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Research Article

STUDYING THE EFFECT OF KNOWLEDGE MANAGEMENT ON EMPLOYEES' INNOVATION AND PRODUCTIVITY IN IRANIAN OIL TERMINALS COMPANY

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ABSTRACT
With the fast pace of change in today's world of science and industry, societies started to build up their power for keeping up with changes, viewed from a new perspective on their intangible assets. The present research aims, generally, to study the effect of knowledge management on employees' innovation and productivity the Iranian Oil Terminals Company (IOTC). This is an applied research study in terms of purpose and descriptive correlation by nature and methodology. The statistical population includes 460 employees of IOTC. The sampling method is of relative stratified kind. Data was gathered using three standard questionnaires of Pullani's Knowledge Management scale, Hersi and Goldsmith Human Resource Productivity (1980) and Sigel and Kaimer's Innovation (1978). All three questionnaires were standard with reliability estimated by Cronbach's alpha at 0.909, 0.874 and 0.948 respectively. Pearson correlation coefficient and multivariate regression were practiced to test the research hypotheses. Results suggest that there is no significant correlation between knowledge management components and innovation. However, the same does not applied to knowledge management components and productivity.

Keywords: *Knowledge Management, Productivity, Iranian Oil Terminals Company (IOTC)*

INTRODUCTION
By analyzing and studying the knowledge and the importance of its features on the ground of organizational performance, we would see knowledge and updated information as a deniable necessity for organizational survival. If the pace of change in societies' knowledge is carefully weighted up, it will be concluded that, in our today post-industrial society, power-oriented technologies is gradually replaced by knowledge-oriented technologies (Ahmadpour, 2002). And in our dynamic and bewildering world, it is now critically important for organizations to invariably employ new knowledge as a tool for generation, validation and application of their products and services. Relying on superior knowledge, organizational management, thus, has to make more sensible decisions on important matters and improve knowledge-based functions. Decidedly, knowledge management is an important area that any organization seeks to disclose how it is possible to turn personal and organizational information into personal and group knowledge and skills. Providing a ground for sharing, transferring and contrasting knowledge among the members of organizations is of the primary goals, because knowledge management can develop a wide range of organizational performance features by helping organizations to be more smartly operated (Wiig, 2005).

With the fast pace of change in today's world of science and industry, societies started to build up their power for keeping up with changes, viewed from a new perspective on their intangible assets. Immobility and inertness in our constantly varying world virtually bring nothing but annihilation, whether for organizations or countries. Innovation and creativity are now regarded as not only a need; they are also a survival condition for any organization or society (Nonaka and Takeuchi, 1995).

Productivity has turned a national priority in the economy of all developed or developing countries. The life and survival of countries, that their sole resource is human, highly depend on their continuous effort to have as much production as possible for any unit. Productivity is a ground for economic growth and inflation control and sets high standards for life. Improved productivity offers benefits to organizations

that include: efficient use of rare resources and intensified power for competition (Singapure Productivity Center, 1995). This research, thus, is aimed at studying the role of knowledge management in employees' innovation and productivity.

Research Literature

Knowledge Management

American Productivity and Quality Center (APQC) define knowledge management as a strategy, aiming to provide suitable people with explicit knowledge in a suitable time (Lee and Choi, 2003). Knowledge management consists of human behaviors, insights, human capabilities, business philosophies, models, operations, procedures and high technologies (Wiig, 2005). It is a process of creating, sharing, transferring and preserving knowledge as to effectively apply it to organizations (Hoffman *et al.*, 2005).

Types of Knowledge Management

Nonka and Takuchi (1995) classified knowledge into two groups: explicit knowledge and implicit knowledge. The importance of implicit knowledge was first emphasized by Pulani (1955). The explicit knowledge is a knowledge which is easily transferred and can be coded by a series of signs (letters, numbers, etc.) in form of written words, sounds, images, pictures, software, and database. Sharing explicit knowledge is, for this reason, simply carried out. On the other hand, implicit or latent knowledge includes feelings, perceptions, beliefs, intuition, and visions. It is a mental and personal knowledge which can be easily transferred, shared and formulized and achieved by observation and imitation. This type of recognition is the foundation of creativity and innovation (Mirmiran, 2005).

Different Viewpoints

Bukowitz and R. Williams

Bukowitz and Williams and American Productive Center framed knowledge management and its major activities as including the following stages:

- Achieving knowledge: by different tools such as library sources and local group;
- Applying knowledge: using acquired knowledge proved to be suitable;
- Learning how to use previous experiences and organizational support from members' learning and achieving the needed experiences;
- Sharing and exchanging knowledge: organizational support from knowledge exchange between members and interactions and communications in this regard;
- Evaluating knowledge: developing a framework by organization according to quantitative and qualitative criteria to evaluate organizational knowledge, weaknesses, strengths and the effects of using knowledge in organization;
- Developing and stabilizing knowledge: acquiring organizational capacities, creating, generating and stabilizing knowledge, using technological tools, and using participation and cooperation as a tool for knowledge stabilization;
- Optimally using knowledge: based on a planned method, organizations optimally use and watch over strategic knowledge and people having such vital information.

Suzie Allard

Suzie (1997) enlisted five types of major activities for organizational knowledge management:

1. Knowledge acquisition: occurs when knowledge is externally identified and deformed to be practiced internally.
2. Knowledge selection: identifying and deforming the main knowledge asset describe the organization internal knowledge.
3. Knowledge internalization: it is a process of knowledge acquisition within which knowledge is acquired, selected, distributed inside the organization and stored.
4. Knowledge externalization: it is a process of knowledge penetration into outputs to do releases in the external environment.
5. Knowledge generalization: providing new knowledge from the existing one, which can be forms of discovery or derivation.

Some scientists considered knowledge acquisition and generalization as a tool for knowledge generation.

Innovation

Innovative activities in organizations are the direct results of investing in knowledge management. By correctly directing employees' creativity and innovation, management team can exploit these people in organizational problems requiring new solutions. Creativity and innovation are especially important in proportion to different circumstances and conditions. As there are particular, critical and urgent conditions in organizations, by nature, creativity and innovation are ordinarily much more important than creativity in organizational activities.

Organizations, therefore, are recommended to provide the ground for continuous manifestation of creativity and innovation and this is, of course, considered as of the obligations of knowledge management.

Factors Affecting Innovation

A. Environmental or External Factors: (1) freedom; (2) sufficient resources; (3) sufficient time; (4) suitable environment; (5) suitable research layout; and (6) pressure (some pressures may be stimulator of innovation)

B. Personal or Internal Factors: (1) various personal features; (2) self-motivation; (3) cognitive abilities; (4) being risky; (5) specialization; and (6) various business (Amabile, 1989).

According to Amabil *et al.*, (1988), environmental factors have more prominent impact on the growth of innovation than personal factors. An important point is that the share of environment is much more variable. Put it differently, social factors can be changed, but the same is not true of personal qualifications and capacities. Amabil (1989) presented a model for factors affecting innovation:

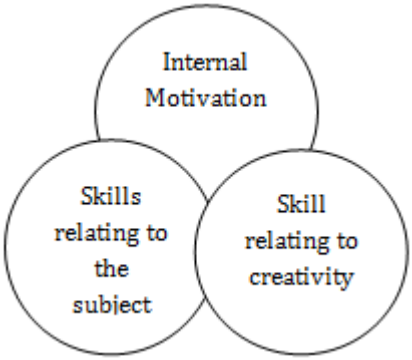

Figure 1: a model for factors affecting innovation (Amabile Teresa, 1989).

Barriers to Innovation

Hosseini (2008) enumerated barriers to innovation, including environmental and personal obstacles, as follows:

Environmental barrios: (1) inverse environment; (2) restrictions; (3) pressure assessment; (4) competitions; (5) insufficient resources; (6) weak research layout; and (7) killing ideas (Mirmiran, 2005).

Personal Barrier: (1) lack of motivation; (2) being incompetence or inexperienced; (3) non-flexibility; (4) external motivation; (5) lack of social skills

Productivity

Productivity is an English word meaning fertility, fruitfulness and abundance. In scientific contexts, it is defined as the relation between input and output (Van and Theo, 2004). Put it concisely, productivity is the efficiency of inputs used to generate output (Diewert, 1992).

Factors Affecting Human Productivity

- Meaningful and challenging job
- Self-management
- Supportive leadership

- Multidimensional skills
- Priority for person-oriented rewarding system
- Priority for group-oriented rewarding system

Moreover, style and internal motivation are of main features of employees' productivity (Amabile, 1989; Walters, 2007).

Ramzgooyan categorized factors affecting productivity in three groups as follows:

1- Job-related factors
2- Resource-related factors
3- Environment-related factors

According to Hans and Hamfry (1997), factors affecting productivity generally include:

1- Physical factors: these are tangible factors affecting productivity.
2- Mental factors: they refer to employees' and managers' behavioral models.

Taheri (2004) counted factors affecting human productivity as bellow:

- Continuously training employees and managers;
- Motivating employees to better and more work;
- Giving suitable opportunity to employees and managers for creating and innovating;
- Establishing performance-based payment system and reward and punishment system;
- Conscience to Work and social discipline which is a factor for self-control;
- Making change in systems and strategies having key importance;
- Reinforcing the supreme power and the dominance of organizational policies over affairs

Here, knowledge management is the independent variable and Pulani's model (1966) was employed to study it. On the other hand, Hersi and Goldsmith's model (1980) was practiced in order to look at human force productivity as the dependent variable. Another dependent variable is the organizational innovation which was checked by Sigel and Kimer's model (1978), translated by Afshari and Anami (2006). It was considered as the research theoretical framework.

Note, also, that the research model was derived from Wang's studies (2012).

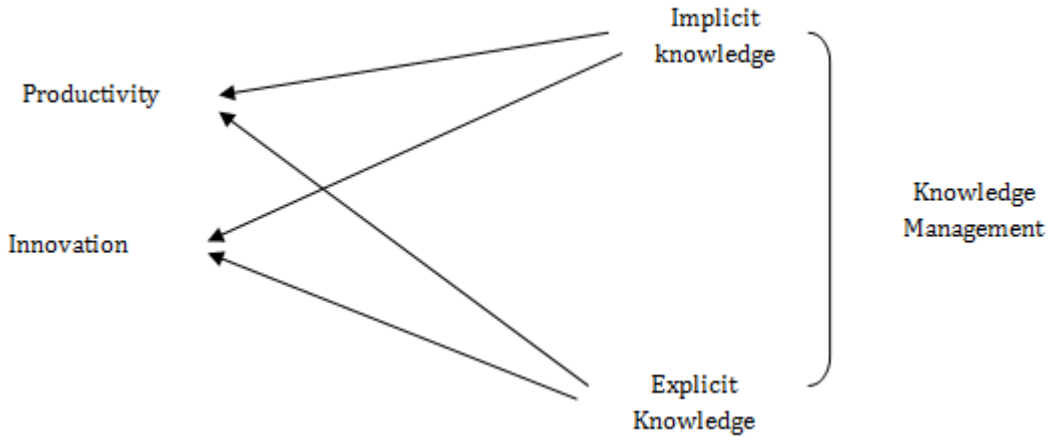

Figure 2: Research model

Research Hypothesis

Leading Hypothesis

There is a positive correlation between knowledge and innovation management and productivity.

Subordinate Hypotheses

1- There is a positive correlation between the components of knowledge management and innovation.
2- There is a positive correlation between the components of knowledge management and productivity.

3- The components of knowledge management can predict innovation and productivity.

MATERIALS AND METHODS

This is an applied research study in terms of purpose and descriptive correlational by nature and methodology. As it was conducted in a certain time schedule, it is considered as a cross-sectional research. The statistical population included all 1439 employees of IOTC. 210 were selected as samples. Questionnaires were regulated by stratified sampling and then randomly distributed among samples. The researcher applied standardized questionnaires, including 70 questions (24 for innovation questionnaire, 26 for productivity questionnaire, and 24 for knowledge management questionnaire). All questions were standardized and designed on the 5-point Likert scale format.

Table 1: Distribution of questions according to features

Row	Questionnaire	Variables	Questions	References
1	Knowledge Management	Knowledge Acquisition	1-6	Pullani (1966)
		Knowledge Generation	7-10	
		Knowledge Organization	11-14	
		Knowledge Storage	15-18	
		Knowledge propagation	19-22	
		Knowledge Application	23-24	
2	Human Force Productivity	Human Force Productivity	1-26	Hersi and Goldsmith (1980)
3	Innovation	Innovation	1-24	Sigel and Kaimer (1978) (translated by Afshari and Anami, 2006)

Cronbach's alpha was calculated in SPSS. The value indicates that the questionnaires are acceptably valid. Table 2 presents cronbach's alpha for the dimensions of the research questionnaire.

Table 2: Cronbach's alpha calculated for each dimension of the research questionnaire

Questionnaire	Cronbach's alpha
Knowledge Management	0.909
Human Force Productivity	0.874
Innovation	0.948

Data Analysis

First Hypothesis

There is a positive correlation between knowledge management and innovation.

Table 3: Correlation coefficient of knowledge management and innovation

Innovation	Knowledge Management	
0.107	1	Pearson coefficient correlation
0.061		Sig
210	210	n

As it is observed, the correlation coefficient of knowledge management and innovation is 0.107 and the level of significant is 0.06. There is, thus, no significant correlation between two variables.

Table 4: Correlation coefficient of innovation and the components of the knowledge management

		Knowledge Acquisition	Knowledge Generation	Knowledge Organization	Knowledge Storage	Knowledge Propagation	Knowledge Application
Innovation	Pearson Correlation Coefficient	.184	.094	.037	.073	.110	.040
	Sig	.004	.088	.295	.146	.055	.284
	n	210	210	210	210	210	210

As it is observed, among the components of knowledge management, the only component which is significant at level 0.05 is knowledge acquisition (0.004). There is no significant correlation between other components and innovation.

Second Hypothesis

There is positive correlation between the components of the knowledge management and productivity.

Table 5: Correlation coefficient of knowledge management and productivity

Productivity	Knowledge Management	
.117*	1	Pearson Correlation Coefficient
.046		Sig
210		n

The correlation coefficient between above variables is 0.117. As 0.048 is less than the level of significance (0.05), there is a significant correlation between them. This hypothesis is then confirmed. It is concluded that productivity improves with the components of knowledge management.

Table 6: Pearson correlation coefficient of productivity and the components of the knowledge management

		Knowledge Acquisition	Knowledge Generation	Knowledge Organization	Knowledge Storage	Knowledge Propagation	Knowledge Application
Productivity	Pearson Correlation Coefficient	.186	.091	.070	.093	.095	.056
	Sig	.004	.094	.155	.090	.085	.209
	n	210	210	210	210	210	210

As it is observed, among the components of knowledge management, the only component which is significant at level 0.05 is knowledge acquisition (0.004). There is no significant correlation between other components and productivity.

Third Hypothesis

The components of knowledge management can predict innovation and productivity. First, the components of knowledge management are studied as predictors of innovation:

1. Knowledge acquisition can predict innovation.

Table 7: Regression test results between innovation and knowledge acquisition

Independent Variable	Dependent Variable	β	sig	t	Test Result
Knowledge Acquisition	Innovation	0.363	0.005	2.847	H_0 is rejected

According to multivariate regression analysis test results, knowledge acquisition variable and t were calculated at 0.363 and 2.847. Given t is positively larger than 1.96, H0 is rejected at the error level

(95%). However, the contrasting hypothesis, i.e. there is a correlation between knowledge acquisition and innovation, is confirmed.
2. Knowledge organization can predict innovation.

Table 8: Regression test results between innovation and knowledge organization

Independent Variable	Dependent Variable	β	sig	t	Test Result
Knowledge organization	Innovation	-0.081	0.529	-0.631	H_0 is confirmed

Given multivariate regression analysis test results, knowledge organization variable and t were calculated at -0.081 and -0.631. As t is positively smaller than 1.96, H0 is rejected at the error level (95%). However, the contrasting hypothesis, i.e. there is a correlation between knowledge organization and innovation, is rejected.
3. Knowledge propagation can predict innovation.

Table 9: Regression test results between innovation and knowledge propagation

Independent Variable	Dependent Variable	β	sig	t	Test Result
Knowledge propagation	Innovation	0.018	0.864	0.172	H_0 is confirmed

Regarding multivariate regression analysis test results, knowledge propagation variable and t were calculated at 0.018 and 0.172. Given t is positively smaller than 1.96, H0 is confirmed at the error level (95%). However, the contrasting hypothesis, i.e. there is a correlation between knowledge propagation and innovation, is rejected.
4. Knowledge storage can predict innovation.

Table 10: Regression test results between innovation and knowledge storage

Independent Variable	Dependent Variable	β	sig	t	Test Result
Knowledge storage	Innovation	0.034	0.758	0.309	H_0 is confirmed

Regarding multivariate regression analysis test results, knowledge storage variable and t were calculated at 0.034 and 0.309. Given t is positively smaller than 1.96, H0 is confirmed at the error level (95%). However, the contrasting hypothesis, i.e. there is a correlation between knowledge storage and innovation, is rejected.
5. Knowledge generation can predict innovation.

Table 10: Regression test results between innovation and knowledge generation

Independent Variable	Dependent Variable	β	sig	t	Test Result
Knowledge Generation	Innovation	-0.111	0.411	-0.825	H_0 is confirmed

As to multivariate regression analysis test results, knowledge generation variable and t were calculated at -0.111 and -0.825. Given t is positively smaller than 1.96, H0 is confirmed at the error level (95%). However, the contrasting hypothesis, i.e. there is a correlation between knowledge generation and innovation, is rejected.
6. Knowledge application can predict innovation.

Table 10: Regression test results between innovation and knowledge application

Independent Variable	Dependent Variable	β	sig	t	Test Result
Knowledge Application	Innovation	-0.92	0.400	-0.844	H_0 is confirmed

Based on multivariate regression analysis test results, knowledge application variable and t were calculated at -0.092 and -0.844. Given t is positively smaller than 1.96, H0 is confirmed at the error level (95%). However, the contrasting hypothesis, i.e. there is a correlation between knowledge application and innovation, is rejected.
Table 13 presents the coefficients of the direct effect, the level of significance and the variance explained by the research variables.

Table 13: Regression analysis test results of independent (the components of the knowledge management) and dependent (innovation) variables

Variable	Non-standardized coefficients		β	T	sig
	β	Standard Error			
Knowledge Acquisition	0.255	0.089	0.363	2.847	0.005
Knowledge Generation	-0.077	0.093	-0.111	-0.824	0.411
Knowledge Organization	0.067	0.106	-0.081	-0.631	0.529
Knowledge Storage	0.026	0.085	0.034	0.309	0.758
Knowledge propagation	0.014	0.081	0.018	0.172	0.864
Knowledge Application	-0.071	0.084	0.092	-0.844	0.400

In the remainder of our paper, the effect of the components of the knowledge management on prediction of productivity is studied:
7. Knowledge acquisition affects productivity.

Table 14: Regression test results between productivity and knowledge acquisition

Independent Variable	Dependent Variable	β	sig	t	Test Result
Knowledge Acquisition	Productivity	0.372	0.004	2.934	H_0 is rejected

According to multivariate regression analysis test results, knowledge acquisition variable and t were calculated at 0.372 and 2.934. Given t is positively larger than 1.96, H0 is rejected at the error level (95%). However, the contrasting hypothesis, i.e. there is a correlation between knowledge acquisition and productivity, is confirmed.

Table 15: Regression test results between productivity and knowledge generation

Independent Variable	Dependent Variable	β	sig	t	Test Result
Knowledge Generation	Productivity	-0.055	0.686	-0.405	H_0 is confirmed

Given multivariate regression analysis test results, knowledge generation variable and t were calculated at -0.055 and -0.405. As t is positively smaller than 1.96, H0 is confirmed at the error level (95%). However, the contrasting hypothesis, i.e. there is a correlation between knowledge generation and productivity, is rejected.

Table 16: Regression test results between productivity and knowledge organization

Independent Variable	Dependent Variable	β	sig	t	Test Result
Knowledge Organization	Productivity	-0.177	0.168	-1.385	H_0 is confirmed

Regarding multivariate regression analysis test results, knowledge organization variable and t were calculated at -0.177 and -1.385. Given t is positively smaller than 1.96, H0 is confirmed at the error level

(95%). However, the contrasting hypothesis, i.e. there is a correlation between knowledge organization and productivity, is rejected.

Table 17: Regression test results between productivity and knowledge storage

Independent Variable	Dependent Variable	β	sig	t	Test Result
Knowledge storage	Productivity	0.007	0.945	0.065	H_0 is confirmed

Regarding multivariate regression analysis test results, knowledge storage variable and t were calculated at 0.007 and 0.065. Given t is positively smaller than 1.96, H0 is confirmed at the error level (95%). However, the contrasting hypothesis, i.e. there is a correlation between knowledge storage and innovation, is rejected.

Table 18: Regression test results between productivity and knowledge propagation

Independent Variable	Dependent Variable	β	sig	t	Test Result
Knowledge Propagation	Productivity	0.085	0.425	0.799	H_0 is confirmed

As to multivariate regression analysis test results, knowledge propagation variable and t were calculated at 0.085 and 0.799. Given t is positively smaller than 1.96, H0 is confirmed at the error level (95%). However, the contrasting hypothesis, i.e. there is a correlation between knowledge propagation and innovation, is rejected.

Table 19: Regression test results between productivity and knowledge application

Independent Variable	Dependent Variable	β	sig	t	Test Result
Knowledge Application	Productivity	-0.110	0.310	-1.017	H_0 is confirmed

Based on multivariate regression analysis test results, knowledge application variable and t were calculated at -0.110 and -1.017. Given t is positively smaller than 1.96, H0 is confirmed at the error level (95%). However, the contrasting hypothesis, i.e. there is a correlation between knowledge application and innovation, is rejected.

Table 20: Regression analysis test results of independent (the components of the knowledge management) and dependent (productivity) variables

Variable	Non-standardized coefficients		β	T	sig
	β	Standard Error			
Knowledge Acquisition	0.232	0.079	0.372	2.0934	0.004
Knowledge Generation	-0.033	0.082	-0.055	-0.405	0.686
Knowledge Organization	-0.130	0.094	-0.177	-1.385	0.168
Knowledge Storage	0.005	0.075	0.007	0.065	0.945
Knowledge propagation	0.057	0.072	0.085	0.799	0.425
Knowledge Application	0.076	0.074	-0.110	-1.017	0.310

Table 21: A summary of the effect of knowledge management components on prediction of innovation

Variable	Correlation Coefficient	Coefficient of Determination	Regulated Coefficient of Determination	Durbin-Watson
Knowledge Acquisition	0.184	0.033	0.046	1.839

As seen above, the coefficient of determination is 0.033. This means that among the components of knowledge management, the only component having a significant correlation with innovation is knowledge acquisition. This variable determines 3.3 percent of changes made in innovation.

Table 22: A summary of the effect of knowledge management components on prediction of productivity

Variable	Correlation Coefficient	Coefficient of Determination	Regulated Coefficient of Determination	Durbin-Watson
Knowledge Acquisition	0.186	0.034	0.030	1.892

As seen above, the coefficient of determination is 0.034. This means that among the components of knowledge management, the only component having a significant correlation with productivity is knowledge acquisition. This variable determines 3 percent of changes made in productivity.

Research Findings

First Hypothesis: There is a Positive Correlation between Knowledge Management Components and Innovation

As table 4 displays, among knowledge management components, knowledge acquisition is the only components predicting innovation. The research findings agree with results found by Safarzadeh *et al.*, (2012); Niaz *et al.*, (2011); Samadian and Seyed (2011); Amani (2008); Fathian *et al.*, (2005); Fararasi *et al.*, (2012), Hind (2008) and Vall (2005). According to findings, when there is innovation, organizations distribute power, information, knowledge and rewards.

Second Hypothesis: There is a Positive Correlation between Knowledge Management Components and Innovation.

According to table 6, there is a significant correlation between knowledge management components and productivity. These findings agree with results found by Zheng *et al.*, (2010), Wang and Wang (2012), Muherman (2001), Li and Choi (2003), and Mackain and Zack (2006).

To improve employees' productivity and stand against competitors, companies have to have competitive advantages to be able to keep their market share and superior position in today complicated and varying circumstances. Organizations have changed their view from tangible to intangible resources to have superior performance and competitive advantages (Sinaee *et al.*, 2011). In modern economy, as a strategic factor, knowledge is viewed as a sustainable competitive advantage. Although knowledge assets cannot create power and value, sharing it with internal and external members will provide a good ground for creating new knowledge asset (Gholizadeh, 2010) and will bring more productive employees and organizations.

Third Hypothesis: Knowledge Management Components can predict Innovation and Productivity

As to tables 13 and 20, we can find the effect of knowledge management components on innovation and productivity. To further explain this issue, implicit knowledge allows employees to innovate and be more productive; the mechanism of transferring it is though different from explicit knowledge. In addition, we cannot forget its effect on viewpoints, perceptions, values, feelings and personal proceedings. It is, therefore, concluded that by providing the required information for keeping up with technological changes, the explicit knowledge has a strong impact on employees' innovation. So, it is a good idea to set a good ground for transferring this knowledge and allow employees to associate with each other. In fact, explicit knowledge is exchanged through language and with no need to physically display skills.

Suggestions

1. IOTC managers are recommended to practically support knowledge management and encourage employees to share their knowledge. Leaders have to skillfully facilitate knowledge sharing. The skills they need on this ground include: directing organizational changes, helping employees to understand the importance of sharing knowledge, and developing the culture of sharing knowledge. CEOs' support and

commitment to the knowledge management projects is as vital as all programs carried out to make organizational changes. A continuous and practical support from managers can turn orchestrated efforts for successfully implementing the knowledge sharing strategy.
2. IOTC human resource unit should recruit those respecting the culture of sharing and propagating knowledge. This is crucially important because they will carry new knowledge and skills with themselves. In fact, they can suitably fill the existing knowledge gap.
3. IOTC is recommended to hold training courses for its managers and employees in order to inform them of the important effects of knowledge management. They should be taught how they can use it to improve employees' innovation and productivity.

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