it has been shown in coefficient table, the standardized beta coefficient value is (0.143), which shows the positive relationship between structural capital and information system.

NHo1-3 :There is no significant impact of patents on product innovation strategy at a significant level of (α=0.005).

To test this hypothesis, multiple regression was used and the following tables shown the result.

Table (4-14): Model Summary for patents and product innovation

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate
1	.070(a)	.005	.000	13.77529

(a) Predictors: (Constant), Patent

From the table, the R coefficient between patents and product innovation strategy is (0.143). As in ANOVA table the f value is (0.972) with Sig level more than 0.05 with an indication of a non significant effect for patent on the product innovation . The R^2 value is 0.005, which show a very little amount of explained variance in the structural capital by patent.

Table (4-15): ANOVA test for patents and product innovation

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	184.386	1	184.386	.972	.325(a)
	Residual	37572.209	198	189.759		
	Total	37756.595	199			

(a) Predictors: (Constant), Patent

(b) Dependent Variable: Product Innovation

Table (4-16): Coefficient test for patents and product innovation

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	76.202	3.198		23.828	.000
	PATENT	.229	.233	.070	.986	.325

(a) Dependent Variable: Product Innovation

Furthermore, as it has been shown in coefficient table, the standardized beta coefficient value is (0..07), which shows the positive relationship between structural capital and patent.

NHo2: There is no significant impact of structural capital on product innovation strategy due to demographic characteristics (years of experience, qualification, career center) at a significant level of (α=0.005).

To test this question one way ANOVA and T-test were used and the following tables show the result.

Table (4-17): ANOVA analysis for the differences in the impact of structural capital on product innovation strategy due to experience

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	747.002	2	373.501	1.919	.149
Within Groups	38338.793	197	194.613		
Total	39085.795	199			

From the table (4-17) its noticeable that there is no significant impact of structural capital on product innovation strategy at a significant level of (α=0.005) due to experience, the (F) value was (1.919) with P value of (0.149) which means that there is no significant impact of structural capital on product innovation strategy at a significant level of (α=0.005) due to experience.

Table (4-18): ANOVA analysis for the differences in impact of structural capital on product innovation strategy due to education

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	505.656	3	168.552	.859	.463
Within Groups	38653.817	197	196.212		
Total	39159.473	200			

From the table (4-18) its noticeable that there is no significant impact of structural capital on product innovation strategy at a significant level of (α=0.005) due to education , the (F) value was (0.859) with P value of (0.463) which means that there is no significant impact of structural capital on product innovation strategy at a significant level of (α=0.005) due to education.

Table (4-19): ANOVA analysis for the differences in impact of structural capital on product innovation strategy due to career center

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	399.815	2	199.907	1.021	.362
Within Groups	38759.658	198	195.756		
Total	39159.473	200			

From the table (4-19) its noticeable that there is no significant impact of structural capital on product innovation strategy at a significant level of (α=0.005) due to the career center , the (F) value was (1.021) with P value of (0.362) which means that there is no significant impact of structural capital on product innovation strategy at a significant level of (α=0.005) due to career center.

Chapter Five
Results and Recommendations

(1-1): Introduction

(1-2): Study Results

(1-3): Study Recommendations

(1-1): Introduction

In this chapter, the researcher demonstrates the most important results related to the variables of the study, in addition to the recommendations thought to be helpful for improving the product innovation strategies in the dental technology laboratories in Jordan.

(1-2): Study Results

First: Results related to the variables of the study

1- The overall mean for database factor was in the medium level, the items means were sorted from the highest mean which was for the item "Databases available in the laboratory and include interactive models to display the basic information in an easy and simple way" with a mean of (3.96) and a standard deviation of (1.07). While the lowest mean was for item (6) ,which mentioned to "Database in the modern laboratory is being developed continuously to keep up with changes and developments in and outside the institution", with a mean of (3.47) and a standard deviation of (1.18). The researcher interpreted this result by focusing on the function of the database in the knowledge management and human capital. The major aspect of database can be summarized as knowledge accumulation environment. Employees can share their knowledge within this environment, and help in a decision-making process. Moreover, **the**

database can contribute in the high level of accuracy, and high speed of work accomplishment with low cost.

2- The overall mean for information system factor was in the medium level, the items means were sorted from the highest mean which was for the item "Administrative decisions are made on the basis of information contained in periodic reports", with a mean of (4.07) and a standard deviation of (1.03). While the lowest mean was for item (12) which mentioned to "Information system applications match the size of the work to be done" with a mean of (3.67) and a standard deviation of (1.10). **This result can be interpreted in light of the information system functionality in human capital, which could be determined by the pathway of information processing within the laboratories to direct and organize the day work activities in order to speed up the work and achievement in the laboratory.**

3- The overall mean for patent factor was in the medium level, the items means were sorted from the highest mean which was for the item "There is documentation of ideas reached by the staff at the concerned authorities to ensure their intellectual property rights" with a mean of (3.49) and a standard deviation of (1.10). While the lowest mean was for item (21)

which mentioned to “There is documentation of the achievements of staff in the development area, at the institutions of international bodies" with a mean of (3.16) and a standard deviation of (1.19**). The reason why there is a limited number of patent , is because it’s related to cultural and organizational factors, which can be summarized in lack of believes in human ability and capacity to contribute and innovate on the personal level, Besides, there is a lack of opportunists for financial support, and a limited ground to conduct development researches.**

4- The overall mean for product innovation strategy factor was in the medium level, the items means were sorted from the highest mean which was for the item “The laboratory adapts with the changes that occur in the external environment through new products" with a mean of (40.09) and a standard deviation of (1.01). While the lowest mean was for item (15) which mentioned to “Workers in the laboratory seek to know the needs of customers and convert them into products “with a mean of (3.68) and a standard deviation of (1.19). **The dental Technology industry has obvious limitations because of its nature , and the high costs of conducting development research to invent new material.**

Second: Results related to the hypotheses of the study

1- The (R) coefficient between structural capital and product innovation strategy is (.258). With an indication of **a significant effect of structural capital on the product innovation strategy**. This result is similar to the results of Obaid (2000) study **" The Impact of investment in Human Capital on Organizational Performance"**, where the result was a significant strong relationship between intellectual capital and organizational performance. The researcher interpreted this result by the integration between the human capacity and the ability to the find the necessary information and its application and usage, for purpose of planning for new products and services, or observing problems, or discovering new needs requiring innovation and invention.

2- The (R) coefficient between information systems and product innovation strategy indicates **a significant effect of information systems on the product innovation.** This result was similar to Al-Sabbag (2002) **"Knowledge Management and its Role in Establishing the Information Society",** which indicated that knowledge management contributes to lay the foundations of information society through better exchange of thoughts, allowing greater use of mental resources available and the best possibility for innovation and development. This result can

be interpreted by the information usage to find solutions for current problems, or guide new directions in order to overcome high costs or less effective materials.

3- The R coefficient between database and product innovation strategy **indicates a significant effect of database on product innovation**. This result is similar to Nakahara (2001), **"innovation management using intellectual capital"** , that found that organizations must shift the organizational philosophy from pride in the achievements of the past, to focus on a future strategy that focuses on the importance of intellectual capital, because of its effect on the development of the innovation process of the organization.

The major aspect of database can be summarized as knowledge accumulation environment. Employees can share their knowledge within this environment, and help in a decision-making process.

4- The (R) coefficient between patents and product innovation strategy **indicates a non significant effect of patents on the product innovation.** The reason behind this result could be the level of experience thats available for innovation in the dental technology industry in Jordan, which focuses on the cost and speed of achievement rather than finding new materials and methods. The result is similar to

Choo(2003) **"Knowledge Creation Using a Structural Improvement Approach: Towards an Integration of Quality and Knowledge"** that stated that organizations should make integration between quality and knowledge and develop a framework proposal for the creativity of knowledge, and motivation, by focusing on work teams and membership structures.

5- There is no significant impact of structural capital on product innovation strategy at a significant level of (α=0.005) due to demographic variables. The reason to this result may be embedded in the nature of the product innovation strategy which needs big financial resource in the laboratories to conduct or support research in different relevant areas .

(1-3): Study Recommendations

According the present study results, the researcher set a number of recommendations as follows:

1- Conducting further research in this area to find the relationship between the structural capital and product innovation.

2- The importance of sustaining the human capacity building, in the dental technology laboratories, to create a human infrastructure which could contribute to innovation process.

3- The importance of experiencing exchange with leading international institutions in the field of dental technology industry to find-out employee potentials

4- The importance of including the structural capital as a vital and essential asset in the product innovation in dental technology laboratories.

5- The importance of experiencing exchange with another local laboratories, to find a common ground, and focus on investing the current recourses.

List Of References

First: Arabic References

Second: Foreign References

First: Arabic References

الجاغوب, سهير, و الأمين, عبد الوهاب. (2002). "الاقتصاد المعتمد على المعرفة: هل سيكون مستقبلا للدول النامية: دراسة حالة الاردن" ورقة عمل مقدمة للمؤتمر العلمي السنوي الثاني, كلية الاقتصاد و العلوم الادارية, جامعة الزيتونة الاردنية.

حجازي, هيثم علي ,(2004). " مدى توظيف ادارة المعرفة في المنظمات الأردنية". دراسة منشورة في جامعة البصائر التابعة لجامعة البتراء, المجلد 13, العدد 2, الاردن, 15-19.

الحواجرة, كامل محمد, (2009)," دراسة ارتباط استراتيجيات استثمار رأس المال المعرفي بالاداء التنافسي للمؤسسات", مجلة جامعة الشارقة للعلوم الانسانية و الاجتماعية, المجلد 7, العدد 2.

صالح, أحمد علي,(2001), "أنماط التفكير الاستراتيجي و علاقتها بعوامل المحافظة على رأس المال الفكري: دراسة ميدانية في عينة من شركات القطاع الصناعي الاشتراكي", رسالة ماجستير في ادارة الاعمال غير منشورة, كلية الادارة و الاقتصاد| جامعة بغداد, العراق.

الصباغ، عماد عبد الوهاب (2000). "ادرة المعرفة و دورها في ارساء مجتمع المعلومات". دراسة غير منشورةا جامعة قطر.

عبد المنعم, أسامة, (2008), "رأس المال الفكري و اثره على منشات الاعمال الصناعية: دراسة حالة شركة الألبسة الجاهزة الأردنية", ورقة عمل, عمان: الأردن.

عبيد, أحمد حسن, (2000), "أثر استثمار رأس المال الفكري في الأداء المنظمي: دراسة ميدانية على عينة من الشركات الصناعية العراقية", رسالة ماجستير في ادارة الاعمال غير منشورة, كلية الادارة و الاقتصاد| جامعة بغداد, العراق.

القطارنة, زياد, (2006), " مدى توافر ادارة المعرفة و اثرها في فاعلية المديرين في الوزارات الاردنية", رسالة ماجستير غير منشورة, جامعة مؤتة, الكرك, الاردن.

الكردي, أحمد.(2004)"دور رأس المال المعرفي في زيادة الكفاءة الانتاجية" مجلة العلوم الاقتصادية و الادارية, المجلد 9, العدد 2, ص 24-26.

المومني, حسان, (2005), " اتجاهات المديرين نحو تطبيق ادارة المعرفة في المؤسسات العامة في الاردن", رسالة ماجستير غير منشورة, جامعة ال البيت, الاردن.

النعيمي, محمد عبدالعال, نجم, نجم عبود, (2006),"نحو اطار مفاهيمي لدراسة و تقييم رأس المال الفكري البشري في الجامعات", المؤتمر العلمي لاتحاد الجامعات العربية, جامعة الجزائر, 2-5

Second: Foreign References

Adamides, E.D. and Karacapilidis, N. (2006). Information Technology Support for the Knowledge and Social Process of Innovation Management. Technovation, 26, 50-59.

Battersby, K. (2004), The Important of Knowledge Management. The ICFAI Journal of Knowledge Management. 2(3): 43-47.

Baxter, R. and Matear, S. (2004). Measuring Intangible Value in Business-to-Business Buyer-Seller Relationships: An Intellectual Capital Perspective. Industrial Marketing Management, 33, 491-500.

Bhatt G D (2001) Knowledge Management in Organisation Examining the Interaction between Technology, Techniques and People, Journal of Knowledge Management, 5(1), 68-75.

Boekestein, Bram, (2006), "The relation between intellectual capital and intangible assets of pharmaceutical companies", Journal of Intellectual Capital, Vol7. ,, No. 2: 241-253.

Bontis, N, (2000)," Intellectual Capital and business Performance in Malaysian Industries", Journal of Intellectual Capital, Vol.1, Issue,1,

Brynjolfsson, Erik, Lorin M. Hitt and Shinkyu Yang (2002). Intangible Assets: Computers and Organizational Capital. Brookings Papers on Economic Activity, 2002(1), pp.137-181.

Carmeli, A. and Tishler, A. (2004). The Relationships between Intangible Organizational Elements and Organizational Performance. Strategic Management Journal, 25, 1257-1278.

Castiaux, A. (2007). Radical Innovation in Established Organizations: Being a Knowledge Predator. Journal of Engineering and Technology Management, 24, 36-52.

Chatzkel,L.J. (2003), Knowledge Capital:how knowledge-based enterprises relly get built.1st ed.,Progressive Practice, London.

Choo, A. (2003)." Knowledge Creation Using A Structural Improvement Approach : Towards An Integration Of Quality and Knowledge". PhD. Digital Dissertation. University of Minnesota.

Coombs, J.E. and Bierly, P.E. (2006). Measuring Technological Capability and Performance. R&D Management, 36, 421-438.

Davenport, T. and Prusak, L. 1998. Working Knowledge: Managing What Your Organization Knows. Harvard Business School Press, MA. Boston.

Davenport, T. H. and Prusak, L. (2000) Working Knowledge: How Organizations Manage What They Know, Harvard Business School Press, Boston, Massachusetts.

Dean, A. and Kretschmer, M. (2007). Can Ideas be Capital? Factors of Production in the Postindustrial Economy: A Review and Critique. Academy of Management Review, 32, 573-594.

Díaz-Díaz, N., Aguiar-Díaz, I. and De Saá-Pérez, P. (2008). The Effect of Technological Knowledge Assets on Performance: The Innovation Choice in Spanish Firms. Research Policy, 37, 1515-1529.

Egan,T. (2002). "Learning organization Dimensions and Motivation to Transfer Learning in Large Firm Information Technology". PhD. Digital Dissertation University of Minnesota. www.Lib.umi.com/dissertation/ search.

Egbu, C. (2004). "Managing Knowledge and Intellectual Capital for Improved Organizational Innovations in the Construction Industry: an Examination of Critical Success Factor". Information technologies for knowledge management: their usage and effectiveness, Electronic Journal of Information Technology in Construction, Vol. 7 pp.p125.

Escribano, A., Fosfuri, A. and Tribó, J.A. (2009). Managing External Knowledge Flows: The Moderating Role of Absorptive Capacity. Research Policy, 38, 96-105

Firer, Steven,Williams, S, mitcheel, Intellectual Capital and Traditional Measures of Corporate Performance, Journal of Intellectual Capital, Vol,4, Issue,3, (2003).
.

Galende, J. and De la Fuente, J.M. (2003). Internal factors determining a firm□s innovative behaviour. Research Policy, 32, 715-736.

Galende, J. (2006). Analysis of Technological Innovation from Business Economics and Management. Technovation, 26, 300-311.

Gigg. S (2002): Learning and Development, Macmillan, London, p216.

Grant, R.M. (1996). Toward a Knowledge-based Theory of the Firm. Strategic Management Journal, 17, S109-S122.

Gupta, B., L.S. Iyer and J.E. Aronson, 2000. Knowledge Management: Practices and challenges. Ind. Manage. Data Systems, 100: 17-21.

Hansen, M. and Hass, M. (2002)." Different Knowledge, Different Benefit: Toward A Productivity Perspective on Knowledge, Sharing in Organizations", Academy of Managers Proceeding. 896 (1): 118-142.

Hauschild, S., Licht, T. and Stein, W. (2001), "Creating a knowledge culture", The McKinsey Quarterly, No. 1, pp. 74-81.

Houseman,R. and J.P.Goodman(1997): Leading with Knowledge, Sage Publications, London, p168.

Hsu, Y.H. and Fang, W. (2009). Intellectual Capital and New Product Development Performance: The Mediating Role of Organizational Learning Capability. Technological Forecasting and Social Change, 76, 664-677.

Isaac, R. G., Herremans, I. M., Kline, T. J. (2009) Intellectual Capital Management: Pathways to Wealth Creation. Journal of Intellectual Capital 10(1) pp. 81-92.

Johnson, L.D., Neave, E.H. and Pazderka, B. (2002). Knowledge, Innovation and Share Value. International Journal of Management Review, 4, 101-134.

Kakabadse, K.(2001). From tacit knowledge to knowledge management. 3d Edition. John Wiley & Sons, Munich.

Leitner, K. (2005). Managing and Reporting Intangible Assets in Research Technology Organisations. R&D Management, 35, 125-136.

Lev, B. (2001) Intangibles: management, measurement, and reporting, Brookings Inst.Press, Washington DC.

Liu, P.L., Chen, W.C. and Tsai, C.H. (2005). An Empirical Study on the New Correlation between the Knowledge Management Method and New Product Development Strategy on Product Performance in Taiwan□s Industries. Technovation, 25, 637-644.

López-Cabrales, A., Cabello-Medina, C., Carmona-Lavado, A. and Valle-Cabrera, R. (2008). Managing Functional Diversity, Risk Taking and Incentives for Teams to Achieve Radical Innovations. R&D Management, 38, 35-50.

Maddocks, J. & Beaney, M. 2002. See the invisible and intangible. Knowledge Management, March, 16-17.

Mansury, M.A. and Love, J.H. (2008). Innovation, Productivity and Growth in US Business Services: A Firm-Level Analysis. Technovation, 28, 52-62.

Marr,B, Schiuma,G, and Neely, A. (2002) "Assessing strategic knowledge assets in eBusiness" International Journal of Business Performance Management, Vol 4 Nos 2-4.
Marr,B, Schiuma,G, and Neely, A. (2002) "Assessing strategic knowledge assets in eBusiness" International Journal of Business Performance Management, Vol 4 Nos 2-4.

Marr,B, Schiuma,G, and Neely,A. (2003) "Intellectual capital: defining key performance indicators for organizational knowledge assets", Business Process Management Journal, Vol 10, No 4.

Martinez-Torres, M.,(2006) "A Procedure to Design a Structural and Measurement Model of Intellectual Capital: An Exploratory study ", Information &Management, Vol.43, No.5, Jul.

Mertins, K., Heisig, P. and Vorbeck, J. (2001). Knowledge Management: Best Practices in Europe. New York: Springer-Verlag Berlin Heidelbery.

Mokyr, J.(2003). The knowledge society, journal of knowledge management, 2(5) :24-36.

Nakahara, Tsuneo, Innovation Management Using Intellectual Capital, International Journal of Entrepreneurship and Innovation Management, Vol.1, No.1 (2007).

Nazari, A., Herremans, M. Isaac, I. and G. Manassian, J. (2009). Organizational characteristics fostering intellectual capital in Canada and the Middle East Journal of Intellectual Capital,10 (1):135–148.

Ng, K.K. (2005). Overseas Assurance Corporation (Malaysia) Berhad, Journey Towards The Malaysian Emerging Knowledge Organisation (MEKO) Award 2005 and beyond. The Practice of Knowledge Management Conference. JT Frank Academy Sdn.Bhd. Unpublished.

Nonaka, I. and Takeuchi, H. (1995). The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation. New York: Oxford University Press.

Oslo manual, The Organisation for Economic Co-Operation and Development's document "The Measurement of Scientific and Technological Activities, Proposed Guidelines for Collecting and Interpreting Technological Innovation Data", contains guidelines for collecting and using data on industrial innovation.

Osterman, Paul. (2000). How common is workplace transformation and who adopts it? Industrial and Labor Relations Review 47 (2): 173–87.

Skyrme, David, (2003). Business Intelligence. Academy of management journal, 26, 200-212.

Subramaniam, M. and Youndt, M.A. (2005). The Influence of Intellectual Capital on the Types of Innovative Capabilities. Academy of Management Journal, 48, 450-463.

Sullivan, Patrick H,(1998), Profiting from intellectual capital: extracting value from innovation. 1st ed., Wiley(Intellectual property Series), London.

Thomas, A, Stewart, (2008), Intellectual Capital : The New Wealth of Organization,1st ed., Doubleday, New York.

WIPO, The World Intellectual Property Organization (WIPO) is one of the 16 specialized agencies of the United Nations. WIPO was created in 1967 "to encourage creative activity, to promote the protection of intellectual property throughout the world.

Yahya, S. and Goh, W.K. (2002), "Managing human resources toward achieving knowledge management", Journal of Knowledge Management, Vol. 6 No. 5, pp. 457-68.

List of Appendixes

Appendix (1): Questionnaire Arbitrators

Appendix (2): Study tool (questionnaire)

Appendix (1)

List of questionnaire Arbitrators

No.	Name & scientific title	Major	University
1	Prof. Najm AL-Azawi	Business Administration	Middle East
2	Dr. Hamza Hrem	Business Administration	Middle East
3	Dr. Ashraf Bani Mhammad	Business Administration	Middle East
4	Dr. Ali Abbas	Business Administration	Middle East
5	Dr. Mahfooz Jode	Marketing	Applied Science
6	Dr. Mohammed Emrair	Business Administrattion	Applied Science

Appendix (2)

Study Tool (Questionnaire)

The Impact on Structural Capital on Product Innovation

Empirical Study on Dental Technology Laboratories in capital Amman

As a part of Thesis Submitted in Partial Fulfillment of the

Requirements for the Master degree of Business Administration

Laila Wael Hamad

Supervisor

Dr. Younes Megdadi

Mr/Mrs……Greeting

This questionnaire is part of a study carried out by the researcher, to obtain a master degree majoring in management.

Please answer the paragraphs of the resolution attached honestly and objectively, by ticking (√) in the field that you deem appropriate, with the knowledge that this questionnaire is prepared for the purposes of scientific research, and will be dealt with information confidentially.

Laila Wael Hamad

Part (1):Demographic Information

Sex:

- ☐Male
- ☐Female

Years of Experience:

- ☐Less than 5 years
- ☐5-10 years
- ☐More than 10 years

Qualification:

- ☐Diploma
- ☐Bachelor
- ☐Master degree
- ☐PHD

Career Center:

- ☐General Manager
- ☐Head Manager
- ☐Employee

Procedural definitions help to fill the questionnaire:

Structural capital:

The knowledge that stays within the firm. It comprises organizational routines, procedures, systems, cultures and databases. It belongs to the company as a whole and can be reproduced and shared.

Patents:

The right to entrust grants for invention, which is a product or process in which a new way for the work of something, or provide a technical solution to a new problem where it refers to an exclusive right granted to anyone who invents any new, useful, and non-obvious process, machine, article of manufacture, or composition of matter, or any new and useful improvement thereof, and claims that right in a formal patent application. Patent is the right to prevent others from making, using, selling, or distributing the patented invention without permission.

Database:

s that manage data and allows fast storage and retrieval of that data Application when needed. The term database implies that the data is managed to some level of quality (measured in terms of accuracy, availability, usability, and resilience).

Information Systems:

The means by which people and organizations, utilizing technologies, gather, process, store, use and disseminate information, in a way that allows maximum use of knowledge and data.

Innovation:

The implementation of a new solution aiming at enhancing its competitive , or emergentposition, performance, or its know-how. It may refer to incremental, radical and revolutionary changes in thinking, products, processes, or organizations.

Part (2): Structural Capital

Factor One: Database

	Paragraph	**Strongly agree**	**Agree**	**Neutral**	**Disagree**	**Strongly disagree**
1	Databases available in the laboratory and include interactive models to display the basic information in an easy and simple way					
2	Databases provide information in the laboratory with a high degree of accuracy and reliability					
3	The use of databases in the laboratory provide basic information for decision-making					

4	Databases contribute in the delivery of information without conflict and duplication					
5	Use of databases in the laboratory contributes to the provision of information at lower cost and higher speed					
6	Database in the modern laboratory is being developed continuously to keep up with changes and developments in and outside the institution					
7	The database covers all areas and applications available					
8	There is a capability of the database for change and adjustment as needed by workers in the laboratory					
9	Database can retrieve data and information in the case of loss					

Factor Two: Information system

	Paragraph	**Strongly agree**	**Agree**	**Neutral**	**Disagree**	**Strongly disagree**
10	Information system works to direct efforts and employ them for the purposes of the speed of achievement in the laboratory					

11	Information systems provide clear guidance for staff on how to work					
12	Information system applications match the size of the work to be done					
13	Decision of product innovation is based on the data provided by the information system in the laboratory					
14	Administrative decisions are made on the basis of information contained in periodic reports					
15	There are basis for the classification and arrangement of information within the information system available in the laboratory					
16	Information system is updated periodically and continuously in the laboratory					
17	Information system provides information and useful help in solving business problems					
18	The information provided by the information system is characterized by a high degree of detail, which helps to make decisions during the innovation process					

Factor Three: Patents

	Paragraph	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
19	There is documentation of ideas reached by the staff at the concerned authorities to ensure their intellectual property rights					
20	There is documentation of the achievements of workers in the laboratory to the bodies and regional institutions					
21	There is documentation of the achievements of staff in the development area ,at the institutions of international bodies					
22	Staff in the laboratory meet with personnel and professional bodies to discuss their contributions in product development					

Part (3): Product Innovation

	Paragraph	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	Workers can put new ideas in the laboratory without limitations					

2	workers in the laboratory has groups of new ideas that aim to develop products at the laboratory					
3	Products in the laboratory are developed and produced in a new way					
4	Developed tools and services are used in the laboratory to develop the ideas of the workers					
5	Workers in the laboratory are heavily interested in the development of their products					
6	workers in the laboratory seek to innovative their products					
7	The laboratory adapts with the changes that occur in the external environment through new products					
8	Innovation in products contributes in increasing profits of production					
9	Innovation in products contributes in production time reduction					
10	Innovation in products contributes in improving product quality and efficiency					
11	Workers in the laboratory use their own designs in the manufacture of their products					

12	Workers in the laboratory use methods they innovated in the manufacture of their products					
13	There is a further innovation of new materials, used in the manufacture of products within the laboratory					
14	There is a further innovation of new tools, used in the manufacture of products within the laboratory					
15	Workers in the laboratory seek to know the needs of customers and convert them into products					
16	There is an innovation in the products of the laboratory to service different requirements					
17	There is an innovation in the processes used in the laboratory to develop new products					

18	There is cooperation between the laboratory and a leading foundation at the global level, that supervises the creative and entrepreneurial work of the laboratory					
19	Workers in the laboratory encourage the creative ideas of their colleagues and provide support in their implementation					
20	There is a continuous renewal of the tools and equipment used in the laboratory, which contributes to test new ideas					
21	There is an obvious interest in the management of the laboratory in the availability of appropriate educational and training conditions that encourage employees to develop their ideas					