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The impact of adopting e-collaboration tools on knowledge management processes

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A B S T R A C T

The aim of this study is to identify the impact of adopting and using electronic collaboration tools on knowledge management processes at the Generations For Peace (GFP) Organisation in Jordan. To achieve the objectives of this study, the researchers used an analytical descriptive method by developing a questionnaire consisting of (46) items. A comprehensive survey was adopted for the study and 300 questionnaires were distributed among the study population consisting of GFP Arabic-speaking staff. 281 questionnaires were returned (93.6% of the study sample) and 267 were suitable for analysis. The researchers used SPSS to analyse the data. As part of the study's results, deficiency, on the one hand, was found in the use of electronic links among individuals. Furthermore, the researchers found a drawback in GFP's use of strategies that reduce bureaucracy at work. Another deficiency was found as well in encouraging informal meetings at GFP among staff to exchange work-related views. But on the other hand, knowledge management processes were highly scored; the highest score was given to 'knowledge storage' followed by 'knowledge generation', 'knowledge application' and lastly 'knowledge sharing'.

1. Introduction

GFP is a global not-for-profit leading organisation in the field of promoting peace, with its headquarters in Jordan. GFP was founded by His Royal Highness Prince Faisal Bin al-Hussein in 2007 and it currently occupies the 32nd place on the list of best 500 non-profit organisations in the world. Other than being the best non-profit organisation in Jordan, GFP was also ranked in 2018 among the top 30 non-governmental organisations in the field of promoting peace in the world in 2018 based on the criteria of innovation, impact and sustainability. During the past few years, GFP managed to achieve rapid global growth in different directions contexts proving by that the success, impact and sustainability of its model. In 2017, GFP trained and guided more than 10,689 young volunteer leaders from countries in the Middle East, Africa, Asia and Europe. The work of GFP impacted the lives of more than 479,817 children, youth and adults (Generations For Peace, 2019).

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Knowledge management is considered as one of the most important modern management strategies and techniques to bring about change and development and to achieve competitive advantage in today's world. Modern scientists in the field of management confirm that progressive and innovative thought and knowledge are important elements to the success of a management. Therefore, in light of GFP's need to manage its knowledge processes among its branches around the world, several modern e-collaboration tools were used; they are: Skype for Business, E-Mail, VoIP Calls, and WhatsApp – these electronic tools were used as platform for interaction between staff to ensure proper knowledge management and exchange among workers and volunteers of different tongues, cultures and backgrounds. Therefore, this research aims to achieve the following objectives: study the reality of adopting and using e-collaboration tools (ECTs) at GFP; study knowledge management practices (KMPs) and their level of application at GFP; identify the impact of adopting and using ECTs in all their dimensions (technological, organisational and environmental) on KMPs (knowledge generation, knowledge storage, knowledge sharing and knowledge application); and present the necessary recommendations to improve the level of KMPs and adoption and use of ECT in GFP.

2. Theoretical Framework

2.1 Previous Studies

The researchers surveyed a number of previous studies in order to create a theoretical framework and a model for this study. Olaisen and Revang (2017) aimed at exploring how to facilitate the exchange of high-quality knowledge and found that the sharing of knowledge among virtual team members makes business performance smarter and leads to increased confidence and knowledge collaboration to deliver business solutions and innovations, thereby improving innovation and collective and individual growth; also knowledge sharing, through different technological platforms, makes work greener (i.e., less frequent mobility and travel at a lower rates) and creates less stress and more professionality at work. The study recommended increasing reliance on different technological platforms that would increase knowledge participation among task forces' members in different geographic regions. Another study by Soto-Acosta et al. (2014) tried to identify the impact of the adoption and use of Internet technologies within small and medium organisations on the exchange of knowledge through Web 2.0 techniques based on the technological, organisational and environmental model. The results show that knowledge sharing through Web 2.0 technologies emerges from internal organisational and technological resources rather than from the external environment. Lovrekovic (2013) tried to explain the reasons for the implementation of knowledge management and the changes that took place during the transition to the knowledge economy. The results indicated that knowledge management was an important concept that promotes progress in society, provides organisations with the key to survival and growth in today's market, and that the best way to survive in the market today is to be able to produce knowledge and to strive to produce innovations periodically, known as managing effective knowledge. This study recommended providing the necessary infrastructure for the success of knowledge management, especially competent human resources and advanced information technology, in order to increase the competitiveness of the organisations. The last study reviewed by researchers is (Asian Productivity Organisation, 2013): Knowledge Management for the Public Sector at Asian Productivity Organisation (APO). The purpose of this study is to raise awareness and to demonstrate the importance of knowledge management, especially in increasing the productivity of the governmental sector. The results indicated that knowledge management is important to improve the productivity of organisations in the public sector and to provide better services and solutions for citizens. Learning and innovation resulting from knowledge management processes will increase the knowledge and skills of individuals, leading to improved performance. Higher productivity can be achieved through the collective capacity of individuals, improved working procedures and systems, enhanced cooperation and better decision-making.

2.2 Electronic Collaboration Tools

The electronic collaboration tools concept is relatively new idea in the field of information technology, and it has become increasingly important during the past few years. Given its importance, many different definitions of this concept emerged and each of these definitions was formed according to the specialisation of different researchers and according to their different views. For example, Chong et al. (2009) define ECT as tools and technological media used to help people work together to achieve a common goal or objective over the Internet or networks. These tools exist in two forms: 1. (Synchronous) where all parties involved interact in real time as in online meetings, or through instant messaging applications, 2. (Asynchronous) where the parties involved are not required to communicate at the same time, as when documents or annotations are uploaded to shared workspaces. Similar to the prior definition, Turel and Connelly (2012) described ECT as collaboration tools that work remotely through the Internet. They add that ECT support the implementation of the 'design thinking' concept where teams explore complex challenges and organise flexible operations across any of the various electronic devices whether computers or mobile phones, allowing the addition of drawing tools, sticky notes, icons, photos, comments, discussions and more features to help with decision-making. Another definition was given by Kock (2010) describing ECTs as the process by which a group of individuals communicate without direct face-to-face interaction or through virtual teams using information technology. Their purpose is to establish, facilitate and support cooperation between geographically dispersed groups of parties with common objectives to enable them to work together for mutual benefit.

2.3 The Importance of ECTs

The importance of electronic collaboration tools is demonstrated in many aspects of life. From a sociological angle, the use of ECTs increases communication between people and is a way of establishing new relationships in addition to existing relationships. Given that they are not subject to spatial or temporal constraints, geographical distance is thus not a problem. They also allow synchronised use between all parties involved linking existing interests and practices. Furthermore, ECTs play a role that does not require strong social commitments, such as existing relationships with close friends, family or neighbours (Baumber et al., 2018). Culturally, ECTs can be used as short-term communication systems among different points, enabling communities to be permanently connected and exchange cultures. They also play cultural and social roles bringing together the cultures of different users from all backgrounds into one virtual community (Michaelides et al., 2013). Therefore, the diversity of ECTs makes it more than just a domain, a place or a time. It is valid for all areas and for all purposes at any time and place. ECTs have been launched and are used in information systems, design, office applications, games, health, medical applications, psychology, communication, cognitive sciences, geo-science and many other fields. The role of ECTs in telecommunications is hugely significant. They have a large number of communication models and tools that provide text, audio and visual communications. They are also important means of disseminating knowledge on a large scale and making this knowledge accessible to anyone interested. ECTs created all kinds of human communication that were previously unimagined. They provide many forms and new features that enable sustainability in social relations. Additionally, ECTs in the economic fields help accelerate processes and increase productivity, as well as improve relationships between business organisations and their customers. It provides business teams with a smooth communications system, which facilitates cooperation in business transactions. Through ECTs, business applications can be linked with communication devices in customer relationship management, projects management and resource management (Turban et al., 2011). Moreover, ECTs hold a key importance for being flexible and easy to use allowing a large number of parties with shared interests to cooperate among themselves, achieve their goals and share stored information and data. They can also have access to this information and data easily thanks to easy storage and retrieval. ECTs reduce repetitive entries of data and provide access and usage of remote storage systems and files that may be modified by groups of parties involved (Memon & Meyer, 2017, Chi et al., 2015).

2.4 Dimensions of Adopting ECTs

In order to achieve the objectives of the present study, a number of dimensions were adopted based on the TOE model "Technological, Organisational and Environmental". The dimensions are: technological context, organisational context and environmental context (Soto-Acosta et al., 2014). These were chosen in the matter that commensurate with the study population. The following is a brief explanation of these dimensions:

2.4.1 Technological Context

This dimension constitutes the infrastructure of ECTs, which includes all computers, servers, networks, software and databases available in organisations, which connect all employees and departments together and with other organisations through Internet or Intranet. Technological infrastructures consist of a set of components that work integrally within a general framework, which is made of the communication systems, application systems, database systems and support systems (Mohezar & Soosay, 2010). It is best for an organisation to strive to have the latest computer technology available in order to cover costs of continuous development and maintenance, and to ensure alignment with any new emerging computer and system technology. As for which brands are the best and how suitable are their systems and applications, this depends to the organisations' needs (Meeks et al., 2017).

2.4.2 Organisational Context

The organisational context covers all administrative and organisational matters that the organisation needs to continue and sustain its business. This includes its strategy, vision, leadership, organisational structure, work procedures and others (Kock, 2010). Given that adopting ECTs in organisations requires the availability of specific and clear organisational requirements, the use of ECTs in the absence of a sophisticated and certain management organisation will not ensure the absolute success of the organisation and the continuity of the level of performance and speed of completion. The reason is that without such elements, the organisation will be overcome by random and improvised procedures, which will lead to a limited and non-sustainable success. Therefore, it is a key to give sufficient attention to the organisational structure of the organisations for ECTs to succeed. Having specific administrative divisions under an approved and declared organisational chart and clearly defining the divisions' functions and vertical and horizontal relations is key to the success of an organisation (Kock, 2010). The organisational context also includes the highly qualified and trained human capital, which constitutes the backbone of a successful adoption of ECTs and through which the factors of success, continuity and sustainability would be available. The human element is an essential input to the adoption and use of ECTs. Emphasis should be placed on the human element as the driving force of the e-Collaboration Toolkit strategy, and therefore the development and training of this component is urgent, if not necessary (Mohezar & Soosay, 2010). It is therefore necessary to have a manpower that is capable of dealing with and adapting to the advanced technology, including electronic collaboration tools. Without these competencies that are qualified to deal with the requirements of ECTs' use, it is difficult and even impossible to achieve the objectives of their adoption even if the resources and materials are available (Soto-Acosta et al., 2014).

2.4.3 Environmental Context

According to Chandra and Kumar (2018), the environmental context is the group of attributes related to the business environment such as government regulations, consumers, competition, etc. Competitive pressures and technology vendor support are also included in this dimension. Organisations must adapt to the environment in which they operate including its decisions that are usually derived from strengths, weaknesses, opportunities and threats (known as SWOT analysis). An organisation's administrations should conduct a survey of its external environment to identify opportunities to benefit from and potential

or existing threats to neutralise or confront. It should also examine its internal environment to determine strengths that help it seize opportunities and confront risks, and the weaknesses it needs to solve (Hart et al., 2017).

2.5 Concepts of Data, Information and Knowledge

Because the research focuses on the concept of knowledge, it is necessary to distinguish between the concepts of data, information and knowledge. Baskarada and Koronios (2013) define data as distinct and impartial unprocessed facts without definite meaning. As for information, it is a meaningful form of data that is useful to humans (Laudon and Laudon, 2006, p. 13). Now when it comes to knowledge, and according to Becerra-Fernandez and Sabherwal (2010), it is the set of information required to make a decision or to complete a task. According to Turban et al. (2011, p. 38) knowledge is organised and processed data and/or information to create an understanding or experience that can be used to solve a problem or carry out an activity. In light of the previous definitions, the researchers believe that the concept of knowledge has expanded to include many meanings. Knowledge is information that can be used and invested to reach useful results and make good decisions, through which a person can diagnose problems and identify alternatives to reach good solutions.

2.6 Knowledge Management and its Importance

The concept of knowledge management is a modern concept that emerged from the science of management. With the increased interest in this science, it is easy to find many definitions of this concept but the definitions differ according to the disciplines of researchers and their differences of views especially that the concept of knowledge management is still in the stage of development and discovery. Karasneh and Al-Khalili (2009) defined knowledge management as a process that consists of a set of activities that deal with how to create, organise, store, check, refine, access, develop, disseminate and apply knowledge for the purposes of achieving the organisation's goals through decision- making and problem- solving and for the purpose of achieving competitive advantage. Knowledge management is also defined as a process by which the accumulated experience from any place in the business, whether documented in paper, in databases or in the minds of employees, is combined to add value to the company through innovation, application and integration of knowledge in unprecedented ways (Al-Ali et al., 2012).

The researchers concluded through these definitions that knowledge management is a set of processes (knowledge generation, storage, sharing and application) whose goal is to provide the right knowledge at the right time and to the right person for the purposes of assisting problem-solving, decision-making and strategic planning in order to reach goals developed by the organisation. The importance of knowledge management stems from the fact that it is a new subject that integrates with other intellectual topics in the field of management. It contributes to the development of knowledge and its accumulation in light of the spread of modern communication systems and the expansion of the information network. This concept facilitates the spread of and exchange knowledge. Furthermore, knowledge management created a comprehensive and clear way to understand knowledge management initiatives and to remove knowledge restrictions as well as restructure it. This is the key for developing an organisation and adapting to meet the requirements of the economic environment. Knowledge management also increases the organisation's productivity, employee satisfaction and loyalty.

2.7 Knowledge Management Processes

Researchers do not yet agree on the number of knowledge processes or knowledge activities. However, for the purposes of this study and as cited by Ababneh and Hatamleh (2013) we will refer to four major processes as follows:

2.7.1 Knowledge Generation

It is group of operations that includes discovery, purchase, innovation, acquisition and creation of knowledge from multiple sources such as experts, specialists, knowledge centres, competitors, clients, databases, documents, minds, etc., using various means and methods, including participation in workshops, lectures, and hands-on learning (Al-Mudallal, 2012). To many writers, the creation of knowledge is made through the participation of individuals, working teams and groups in the process of generating a new knowledge capital for new issues and practices, which will consequently contribute of defining problems and finding new solutions in an innovative manner. Knowledge generation provides the organisation with the ability to excel in achieving a high market status in different areas such as implementing strategy, starting new production lines, expediting problem solving, transferring best practices, developing professional skills, and helping management to recruit and retain talent. This reinforces the need to understand that knowledge and innovation are a two-way process, where knowledge is a source of innovation, and innovation becomes a source of new knowledge (Al-Ali et al., 2012).

2.7.2 Knowledge Storage

Knowledge storage is the process of retaining, maintaining, sustaining and organising knowledge as well as facilitating, access and retrieval. This process is considered the organisation's organisational memory (Sweis et al., 2011).

Knowledge storage comes after the aware selection of knowledge in two basic forms: (Olwani, 2001).

- Individuals: Individuals are the custodians of experience. Therefore, it is essential to have administrative procedures that ensure maintaining their expertise through a system of incentives, encouragement and orderly transition of experience in the career ladder.
- Computers: Computers are widespread and fundamental means of maintaining knowledge thanks to their efficiency, accuracy, breadth of storage space, and the high capacity to handle document storage in its digital form. This adds to the fact that computers allow editing documents in various ways and facilitates providing answers to staff questions and queries.

Knowledge storage has become a very important process because knowledge is becoming more and more invaluable. In addition, organisations face a significant risk resulting from knowledge loss when individuals leave an organisation for one reason or another. Hence, knowledge storage, retention and protection are very important elements especially for organisations that suffer from a high turnover.

2.7.3 Knowledge Sharing

This process refers to the dissemination and sharing of knowledge among members of the organisation. Implicit knowledge is disseminated through training and dialogue techniques, and explicit knowledge is disseminated through documents, internal circulars and learning (Sweis et al., 2011). This part of KMPs requires everyone to share knowledge by adopting a culture that encourages it, providing the right environment, creating the general atmosphere and organisational structure, and adopting a system of incentives that encourages knowledge sharing. The process of knowledge transfer and sharing is a fundamental process of KMPs and represents the delivery of appropriate knowledge (implicit or explicit) in a timely manner and to the right person within the appropriate means of communication. Transfer and sharing of knowledge depend on the presence of effective mechanisms, such as reports, manuals, trainings, formal meetings, and on-the-job or informal learning, such as informal meetings, seminars and sessions that usually take place outside working hours.

2.7.4 Knowledge Application

Ajmal and Koskinen (2008) define knowledge application as the process through which knowledge is directly utilised to solve a problem at work by an individual or a team. The application of knowledge is the main goal of knowledge management. It is about investing knowledge. Access, storage, distribution and participation are not enough. The important thing is to transform this knowledge into a concrete reality. Knowledge that is not reflected in implementation is just a cost and the success of ECTs in any organisation depends on the size of knowledge compared to what is available to it. The gap between what you know and what you have implemented is one of the most important evaluation criteria in this area (Al-Zatma, 2011). An efficient knowledge management system is not enough to ensure success in the organisation, but it is a positive step for learning and its power lies in its use. Knowledge implementation is therefore more important than knowledge itself. Knowledge generation, knowledge storage and knowledge sharing will not lead to improved organisational performance as knowledge application would. This is especially true in the strategic process towards achieving high quality products and services corresponding to the needs of customers; knowledge is power if applied (Al-Ali et al., 2012).

3. Study Model

The study model consists of the independent variable (adoption of E-Collaboration Tools), for which the researchers defined three dimensions: technological, organisational and environmental. In choosing these dimensions, the researchers used the Soto-Acosta et al.'s (2014) study and the study by Mohezar and Soosay (2010). As for the dependent variable (Knowledge Management Processes), the researchers defined four dimensions seen by many studies as key knowledge management processes: knowledge generation, knowledge storage, knowledge sharing and knowledge application. In this process, the researchers based their work on the studies by Ababneh and Hatamleh (2013) and Skyrme (1997).

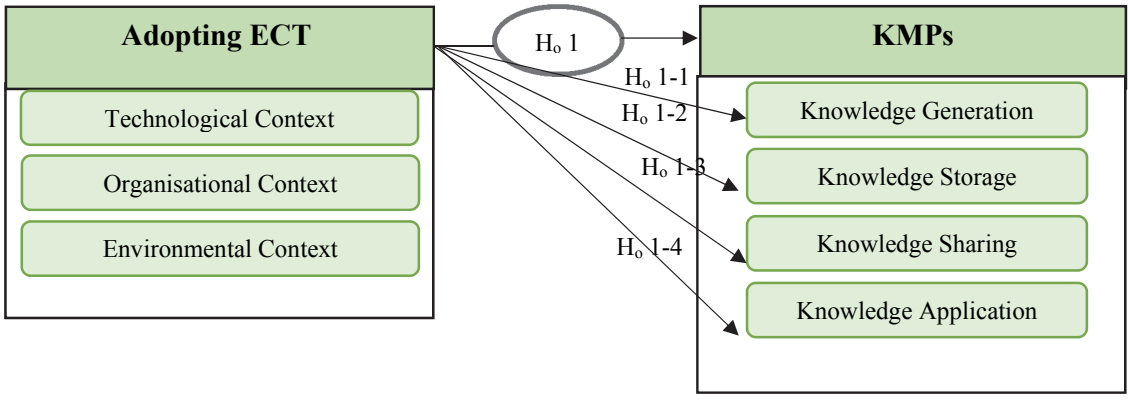

Fig. 1. The Study Model

4. Study Methodology

The present study uses an analytical descriptive approach that studies the phenomenon and describes it with precision as it is in reality. This approach then analyses the interrelationships between the independent variable and the dependent variable in an attempt to identify the nature and scale of impact of the independent variable on the dependent variable. Afterwards, the study reaches conclusions that may contribute to the development and improvement of the situation in reality.

4.1 Study Sample and Population

The study population consists of all management directors, departments' directors, heads of sections and Arabic-speaking staff working at the Generations for Peace (GFP) in Jordan, about 300 employees as per

GFP HR data. Because the study population is relatively small, the researchers adopted a comprehensive survey method. Given that the study population consisted of Arabic-speaking staff at GFP, the researchers distributed 300 questionnaires to the study sample retrieving 281 questionnaires (93.6% of the study sample) and 267 were suitable for analysis.

4.2 Study Tool

The researchers developed the questionnaire based on a number of previous studies. The questionnaire consisted of three parts. The first part contains the demographic and functional data of the respondents. The second includes 21 items related to the "adopting e-collaboration tools" three dimensions: technological (7 items), organisational (7 items) and environmental (7 items). As for the questionnaire's third part, it includes the dimensions of "knowledge management processes" with 25 items distributed on four dimensions: knowledge generation (7 items), knowledge storage (6 items), knowledge sharing (6 items) and knowledge application (6 items). The Likert scale of five levels was used for the questionnaire as follows: (5: strongly agree, 4: agree, 3: moderately agree, 2: disagree, and 1: strongly disagree). This scale was used to measure the level of adopting e-collaboration tools and the level of knowledge management processes at the GFP.

4.3 Study Tool Validity

In order to verify the face validity of the study's questionnaire, the researchers presented it to seven expert arbitrators from within the teaching staff of various universities, who evaluated the validity and suitability of the study. The arbitrators were asked to give their opinions regarding the suitability of the items, to check the correctness of the language, and to provide the researchers relevant recommendations. In light of the feedback provided by the arbitrators, a number of items were deleted or modified.

4.4 Study Tool Reliability

The reliability of the tool is the level of stability of its results if it is applied more than once in similar circumstances based on Cronbach Alpha coefficient as shown in Table 1 below. The high value of Cronbach Alpha coefficient reflects a high level of reliability and the value of Cronbach Alpha coefficient ranges from 0 to 1. The Cronbach Alpha coefficient value for reliability is accepted at a level of 0.7 and above.

Table 1
Reliability Coefficients (the Cronbach Alpha Method) for Study Tool Dimensions

Dimension	Dimension	Number of Items	Cronbach Alpha Coefficient
Adopting electronic collaboration tools	Technological context	7	0.82
	Organisational context	7	0.88
	Environmental context	7	0.81
	Adopting electronic collaboration tools as a whole	21	0.87
Knowledge management processes	Knowledge Generation	7	0.70
	Knowledge Storage	6	0.83
	Knowledge Sharing	6	0.80
	Application of knowledge	6	0.82
	Knowledge management processes as a whole	25	0.86

4.5 Description of Study Sample Characteristics

The sample of the current study consisted of (267) employees and staff members at GFP, Jordan. They were selected using a comprehensive survey method. Table 2 shows the distribution of the sample according to their demographic and functional data.

Table 2
Distribution of Study Sample According to Demographic and Functional Data (N = 267)

Variable	Level	Repetition	Percentage
Gender	Male	146	% 54.7
	Female	121	% 45.3
	Total	267	% 100
Age group	Less than 30 years	141	% 52.8
	30 to less than 40 years	77	% 28.8
	40 to less than 50 year	33	% 12.4
	50+	16	% 6
	Total	267	% 100
Educational level	Diploma or lower	52	% 19.5
	BA	141	% 52.8
	Postgraduate	74	% 27.7
	Total	267	% 100
Job title	Management Director	25	% 9.4
	Director of Department	26	% 9.7
	Head of Section	48	% 18
	Employee	168	% 62.9
	Total	267	% 100
Years of service	Less than 5 years	101	% 37.8
	5 to less than 15 years	105	% 39.3
	15 to less than 25 years	44	% 16.5
	25+	17	% 6.4
	Total	267	% 100

4.6 Description of Study Variables

This section presents the analysis' results as reflected by arithmetic means and standard deviations, which in turn represent the level of agreement cited by sample members at GFP regarding questionnaire items for the "adopting e-collaboration tools" part and its dimensions (technological, organisational and environmental) as well as the "knowledge management processes part" and its dimensions (knowledge generation, storing, sharing and applying). The results are presented below:

4.6.1 Independent variable (adoption of e-collaboration tools)

To answer the first question of the study ("To which extent are e-collaboration tools adopted and used in GFP?"), the arithmetic means and standard deviations of questionnaire responses were calculated for the independent variable (Adopting E-Collaboration Tools: technological, organisational and environmental contexts) as shown in Table 3 below. Table 3 shows that the arithmetic means of respondents' answers concerning the dimensions of the independent variable (adopting ECTs) were calculated between 3.84 and 3.94 at a high evaluation level for all dimensions. The technological context received the highest arithmetic mean value (3.94) followed by the organisational context (3.91) and the environmental context (3.84). The arithmetic mean of adopting ECTs as a whole received a high evaluation of 3.90.

Table 3
Arithmetic Means and Standard Deviations of Respondents' Answers to "Adopting E-Collaboration Tools" Dimensions (in descending order by arithmetic mean)

Rank	Number	Dimension	Arithmetic Mean	Standard Deviation	Evaluation Level
1	1	Technological context	3.94	0.75	High
2	2	Organisational context	3.91	0.78	High
3	3	Environmental context	3.84	0.79	High
Dimensions of Adopting E-Collaboration Tools as a whole			3.90		High

To further qualify in details the level of adopting ECTs at GFP, the researchers calculated the arithmetic means and standard deviations of the answers provided by sample respondents to the questions concerning ECTs dimensions individually:

4.6.1.1 'Technological Context' Results

The arithmetic means and standard deviations of sample responses concerning this context were calculated as shown in Table 4.

Table 4
Arithmetic Means and Standard Deviations of Sample Responses Regarding the Technological Context (in descending order by arithmetic mean)

Rank	Number	Dimension	Arithmetic Mean	Standard Deviation	Evaluation Level
1	1	GFP has an advanced technological infrastructure.	4.36	0.93	high
2	2	GFP has an internal computer network connecting all employees together	4.09	0.86	high
3	3	GFP has a database available to all staff in accordance to the authorities granted to them	3.99	1.00	high
4	4	The Electronic Collaboration Tools at GFP facilitate obtaining information anytime and anywhere.	3.87	1.03	high
5	6	There is an electronic data link between GFP and its branches outside Jordan.	3.85	1.10	high
6	5	GFP has an e-archiving system for all sections.	3.81	1.12	high
7	7	There is an electronic data link between GFP and other institutions.	3.59	1.26	Average
Technological Context as a whole			3.94	0.75	high

Table 4 illustrates that the arithmetic means of respondents' answers to the technological context items were valued between 3.36 and 4.36. The highest value was that for item (1) "there is an electronic data linking between GFP and other institutions" at a medium level. The arithmetic mean for the dimension as a whole was 3.94 at a high level.

4.6.1.2 'Organisational Context' Results

The arithmetic means and standard deviations of sample responses concerning the organisational context were calculated as shown in Table 5.

Table 5
Arithmetic Means and Standard Deviations of Sample Responses Regarding the Organisational Context (in descending order by arithmetic mean)

Rank	Number	Dimension	Arithmetic Mean	Standard Deviation	Evaluation Level
1	4	E-Collaboration tools help achieving task performance transparency.	4.30	0.94	high
2	1	GFP higher management support adopting novel e-collaboration tools to carry out tasks.	4.00	1.22	high
3	5	GFP attracts and employs individuals capable of working with IT.	3.94	0.92	high
4	7	E-Collaboration tools assist in speeding the process of making administrative decisions.	3.87	1.10	high
5	6	GFP employees receive specialised training courses on using e-collaboration tools.	3.86	1.07	high
6	3	E-Collaboration tools help apply new work procedures.	3.74	1.23	high
7	2	E-Collaboration tools help eliminate bureaucracy in performing tasks.	3.66	1.13	Average
Organisational Context as a whole			3.91		high

Table 5 demonstrates that the arithmetic means of respondents' answers to the organisational context items were valued between 3.66 and 4.30. The highest value was that for item (4) "ECTs contribute to achieving transparency in performing tasks" at a high level. On the other hand, the lowest value was that

of item (2) "ECTs assist in eliminating bureaucracy at work" at a medium level. The arithmetic mean for the dimension as a whole was 3.91 at a high level.

4.6.1.3 'Environmental Context' Results

The arithmetic means and standard deviations of sample responses concerning the environmental context were calculated as shown in Table 6.

Table 6
Arithmetic Means and Standard Deviations of Sample Responses Regarding the Environmental Context (in descending order by arithmetic mean)

Rank	Number	Dimension	Arithmetic Mean	Standard Deviation	Evaluation Level
1	1	E-Collaboration tools facilitate creating an accurate working environment.	4.07	1.15	high
2	5	E-Collaboration tools play a role in strengthening GFP vision.	3.92	1.05	high
3	3	E-Collaboration tools facilitate creating a flexible working environment.	3.89	1.02	high
4	2	E-Collaboration tools facilitate communication between GFP and the local community.	3.79	1.04	high
4	4	E-Collaboration tools help GFP management fulfil the evolving needs to complete tasks.	3.79	1.12	high
6	7	E-Collaboration tools help GFP in utilising internal environment factors (strengths and weaknesses).	3.75	1.14	high
7	6	E-Collaboration tools help GFP utilise external environment factors (opportunities and threats).	3.69	1.11	high
Environmental Context as a whole			3.84		high

Table 6 reveals that the arithmetic means of respondents' answers to the environmental context items were valued between 3.69 and 4.07 with a high value for all items. The highest value was that for item (1) "ECTs help create an accurate work environment" while the lowest value was that of item (6) "ECTs help GFP seize the benefits of the external environment factors (opportunities, threats)". The arithmetic mean for the dimension as a whole was 3.84 at a high level.

4.6.2 Dependent Variable (Knowledge Management Processes)

To answer the second question of the study ("what is the level of knowledge management processes at GFP?"), the arithmetic means and standard deviations of questionnaire responses were calculated for the dependent variable (Knowledge Management Processes: generating, storing, sharing and applying knowledge) as shown in Table 7 below.

Table 7
Arithmetic Means and Standard Deviations of Respondents' Answers to "Knowledge Management Processes" Dimensions (in descending order by arithmetic mean)

Rank	Number	Dimension	Arithmetic Mean	Standard Deviation	Evaluation Level
1	2	Knowledge Storage	3.91	0.76	high
2	1	Knowledge Generation	3.90	0.77	high
3	4	Knowledge Application	3.84	0.85	high
4	3	Knowledge Sharing	3.75	0.85	high
Knowledge Management Dimensions as a whole			3.85		high

Table 7 shows that the arithmetic means of respondents' answers concerning the dimensions of the dependent variable (KMPs) were valued between 3.75 and 3.91 with a high evaluation for all dimensions. The highest value was that for knowledge storage (3.91) followed by knowledge generation (3.90), knowledge application (3.75) and knowledge sharing (3.75). The arithmetic mean for KMPs as a whole was 3.85 at a high evaluation.

4.6.2.1 'Knowledge Generation' Results

The arithmetical means and standard deviations of GFP sample responses concerning the 'Knowledge Generation' dimension are presented below in Table 8.

Table 8
Arithmetic Means and Standard Deviations of Sample Responses to 'Knowledge Generation' Dimension (in descending order by arithmetic mean)

Rank	Number	Dimension	Arithmetic Mean	Standard Deviation	Evaluation Level
1	1	GFP seeks the assistance of specialised experts to transfer their knowledge to GFP staff.	4.26	1.04	high
2	4	GFP facilitates access to database for all employees based on their level of authorisation.	3.97	1.05	high
3	5	GFP has a mechanism for receiving the opinions and proposals of its staff.	3.87	1.12	high
4	6	GFP regularly informs all employees about any new knowledge concerning its work policies and procedures.	3.84	1.11	high
5	2	GFP encourages its staff to learn from the experiences of other organisations to widen their knowledge.	3.82	1.09	high
5	3	GFP staff interact with each other to find suitable solutions for problems they face.	3.82	1.15	high
7	7	GFP assign employees to training courses for the purpose of increasing their scientific and technical knowledge.	3.73	1.19	high
Knowledge Generation as a whole			3.90		high

Table 8 demonstrates that the arithmetic means of respondents' answers to the knowledge generation items were valued between 3.73 and 4.26 at a high level for all items. The highest value was that for item (1) "GFP seeks the assistance of experts and specialists to transfer their knowledge and expertise to GFP workers." The lowest value was that of item (7) "GFP assigns employees to training courses for the purpose of increasing their scientific and technical knowledge". The arithmetic mean for the dimension as a whole was 3.90 at a high level.

4.6.2.2 'Knowledge Storage' Results

The arithmetical means and standard deviations of GFP sample responses concerning the 'Knowledge Storage' dimension are presented below in Table 9.

Table 9
Arithmetic Means and Standard Deviations of Sample Responses to 'Knowledge Storage' Dimension (in descending order by arithmetic mean)

Rank	**Number**	**Dimension**	**Arithmetic Mean**	**Standard Deviation**	**Evaluation Level**
1	3	GFP encourages its staff to document all issues they face along with their solutions for future use.	4.22	0.99	high
2	1	Information is stored in a comprehensive and sufficient database that is available to all staff based on their level of authorisation.	4.07	1.07	high
3	6	GFP uses ICT to provide data when needed.	3.83	1.09	high
4	4	GFP documents experts' knowledge in the various sections in the form of work rules and procedures.	3.79	1.00	high
4	5	In storing knowledge, GFP uses written records and documents.	3.79	1.01	high
6	2	I document any new or acquired knowledge from any project carried out by my section.	3.74	1.12	high
Knowledge Storage Dimension as a whole			3.91		high

Table 9 shows that the arithmetic means of respondents' answers to the knowledge storage items were valued between 3.74 and 4.22 at a high level for all items. The highest value was that for item (3) "GFP encourages employees to document most of the issues they face and their solutions for future benefit."

The lowest value was that of item (2) "I document new and acquired knowledge of any project run by my department". The arithmetic mean for the dimension as a whole was 3.91 at a high level.

4.6.2.3 'Knowledge Sharing' Results

The arithmetical means and standard deviations of GFP sample responses concerning the 'Knowledge Sharing' dimension are presented below in Table 10.

Table 10
Arithmetic Means and Standard Deviations of Sample Responses to 'Knowledge Sharing' Dimension (in descending order by arithmetic mean)

Rank	Number	Dimension	Arithmetic Mean	Standard Deviation	Evaluation Level
1	1	GFP has an internal network that enables knowledge sharing among all parts of the organisation.	3.93	1.15	high
2	3	Collective work at GFP helps me exchange knowledge with others.	3.79	1.12	high
3	2	I do not hesitate to request help and advice from my supervisor or colleagues when needed.	3.76	1.12	high
4	5	GFP issues different newsletters and periodicals to share new information with the staff.	3.70	1.15	high
5	6	GFP holds internal training courses led by expert and qualified personnel.	3.68	1.12	high
6	4	GFP encourages holding non-official meetings among staff to exchange work-related views.	3.64	1.13	average
Knowledge Sharing Dimension as a whole			3.75		high

Table 10 demonstrates that the arithmetic means of respondents' answers to the knowledge sharing items were valued between 3.64 and 3.93. The highest value was that for item (1) "GFP has an internal communication network that allows knowledge sharing among all different parties" at a high level. The lowest value was that of item (4) "GFP encourages employees to hold informal meetings to exchange views and opinions related to work" at a medium level. The arithmetic mean for the dimension as a whole was 3.75 at a high level.

4.6.2.4 'Knowledge Application' Results

The arithmetical means and standard deviations of GFP sample responses concerning the 'Knowledge Application' dimension are presented below in Table 11.

Table 11
Arithmetic Means and Standard Deviations of Sample Responses to 'Knowledge Application' Dimension (in descending order by arithmetic mean)

Rank	Number	Dimension	Arithmetic Mean	Standard Deviation	Evaluation Level
1	3	GFP takes on new work methods as they emerge for the benefit of improving work effectiveness.	4.18	1.04	high
2	1	GFP encourages workers to apply the knowledge the acquire from different sources.	3.87	1.17	high
3	4	I can easily process and benefit from data I receive from any source.	3.82	1.04	high
3	5	I find no difficulty applying work procedures I trained on.	3.82	1.09	high
5	2	Using computer technology facilitates applying my acquired knowledge.	3.69	1.18	high
5	6	GFP administration follows up to ensure that workers apply the work procedures they were trained on.	3.69	1.24	high
Knowledge Application as a whole			3.84		high

Table 11 reveals that the arithmetic means of respondents' answers to the knowledge application items were valued between 3.69 and 4.18 at a high level for all items. The highest value was that for item (3) "GFP adopts new ways of conducting business when discovered for the purpose of improving work efficiency." The lowest value was that of item (6) "GFP follows up to ensure that workers apply the work methods they were trained on". The arithmetic mean for the dimension as a whole was 3.84 at a high level.

4.7 Study Hypotheses: Testing and Discussion

To answer the study's question (What is the impact of adopting e-collaboration tools on knowledge management processes at GFP?), the researchers, prior to testing the hypotheses, started with diagnosing the interrelation issues of independent variable. The 'tolerance' coefficient was calculated for each independent variable as well as the (VIF: Variance Inflation Factor) text, where VIF should be lower than 10 for all independent variables and 'Tolerance' should be higher than 0.05 (see Table (12)).

Table 12
VIF Test and Tolerance of Independent Variable Dimensions

Dimension	Tolerance	VIF
Technological	0.49	2.04
Organisational	0.28	3.61
Environmental	0.32	3.16

Table 12 shows that VIF values for all dimensions of the independent variable scored below 10 and the value of the Tolerance coefficient for all dimensions was above 0.05. This means that there is no high correlation between the dimensions of the independent variable which allows using all of them for the regression model. Based on that, the study's hypotheses will be tested as follows:

First main hypothesis: there is no statistically significant impact at the level (α≤0.05) of adopting ECTs in its three dimensions (technological, dimensional and environmental contexts) on KMPs (knowledge generation, storage, sharing and application) at GFP, Jordan.

To validate this hypothesis, the multiple regression equation was applied to study the effect of adopting e-collaboration tools on knowledge management processes as a whole (Table (13)).

Table 13
Results of Applying the Multiple Regression Equation to Study the Impact of Adopting E-Collaboration Tools on Knowledge Management Processes

Dimension	ß	T	Statistical Significance	R	R^2	F	Statistical Significance
Technological	0.17	3.42	0.00				
Organisational	0.34	5.32	0.00	0.84	0.70	201.92	0.00
Environmental	0.40	6.65	0.00				

Table 13 shows that adopting ECTs with all its dimensions has a statistically significant impact at (α≤0.05) on KMPs as a whole. The correlation coefficient (R) was calculated at 0.84, which is a statistically significant value reflecting a significant correlation between the independent variables and the dependent variable. R-square was calculated to be 0.70, which is a statistically significant value meaning that ECTs' dimensions explain 70% of the change occurring to KMPs. The F value was 201.92 with a statistical significance (0.00). This is a statistically significant value that reflects contrasts regarding the ability of the independent variables to impact the dependent variable. Therefore, the first main hypothesis is rejected as a null hypothesis and it is accepted as an alternative hypothesis to become: "There is a statistically significant impact at significance level (α≤0.05) for ECTs in their three dimensions (technological context, organisational context, environmental context) on KMPs (knowledge generation, storage, sharing and application) at GFP", Jordan. There is also a statistically significant impact at (α≤0.05) for the three contexts separately on KMPs, where (T, ß) values were statistically significant.

Out of the main hypothesis, the following sub-hypotheses can be derived:

First sub-hypothesis: there is no statistically significant impact at significance level (α≤0.05) for the adoption of ECTs with their three dimensions (technological context, organisational context, environmental context) on knowledge generation at GFP.

To validate this hypothesis, the multiple regression equation was applied to study the effect of adopting ECTs dimensions on the process of generating knowledge as a whole; Table 14 illustrates.

Table 14
Results of Applying the Multiple Regression Equation to Study the Impact of Adopting E-Collaboration Tools on Knowledge Generation

Dimension	ß	T	Statistical Significance	R	R^2	F	Statistical Significance
Technological	0.21	3.50	0.00				
Organisational	0.30	3.74	0.00	0.74	0.54	103.95	0.00
Environmental	0.31	4.12	0.00				

Table 14 shows that adopting ECTs with all its dimensions has a statistically significant impact at (α≤0.05) on knowledge generation. The correlation coefficient (R) was calculated at 0.74, which is a statistically significant value. R-square was calculated to be 0.54, which a statistically significant value that shows ECTs' ability to impact knowledge generation. This means that ECTs' dimensions explain 54% of the change occurring to knowledge generation processes. The F value was 103.95 with a statistical significance (0.00). This is a statistically significant value that reflects contrasts regarding the ability of the independent variables to impact the dependent variable. Therefore, the first sub-hypothesis is rejected as a null hypothesis and it is accepted as an alternative hypothesis to become: "There is a statistically significant impact at significance level (α≤0.05) for ECTs in their three dimensions (technological context, organisational context, environmental context) on knowledge generation at GFP, Jordan". Also found was a statistically significant impact at (α≤0.05) for the three contexts separately on knowledge generation, where (T, ß) values were statistically significant.

Second sub-hypothesis: there is no statistically significant impact at significance level (α≤0.05) for the adoption of ECTs with their three dimensions (technological context, organisational context, environmental context) on knowledge storage at GFP.

To validate this hypothesis, the multiple regression equation was applied to study the effect of adopting ECTs dimensions on the process of storing knowledge as a whole; Table (15) illustrates.

Table 15
Results of Applying the Multiple Regression Equation to Study the Impact of Adopting E-Collaboration Tools on Knowledge Storage

Dimension	ß	T	Statistical Significance	R	R^2	F	Statistical Significance
Technological	0.15	2.43	0.02				
Organisational	0.29	3.65	0.00	0.73	0.54	101.67	0.00
Environmental	0.36	4.85	0.00				

Table 15 shows that adopting ECTs with all its dimensions has a statistically significant impact at (α≤0.05) on knowledge storage. The correlation coefficient (R) was calculated at 0.73, which is a statistically significant value reflecting a statistically significant correlation level between the independent variables and the dependent variable. R-square was calculated to be 0.54, which a statistically significant value that shows ECTs' ability to impact knowledge storage. This means that ECTs' dimensions explain 54% of the change occurring to knowledge storage processes. The F value was 101.67 with a statistical significance (0.00). This is a statistically significant value that reflects contrasts regarding the ability of

the independent variables to impact the dependent variable. Therefore, the second sub-hypothesis is rejected as a null hypothesis and it is accepted as an alternative hypothesis to become: "There is a statistically significant impact at significance level (α≤0.05) for ECTs in their three dimensions (technological context, organisational context, environmental context) on knowledge storage at GFP, Jordan". Also found was a statistically significant impact at (α≤0.05) for the three contexts separately on knowledge storage, where (T, ß) values were statistically significant.

Third sub-hypothesis: there is no statistically significant impact at significance level (α≤0.05) for the adoption of ECTs with their three dimensions (technological context, organisational context, environmental context) on knowledge sharing at GFP.

To validate this hypothesis, the multiple regression equation was applied to study the effect of adopting ECTs dimensions on the process of sharing knowledge as a whole; Table 16 illustrates.

Table 16
Results of Applying the Multiple Regression Equation to Study the Impact of Adopting E-Collaboration Tools on Knowledge Sharing

Dimension	ß	T	Statistical Significance	R	R^2	F	Statistical Significance
Technological	0.09	1.55	0.12	0.76	0.57	116.04	0.00
Organisational	0.35	4.55	0.00				
Environmental	0.37	5.18	0.00				

Table 16 shows that adopting ECTs with all its dimensions has a statistically significant impact at (α≤0.05) on knowledge sharing. The correlation coefficient (R) was calculated at 0.76, which is a statistically significant value reflecting a statistically significant correlation level between the independent variables and the dependent variable. R-square was calculated to be 0.57, where a statistically significant value that shows ECTs' ability to impact knowledge sharing. This means that ECTs' dimensions explain 57% of the change occurring to knowledge sharing processes. The F value was 116.04 with a statistical significance (0.00). This is a statistically significant value that reflects contrasts regarding the ability of the independent variables to impact the dependent variable. Therefore, the third sub-hypothesis is rejected as a null hypothesis and it is accepted as an alternative hypothesis to become: "There is a statistically significant impact at significance level (α≤0.05) for ECTs in their three dimensions (technological context, organisational context, environmental context) on knowledge sharing at GFP, Jordan". Also found was a statistically significant impact at (α≤0.05) for the organisational and environmental contexts on knowledge sharing, while there was no statistically significant impact for the technological context on knowledge sharing where (T, ß) (1.55, 0.09) values were not statistically significant.

Fourth sub-hypothesis: there is no statistically significant impact at significance level (α≤0.05) for the adoption of ECTs with their three dimensions (technological context, organisational context, environmental context) on knowledge application at GFP.

To validate this hypothesis, the multiple regression equation was applied to study the effect of adopting ECTs dimensions on the process of applying knowledge as a whole; Table 17 illustrates.

Table 17
Results of Applying the Multiple Regression Equation to Study the Impact of Adopting E-Collaboration Tools on Knowledge Application

Dimension	ß	T	Statistical Significance	R	R^2	F	Statistical Significance
Technological	0.14	2.32	0.02	0.73	0.54	101.62	0.00
Organisational	0.28	3.46	0.00				
Environmental	0.38	5.13	0.00				

Table 17 shows that adopting ECTs with all its dimensions has a statistically significant impact at ($\alpha \leq 0.05$) on knowledge application. The correlation coefficient (R) was calculated at 0.73, which is a statistically significant value reflecting a statistically significant correlation level between the independent variables and the dependent variable. R-square was calculated to be 0.54, which a statistically significant value that shows ECTs' ability to impact knowledge application. This means that ECTs' dimensions explain 54% of the change occurring to knowledge application processes. The F value was 101.62 with a statistical significance (0.00). This is a statistically significant value that reflects contrasts regarding the ability of the independent variables to impact the dependent variable. Therefore, the fourth sub-hypothesis is rejected as a null hypothesis and it is accepted as an alternative hypothesis to become: "There is a statistically significant impact at significance level ($\alpha \leq 0.05$) for ECTs in their three dimensions (technological context, organisational context, environmental context) on knowledge application at GFP, Jordan". Also found was a statistically significant impact at ($\alpha \leq 0.05$) for the three contexts separately on knowledge storage, where (T, ß) values were statistically significant.

5. Results

Results have shown that adopting e-collaboration tools was highly evaluated by survey respondents at GFP for each dimension and for the dimension as a whole. Highest evaluated was the technological context followed by the organisational context and at third place was the environmental context. However, the electronic link between GFP and other institution was evaluated as 'medium'. This evaluation can be attributed to the fact that GFP has an advanced technological infrastructure that contains an internal computer network that links all workers together. However, this link needs to continuously develop to ensure the sustainability and security of connection among staff members. Also needed is creating a database that is available to all staff and introducing an effective archiving system that allows workers instant access to information anytime and anywhere. This, additionally, links all GFP branches inside and outside Jordan and enhances transparency in conducting business, which in turn expedites decision-making, applying new procedures, and fostering a flexible and accurate environment that enhances GFP vision. Moreover, the results of the study indicated that knowledge management processes, from the perspective of surveyed individuals, are of a high assessment as a whole and each dimension. 'Knowledge Storage' received highest evaluation followed by 'Knowledge Generation' "Knowledge Application" and finally "Knowledge Sharing". These results can be explained by GFP's keenness to facilitate database access to all employees according to the authorisations granted to each of them. GFP also ensures informing all employees of any knowledge-related developments regarding policies and work procedures, and it encourages employees to interact with each other to find appropriate solutions to problems they face. GFP also assigns its employees to training programmes to increase their scientific and technical capabilities. In storing knowledge, GFP relies on written records and documents and adopts new methods of work when they emerge to improve work efficiency. The results also presented that there is a statistically significant effect at the level of ($\alpha \leq 0.05$) for adopting e-collaboration tools dimensions (technological context, organisational context and environmental context) combined and separate on knowledge management processes at GFP, on knowledge generation, storage, sharing and application. The finding can be explained by the fact adopting e-collaboration tools enhances daily tasks among workers, which helps knowledge, experience and skill exchange among them. This in turn leads to the highest levels of knowledge generation, knowledge storage, knowledge sharing and knowledge application which helps in finding the right solutions at the right time and making the right decisions. However, intercommunication among staff must be strengthened. As for the results on knowledge generation at GFP, it means that adopting e-collaboration tools promotes communication and interaction between individuals for the purpose of transferring and improving their experience and skills, which enhances introduction of new ideas for work. For knowledge storage, the results show that adopting e-collaboration tools assists in storing and maintaining knowledge for re-use as well as protect it from loss or damage. The tools also help storing knowledge in electronic files in a database or in the form of written documents (reports, documents, and records). Knowledge sharing results disclose a shortage in the area of encouraging informal meetings among GFP staff to exchange work-related views. This indicates a dire need for

GFP to hold workshops and increase the number of informal meetings among workers. Lastly, concerning knowledge application, the results are attributed to the fact that adopting e-collaboration tools at GFP plays a role in applying knowledge, re-using it, and benefiting from it in implementation, as well as broadcasting and publishing it when needed. The tools also play a role in the optimal knowledge application that facilitates achieving GFP goals.

6. Recommendations

In light of the above results, the researchers recommend that GFP provides an effective electronic linking among employees to facilitate and activate knowledge management processes as a whole. GFP also needs to provide the necessary explanatory manuals and instructions to explain the mechanisms of dealing with e-collaboration tools at GFP. Also recommended is adopting additional electronic links to the data between the GFP and other institutions in order to eliminate work bureaucracy as well as adopt new work procedures. Furthermore, GFP needs to use knowledge management as the way to develop and improve individual and organisational performances. This is done through establishing an independent department at GFP (Knowledge Management Department) as part of the organisational structure. Holding training programmes and formal and informal workshops is also recommended to acquaint employees with the different knowledge management processes and their importance in facilitating work procedures and increasing productivity. It is also noted that GFP needs to increase supervision and auditing procedures by the GFP management to ensure good business flow while creating an incentives system that supports and stimulates activities that raise the level of implementing knowledge management processes. Lastly, it is advised that GFP conducts further studies on the impact of other e-collaboration tools dimensions on knowledge management processes and other business sectors.

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