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Developing a knowledge map driven framework for human resources strategy formulation: a knowledge based IT company case study in Iran

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Abstract

Purpose – The main purpose of this paper is developing a framework for human resource strategy planning based on knowledge maps in organizations.

Design/methodology/approach – Considering literature review of human resources strategy (HRS) planning in one hand and knowledge mapping in another hand to develop a framework, and then deploying this framework in a company as case study.

Findings – A knowledge map driven framework for human resources strategy formulation, which attempts to improve the process of HRS is the main finding of this research. The results of implementation of this model in a knowledge based IT company may show its potential capability for deploying the model in similar corporations for better formulation of human resource strategy.

Originality/value – Linking of human resource strategy with knowledge maps is quite new. This paper opens up new outlines in human resource management from a knowledge based point of view. It may have value for experts who work and research in both areas especially in field of human resources in knowledge based organizations.

Keyword: *knowledge map, human resource strategy, knowledge strategy*

Introduction

In recent decades, organizations have been transformed to knowledge-based organizations (Jafari and Akhavan, 2007). Knowledge and knowing are not competing, but complementary and mutually enabling (Currie and Kerrin, 2004) and knowledge is regarded as the most important source of competitive advantage (Jafari et al., 2008; Renzl et al., 2006). The businesses and also the universities (Akhavan et al., 2009), are increasingly concerned with better management of their knowledge (Spender, 2008). We can survey this transformation in organizations from two perspectives:

The first perspective is the importance of knowledge in new organizations. Knowledge as noted because of its role in creating sustainable competitive advantage has a vital role in organizations (Jafari et al., 2010) and therefore obtaining, preserving and developing a suitable knowledge domain is very important for organizations (Akhavan et al., 2010).

On the other hand, the second perspective is the role of human resources of new organizations. The 1980s saw the emergence of the concept of strategic HRM. Biswas and Cassell (1996) cited that: "Increased competition in both national and global arenas has forced managers to reconsider the management of all resources within the organization, paying specific attention to the effective management of the human resource, leading to declarations such as people are our most valuable asset. In fact, the organizational knowledge which we explained its importance, exist within the workers of organizations. They form the most important part of intellectual capital of the organizations and in new knowledge based organizations they are the most effective organizational capital that can create and apply knowledge for generating competitive advantage. Therefore the knowledge aspects of workers are very important in the current business world and knowledge issues like:

- What kinds of knowledge do exist in organizations?
- What about the quantity and quality of them?
- Who (persons and positions) knows the knowledge in organizations?

All these topics are directly related to human resources. The aim of this paper and its main contribution is connecting the knowledge situation and conditions as a vital matter for

organizations with human resources strategy planning and developing a framework for human resources strategy planning which emphasizes the knowledge possessions of the workers in its process. This approach is quite new and has not been traced in similar frameworks. Therefore we use knowledge maps as basic tools in this framework. The knowledge map is a tool that may answer the above questions. Knowledge maps are techniques and tools for visualizing knowledge and relationships in a clear form in such a way that relevant features are clearly highlighted (Vail, 1999). At first we study the available literature of the knowledge maps, then we survey the concepts of human resources strategy and finally we try to articulate our framework and examine it in the real business world.

Knowledge maps

Definition and application

Knowledge of an organization can be segmented into different topics or knowledge areas (Hofer, 2008). Speel (1999) defined knowledge mapping as the process, method and tools for analyzing knowledge areas in order to discover features or meaning and to visualize these in a comprehensive, transparent form, such that the business relevant features are clearly highlighted. In another opinion, Eppler (2001) defined the terms knowledge map or knowledge cartography as a visual architecture of knowledge domain that enables us to examine the knowledge on a global scale and from different perspectives.

Grey (1999) argued that a knowledge map is a navigation aid to explicit and tacit knowledge, illustrating how knowledge flows throughout an organization.

In another definition, a knowledge map is a kind of influence diagram representing the possible actions a person may take and the information or knowledge that person possessed when he/she took the actions (Howard, 1989).

Davenport and Prusak (1998) note that developing a knowledge map involves locating important knowledge in the organization and then publishing some sort of list or pictures that shows where to find it. Knowledge maps typically point to people as well as document and database.

Knowledge maps are visual representations of “knowledge about knowledge”, rather than of the knowledge itself. They provide abstract models of a domain that simplify a complex reality, downsize it to the important aspects, add relevant information and thus help to find locations and the paths that lead to them (Jetter, 2006). Knowledge maps can be employed to analyze shifting knowledge territories by codifying the different individual views or “mental models” people have about reality. These models can be transferred to other people, assessed, updated, and improved, subsequently leading to increasingly adequate shared mental models of reality (Schreyögg and Geiger, 2003).

A knowledge map assists an individual employee, a team, or an organization unit in understanding and using the knowledge available in an organizational setting (Eppler, 2006).

Types of knowledge maps

This section surveys the types of knowledge maps considering their application. The main purpose of preparation of knowledge maps shows which type should be selected. The following types are known as usual knowledge map:

- *Hierarchical or radial knowledge structure maps: concept maps and mind maps*

As Jetter (2006) mentioned, hierarchical knowledge structure maps are strongly related to psychological models that are grounded on the notion that the human brain organizes semantic knowledge in networks or hierarchies of concepts and propositions.

Leithoff (1999) cited that *concept maps* provide one model for the hierarchical organization of knowledge: top-level concepts are abstract with few characteristics. Concepts on the levels below have detailed individual traits, as well as all the characteristic of the super ordinate concept. The propositions between concepts are described verbally and can represent any type of relation like “is part of”, “influences”, “can determine”, “maybe disturbs”, etc.

Mind maps, too, consist of concepts that are linked through propositions. In this method of knowledge mapping, a key topic is placed in the centre of the map. In addition, more specific concepts are added to the map and branched from the central concept. These concepts are again expanded outward into branches and sub-branches. In the resulting mind map, the most specific

aspects of the key concept are at the edge of the map and the more general ones are in its centre (Buesser and Ninck, 2004).

- *Knowledge structure maps: causal maps*

Causal mapping is characterized as a technique “for linking strategic thinking and acting, helping make sense of complex problems, and communicating to oneself and others what might be done about them” (Buesser and Ninck 2004). Causal maps are widely used to capture complex mental models of individuals, to provide a starting point for strategic business analysis (Barchan, 1999) and to visualize systems for modeling and simulation design (Polanyi M, 1966). Figure 1 shows the positive and negative causal links (black and dotted lines) between environmental forces (white boxes) and the desired characteristics (dark boxes) of a specific technology (laser diode pumped Nd-YAG lasers) as an example from Jetter, 2006.

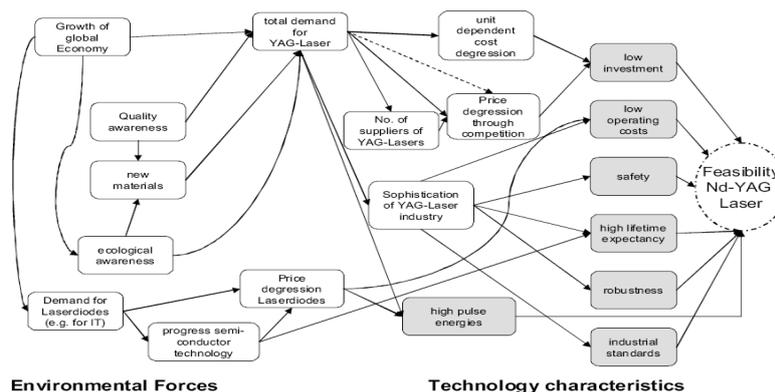


Figure 1 Causal map of environmental forces and characteristics of technology

Source: Jetter, 2006

- *Knowledge source maps*

These maps structure company experts along relevant search criteria, such as their domains of expertise, proximity, seniority, or regional distribution. Knowledge source maps denote knowledge types in organizations, workers who have this knowledge and where this knowledge is (Eppler, 2003). Jetter (2006) cited that knowledge source maps point towards the location of

explicit, as well as tacit knowledge and are clearly intended for detection purposes. When knowledge about the expertise of employees is available, it can, however, also be used to assess capabilities in given knowledge domains. Figure 2 shows a simple knowledge source map for a management consultant company that performs managerial projects.

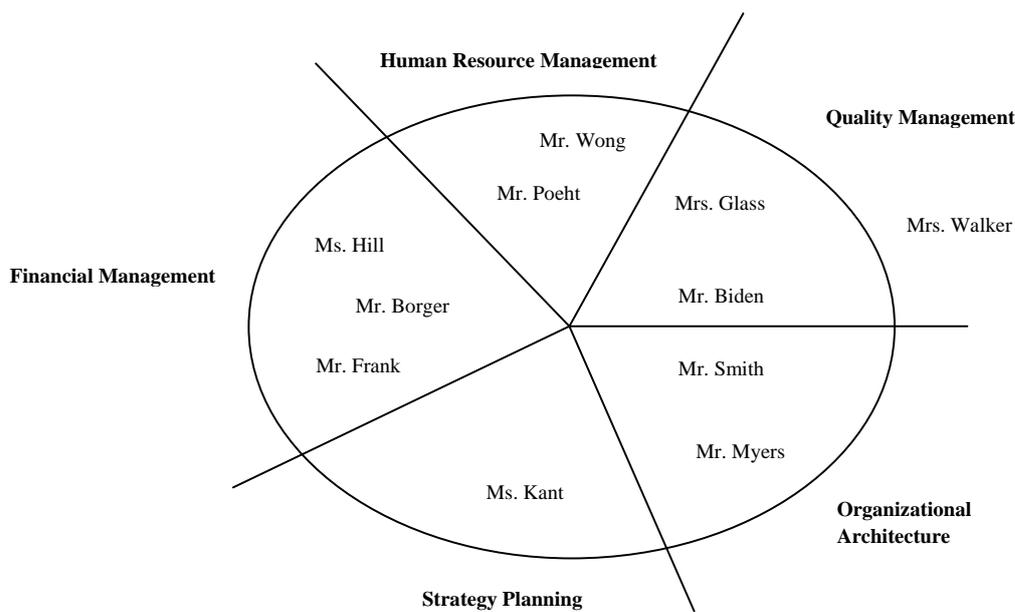


Figure 2 Knowledge source map

- *Knowledge flow map or knowledge application map*

Knowledge flow maps or knowledge application maps show the order in which knowledge resources are and should be used. They are representations of knowledge-intensive business processes that are supplemented by visualizations of the information and knowledge that is needed to manage specific steps of the process (Chai et al., 2003).

Knowledge application maps answer questions of people who are involved in a knowledge intensive process, such as auditing, consulting, research, or product development (Eppler, 2003). Figure 3 shows a process flow chart for a routine business process.

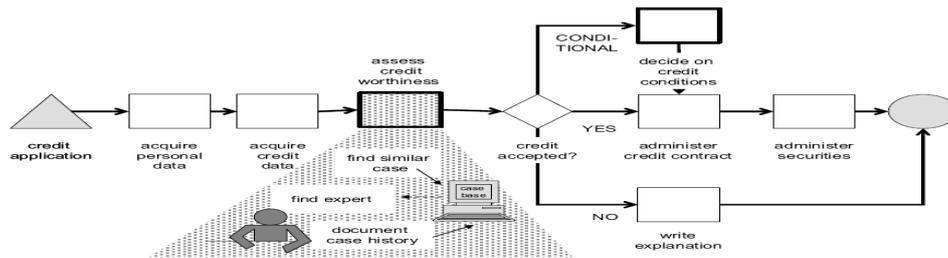


Figure 3 Knowledge flow map

Source: Jetter, 2006

- *Knowledge development map*

“These diagrams can be used to depict as a team, or as an organizational entity. These maps can serve as visualized learning or development roadmaps that provide a common corporate vision for organizational learning. They answer questions such as ‘how do we achieve business excellence for our unit?’ or ‘how can be prepare our unit (intellectually) for the entry into new market?’” (Eppler, 2003).

Human resources management & human resources strategy

It is known that we are living in an increasingly turbulent and complex business environment characterized by continuous change (Heraty and Morely, 2000; McCracker and Wallace, 2000; Drucker, 1992). In order to deal with these challenges, both commentators and practitioners advise that organizations must understand the important role that learning and development will play for their survival (Salamon and Butler, 1990). Accordingly, every firm must identify the significance of developing the knowledge, skills and abilities of its employees (Morgan, 1991). The focus of human resource training is placed on developing people who are capable of tapping internal and external information and turning it into useful organizational knowledge (López, Peón and Ordás, 2006). In this situation, human resource strategy has come to play a vital role in

enhancing a firm's competitive advantage. Traditionally, companies did not grasp the fact that development and support of effective human resources were crucial for success (Gannon, Flood and Paauwe, 1999) but this present realization is the direct result of intense competition, economic globalization, and the transformation of most of the industrial countries to knowledge-based societies. In fact, the industries of the future are all based on brainpower (Thurow, 1999). New sources of wealth for business organizations are the brains, knowledge and skills of employees and workers. In the era of globalization, knowledge workers are the real assets; the real creators of wealth. Organizations traditionally owned and controlled capital and property. In the 21st century, however, organizations do not own intelligence; the owners are the people who work for the organization. This raises a real challenge to the "traditional" organizations, ways of conducting their affairs. In today's business environment, organizations' primary human resource strategy is to train and educate workers; nurturing intelligence (Ali et al., 2000). We can say that human resource should be considered as a strategic factor, not only for the role it plays in putting managerial strategy into effect, but also for the potential that it becomes a source of sustainable competitive advantage ([Wang and Shyu, 2008](#)).

Over the past decade, HR researchers and practitioners have focused their attention on other important questions. First, what determines whether an organization adopts a strategic approach to HRM, and how is HR strategy formulated? Research studies denoted that for organizational practitioners who are looking for ways to gain a competitive advantage, the implication of HR strategic choices for company performance is certainly the key factor.

Strategic human resource management: concept & definition

Interest among academics and practitioners in linking the strategy concept to HRM can be explained from both the "rational choice" and the "constituency-based" perspective. The definitions below are about this concept:

- Strategic HRM is the key to improve business performance within which there is comprehensive coverage of the various definitions and approaches to HRM, strategy and strategic HRM (Armstrong and Baron, 2002).
- All those activities affecting the behavior of individuals in their efforts to formulate and implement the strategic needs of business ([Schuler, 1992](#)).

- Boxall and Purcell (2003) argue that strategic HRM is concerned with explaining how HRM influences organizational performance. They also point out that strategy is not the same as strategic plans. Strategic planning is the formal process that takes place, usually in larger organizations, defining how things will be done. However, strategy exists in all organizations even though it may not be written down and articulated. It defines the organization’s behavior and how it tries to cope with its environment.
- “Effective HRM strategy systematically coordinates all individual HRM measures and implements them so as to directly influence employee attitude and behavior in a way that helps a business to achieve its competitive strategy” ([Huang, 2001](#)).

Human resource issues and strategies

Hax and Majluf (1996) cited that major categories of decision link to human resources are divided into seven main categories as “human resource intelligence”, “selection, promotion and placement”, “appraisal”, “rewards”, “management development”, “labor relation and voice” and human resource management organization and managerial infrastructure.

We can see major issues that are about and around the human resource so they are the basis of strategies which can be developed in organizations in various situations. According to Hax and Majluf (1996) on one hand and Armstrong (2001) on the other hand, we can summarize the main human resources strategies in three categories as:

- Encouragement and Promotion
- Training and Development
- Ejection and Replacement

It is important to say that in each situation and in each business strategy and mission, a suitable human resource strategy should be selected.

Methodology

In this research, first, we studied the literature of knowledge mapping and human resource strategy. Then, regarding the available concepts of these fields, we articulated our

framework to link them. To evaluate the suggested framework, we executed this framework in Raveshmand Company whose business is in the IT field in Iran. This company has 53 employees and we tried to do human resource strategy planning according to the suggested framework step by step. The results showed that our developed framework can be used in the real business world as a useful tool, for human resource strategy planning, especially in knowledge-based organizations.

Model development

In this section of the paper, we endeavor to develop a framework for planning human resource strategy based on organizations' knowledge position considering knowledge maps. So, as the first step we use a methodology which Hax and Majluf (1996) introduced for the development of functional strategy (because HR strategy in an organization is categorized to some functional strategies) and then we will develop our suggested framework based on Hax and Majluf's strategic approach. Zero level of the developed framework shows the main structure and fundamentals of the framework; you can see the basis of this framework as shown in Figure 4.

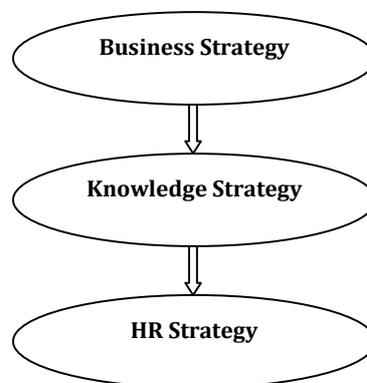


Figure 4 Zero level of conceptual framework

The basic elements of this framework are Corporate Strategy, Knowledge Strategy and Human Resource Strategy.

Zero level shows that knowledge strategy can play a new role in the HR strategy formulating process. On the other hand, knowledge strategy can be extracted from business strategy. In this way HR strategy can be set through knowledge strategy too, which can enrich the formulating process of HR strategy. Figure 5 shows the suggested conceptual framework in more detail. Different steps of Hax's methodology have been deployed within the suggested conceptual framework as shown in Figure 5.

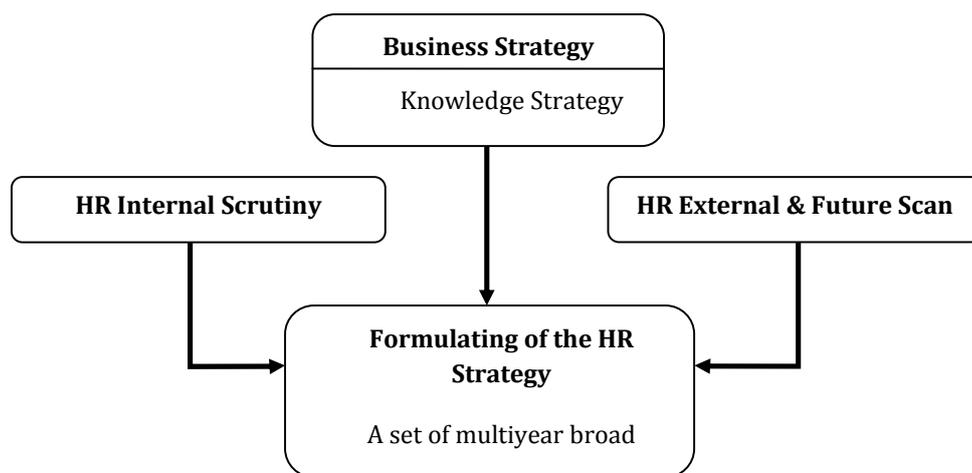


Figure 5 first level of conceptual framework

This level shows the key steps of the conceptual framework for human resource strategy. In the first step, we survey business strategy and then knowledge strategy which has been developed through business strategy as we are to recognize the basic requirements of functional strategy.

In the second step, two parallel parts can be mentioned, we survey the present situation of human resources within the organization and analyze the external situation, future programs and the goals of organization in the human resource management field. The collected data from these steps can lead us to formulate the basic human resource strategies. The detail of each step and their practical solution has been shown in the second level in Figure 6.

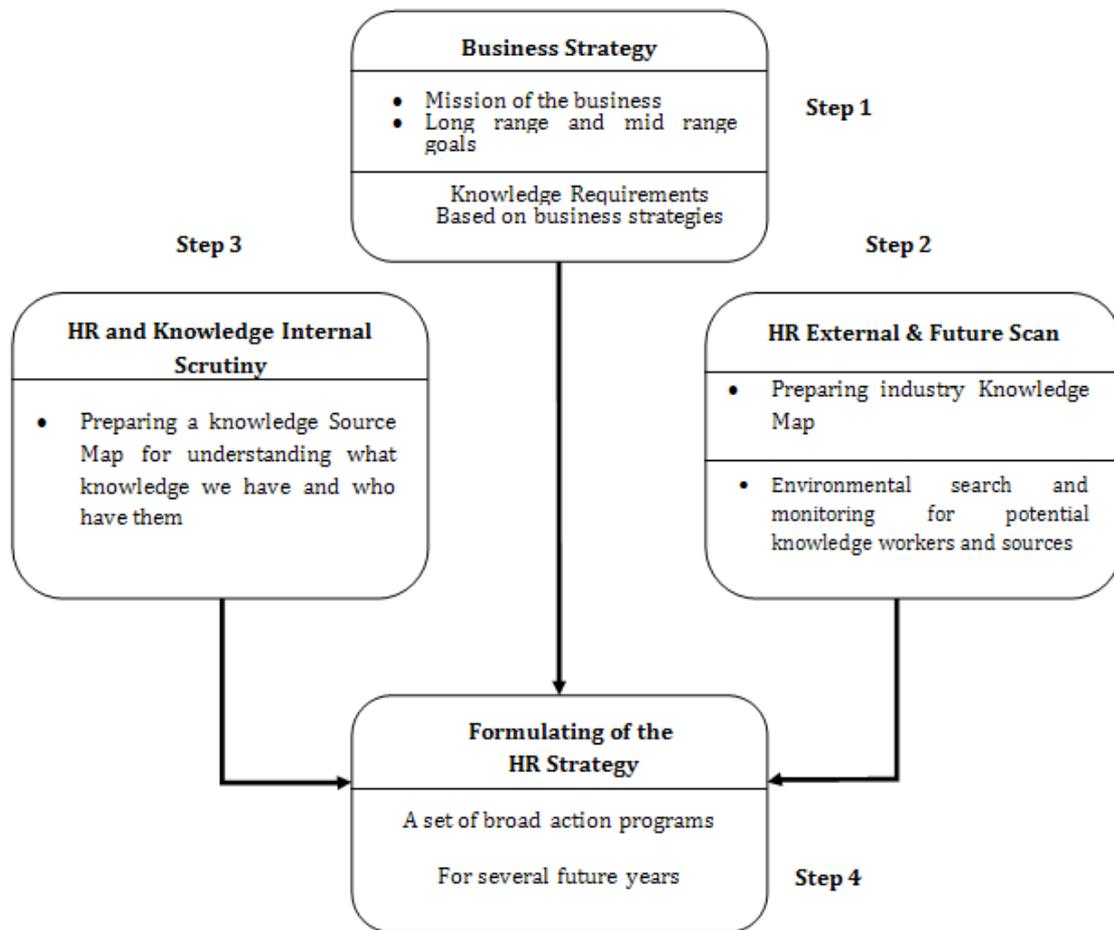


Fig. 6 Second level of Conceptual Framework

Here, we discuss more about the different steps and details of our conceptual framework and present the procedures and action plan for each step.

Step 1

Every strategic position can be linked with a set of intellectual resources and capabilities which shows the firms what they have to know and how to reach to it. The strategic choices that companies make regarding technologies, products, services, markets, processes, whether to engage in manufacturing or assembly, and whether to compete through low cost or differentiation have a profound influence on the knowledge, skills and core competencies required to compete and excel in an industry (Zack, 1999). On the other hand, usually there is a gap between what a firm must do to compete and what it actually is doing. This gap represents a

strategic gap ([Zack, 1999](#)) and organizations formulate the business strategies to cover this gap. At the same time, underlying a firm's strategic gap is a potential knowledge gap; this is a gap between what the firm must know to execute its strategy, and what it does know ([Zack, 1999](#)).

The important issue is that the knowledge gap is directly derived from the strategic gap and aligned with it. This simultaneous alignment of strategy and knowledge is a crucial element of a firm's knowledge strategy ([Zack, 1999](#)) and knowledge strategy, in fact, is articulated to cover the knowledge gap between what we know and what we must know at first and secondly, with covering this knowledge gap, the strategic gap removes in order to achieve business goals. So, in the knowledge strategy articulation process, fields and types of knowledge needed for organization towards goals should be determined.

Briefly, according to the above points in the first step, we survey the business strategies and determine the knowledge fields and types that an organization needs to implement its strategies on the basis of its gap with the present situation. Then, different levels of these knowledge fields should be specified. These levels show, for reaching goals, which level of knowledge is suitable for the organization. In the suggested framework of this article, we define three levels: High Level, Intermediate Level and Low Level. This classification can be altered according to the different situation in each organization. We use this information in step 3.

Step 2

In this step, we look outside the organization and pursue two main targets. First, we should prepare a knowledge source map for industry in which our organization is competing in order to identify the state and situation of our competitors. Second, in this step we analyze the environment to find the suitable potential workers.

[Zack \(1999\)](#) cited that knowledge can be classified according to whether it is *core*, *advanced* or *innovative*.

- 1. Core knowledge:** “Core knowledge is that minimum scope and level of knowledge required just playing *the game*. Having that level of knowledge and capability will not assure the long-term competitive viability of a firm, but does present a basic industry knowledge barrier to entry. Core knowledge tends to be commonly held by members of

an industry and therefore provides little advantage other than over nonmembers.” (Zack, 1999)

2. **Advanced knowledge:** “Advanced knowledge is what makes your company *competitively viable*. Such knowledge allows your company to differentiate its product from that of a competitor, arguably, through the application of superior knowledge in certain areas. Such knowledge allows your company to compete head on with its competitors in the same market and for the same set of customers.” (Tiwana, 2000)
3. **Innovative knowledge:** “Innovative knowledge is that knowledge that enables a firm to lead its industry and competitors and to significantly differentiate itself from its competitors. Innovative knowledge often enables a firm to change the rule of the game itself.” (Zack, 1999)

Knowledge is not static (Zack, 1999) and what is innovative knowledge today will become the core knowledge of tomorrow. The key lies in staying consistently ahead of the competition (Tiwana, 2000). So we must know what knowledge is classified in core knowledge and what knowledge is innovative in the industry in which our organization is competing. Then we can categorize our knowledge in the three categories that Zack has defined. This knowledge categorization helps us to comprehend the priority and importance of each type and field of knowledge.

Industry knowledge map

Because knowledge strategy cannot be formulated in isolation from what competitors are doing (Zack, 1999), in this step we study the industry situation to understand what knowledge competitors have and in which fields they are working. Then we can recognize what type of knowledge we planned to achieve the organizational goal belongs to what category. For this reason a knowledge map like Figure 7 should be prepared. Information of this knowledge map will be applied in the next step.

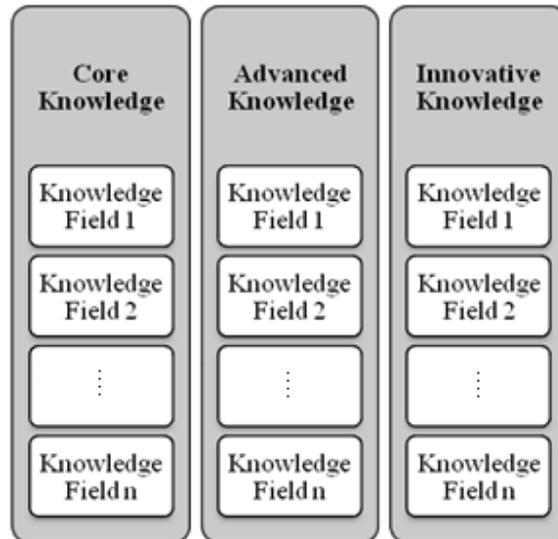


Figure 7 Industry knowledge map

Potential knowledge sources and workers identification

Scanning of the environment is crucial when we are gathering the information in order to extract the industry knowledge map which can show potential workers who possess knowledge that we need. Knowledge requirements are determined during step 1. Knowledge maps also help us to find internal knowledge sources that are related to our requirements. Common sources of external knowledge may include publications, universities, government agencies, professional associations, personal relations, consultants, vendors, knowledge brokers, and inter-organizational alliances (Zack, 1999). We will use this information in HR strategy articulation. This information can be summarized as shown in Table 1.

Table 1 Potential knowledge workers and sources in environment

Knowledge field 1		Knowledge field 2		...	Knowledge field n	
Workers	Sources	Workers	Sources	...	Workers	Sources
				...		
				...		
				...		
				...		

Each row of this table should be filled with workers and sources of each required knowledge fields which are available in the environment.

Step 3

In the third step of our conceptual framework we determine the categories of future organizational knowledge and also capture the present situation of human resource in an organization through a knowledge map.

As explained before, in the first step, the knowledge fields which are required for future strategies and their levels were identified. On the other hand, in the second step, we formed an industry knowledge map which helps us to understand - according to the competitors' activities – what kind of knowledge is core, which knowledge is advantage and what kind of knowledge is innovative. So, in this step we can identify the category of each organizational knowledge field by comparing determined organizational knowledge (which was prepared in the first step) with the industry knowledge map. After this comparison, the result can be set according to Table 2.

Table 2 The future knowledge fields characteristics

Knowledge field	Level			Category		
	High Level	Intermediate Level	Low Level	Core	Advanced	Innovative
Knowledge field 1						
Knowledge field 2						
...
Knowledge field n						

Knowledge fields and their levels in Table 2 were prepared in the first step and their categories are located in this step. As an example for filling out Table 2, in the first row hachured cells show knowledge field 1 that is a required knowledge field which an organization needs at high level and also according to the industry knowledge map, this field is assessed as an advanced knowledge.

The other task of the third step is to answer the question about the current status of the organization in the human resource field and knowledge they have. We can use the knowledge map as a suitable tool. As discussed in the knowledge maps section, the knowledge source map can structure a population of company experts along relevant criteria, such as their domains of expertise. So this type of knowledge map can provide a snapshot of an organization’s situation and therefore we use this type of knowledge mapping for internal human resource scrutiny.

During this process we should gather the information about workers of an organization and survey their knowledge, experiences and performance. We can use the workers’ profile,

interview workers and set a proper questionnaire to identify their knowledge and their knowledge levels. In this process we should analyze them. During the analysis we should classify the information to answer three questions:

- What kind of knowledge does the organization have?
- Who has this knowledge in the organization?
- What level of knowledge does she/he have?

After deriving available knowledge in an organization, workers in each knowledge field can be arranged into three levels on the basis of their level of knowledge. So when we gathered the information about a worker, experts in every field in an organization can give him/her a grade (mark) from 1 to 9. These marks can be assigned as follows:

From 1 to 3: beginner

From 4 to 6: specialist

From 7 to 9: expert

Now, we can form a knowledge source map of the organization as shown in Table 3.

Table 3 Knowledge source map of the

Knowledge field	Experts	Specialist	Beginners
Knowledge field 1			
Knowledge field 2			
...
Knowledge field n			

In cells of each row of Table 3, the names of workers who have related knowledge field (considering their level in that field) are placed.

Step 4

Finally, we can articulate human resource strategy considering previous stages. Factually, in this step, we compare the present knowledge situation of the organization (represented in the knowledge source map of the organization, Table 3) and required knowledge for executing strategies (represented in Table 2). In this step we design an information confirmation as it is simulated in Figure 8.

Table 3 Knowledge source map of the organization

Knowledge field	Experts	Specialist	Beginners
Knowledge field A		A ₂	—
Knowledge field B	B ₁	B ₂	—
Knowledge field C		C ₂	—
Knowledge field D	D ₁		—
Knowledge field G	—	G ₂	G ₃



Extracted from table 2 - the future knowledge fields characteristics

Knowledge field	High Level	Intermediate Level	Low Level
Knowledge field D	D ₁		
Knowledge field C	C ₁		
Knowledge field A			A ₃
Knowledge field E		E ₂	
Knowledge field F			F ₃

Figure 8 Information comparison

Figure 8 shows an example of the information comparison between the present and future knowledge situations. In this figure, each knowledge field is presented by a letter like A, B, C... and shared knowledge fields in both tables are named with the same letter. Colored cells in Table 3 display the level of knowledge which is available in the organization and include the names of the workers who possess it and colored cells in Table 2 display the required level of knowledge in future. For simplicity, the representative letter of its knowledge field with a subscript is allocated to each cell. For example, the first row of Table 3 in Figure 8 shows that we have workers in the organization who have knowledge field A and their knowledge level is assessed as specialist level and the first row of Table 2 in Figure 8 shows that the organization needs the high level of knowledge field D. Now the confirmation process is explained.

As mentioned before, in Table 2, we have the knowledge fields and their levels needed for the organization based on future plans and strategies. Therefore, Table 2 is considered as a start point and we try to confirm Table 3 to it. So we start from the first row of Table 2 in which the first knowledge field has been placed. Then we look at the first column of Table 3 and search it for the same knowledge field. If that knowledge field exists in Table 3, and has equivalent or higher level than the same knowledge field in Table 2, then we should connect the same cells in both tables with an arrow as Figure 8 shows. If the knowledge field in Table 3 has a lower level, then just highlight the related cell in Table 3. Finally if the knowledge field of Table 2 does not exist in Table 3, we should leave that row and go to the next row of Table 2. This process will be continued until the end of Table 2 and for all rows of it (rows are considered as the knowledge fields as mentioned before).

At the end of this process, we have four positions as follows:

1. Cells in Table 3 that have been connected to other cells in Table 2 like A_2 and D_1 in figure 8. (*Position 1*)
2. Cells in Table 2 whose knowledge fields do not exist within knowledge fields of Table 3 like E_2 and F_3 in figure 8. (*Position 2*)
3. Cells in Table 3 whose knowledge fields do not have connection with knowledge fields in Table 2 like B_1 , B_2 , G_2 , G_3 in Figure 8. (*Position 3*)

4. Cells in Table 3 that have similar knowledge field to some cells in Table 2, their level is lower like C_2 in Figure 8. (*Position 4*)

Position 1 is representative of workers who have the knowledge which is required for the organization in future and also their level of knowledge conforms to the organizational need. Position 2 shows the knowledge vacuum for the future. This position contains the knowledge fields which the organization needs to reach its goal in the future but it does not have workers who have knowledge in these fields. On the other hand in position 3 we have workers whose knowledge does not have any place in future organizational plans and strategies. Position 4 shows workers whose available field is suitable for the organization but they are at a lower level of knowledge than the organization's future need.

Considering these subjects, we can articulate human resource strategy for the above positions that are representative of workers. Considering human resource issues in Figure 4, we define four main human resource strategies that are shown in Figure 9. In this figure we have four cells that are specified by *white cell*, *hachured cell*, *black cell* and *gray cell*. Each cell represents a main strategy.

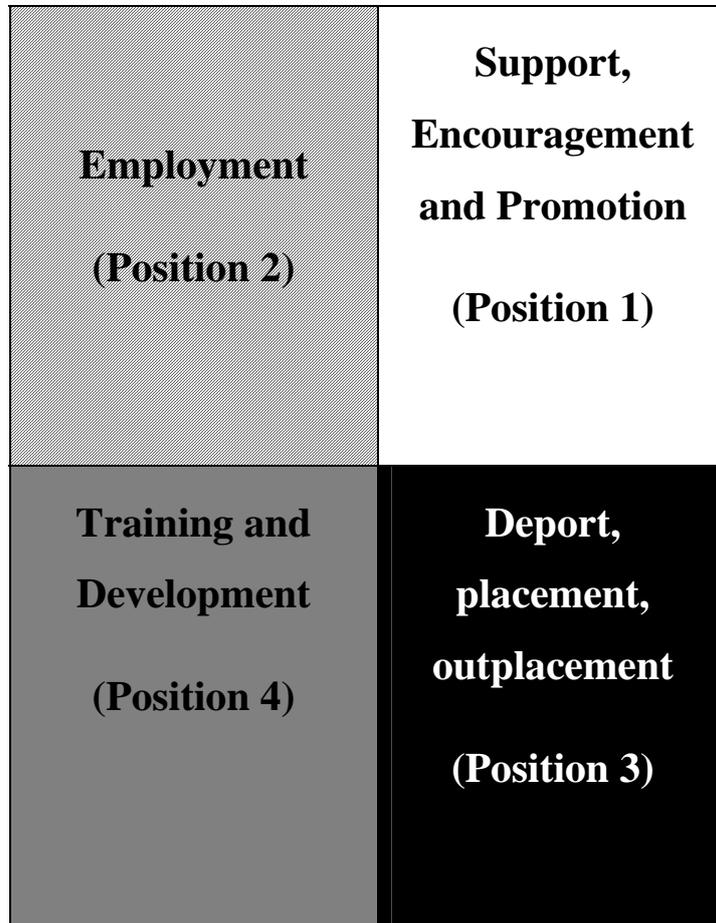


Figure 9 Strategy structure

White Cell- In this cell main strategies are support, encouragement and promotion of employees. In this cell there are workers who we classified in position 1. This position contains cells in Table 3 which are connected to some cells in Table 2. It means that worker's knowledge and its level are enough to achieve knowledge strategy of the organization. These workers have knowledge that exists in the organizational knowledge strategy and the level of this knowledge is enough for the organization in the future because Table 2 has been planned in a way that considers business and knowledge strategy. So the organization must keep them and satisfy their needs and motivate them through encouragement and promotion. These workers are located in position 1 that was explained.

Hachured Cell- Hachured cell represents lack of special knowledge in the organization. In fact, in this cell, there are some knowledge fields that are left in process which was presented in Figure 8 and they are not available in Table 3. It means that the company does not have any worker who has a related knowledge and ability. So this lack should be covered. Therefore, in this stage we should decide about “how we cover the knowledge lack”. One of the alternatives for our human resource strategy is “knowledge worker” employment. In step 2 we gathered this information about potential workers and sources in the business environment and organized this information in Table 1. In this stage we can choose the workers and sources from Table 1. The type of each knowledge field (core, advanced and innovative) can help us for this selection. If the type of required knowledge is innovative, we understand that this knowledge field is very important for the organization and so we should obtain it accurately. On the other hand this type can help us to select the best worker to cover the need of the organization. For example, to cover the need for innovative knowledge, we should employ workers who have two main characteristics: they should be expert in that knowledge field and also they should be creative because they are supposed to explore new fields, branches and applications of knowledge for the organization to compete.

Black Cell- In the third step, in fact we evaluated the human resource of the company in the knowledge aspect and summarized its result in Table 3. In this step we identify workers who have the required knowledge and ability. Considering the four above positions, in position 3 we have workers whose knowledge has no relation to future knowledge needed for the organization. If they are not useful for the organization, we can replace them with potential workers in Table 1. HR strategy in the black cell can be: stop companionship with them and plan replacement of them, outplace these workers or place them in another position in the organization, job rotation, early retirement, etc.

Gray Cell- In this cell we have workers in position 4. In position 4 workers exist who have related knowledge in Table 3 but their level of knowledge is lower than the expected level in the organization. In addition, some of these workers in aspects like socialization, their familiarity with the organization, positive background in the company etc. are better than new workers for the company. So, the company can carry out planning to develop programs to increase the level of knowledge as needed. Because they have related knowledge context to future programs of the company, they just should improve their level through training and developing programs.

Briefly, in this cell human resource strategy is planning the programs in which these workers can develop and improve their knowledge. Some of these programs can be on the job training, attending conferences, workshops, training careers and so on.

Case study: Raveshmand Company

Raveshmand Company is a knowledge-based one which competes in the IT business field in Iran. The IT field is one of the most knowledge-based businesses in Iran which is favorable for private sectors, has a great proportion, and there are many active companies in this area in Iran. For this research, we need a knowledge-based organization which works in a competitive environment. On the other hand we required an organization whose managers believe in concepts like strategy planning, and support the related activities. Fortunately, after surveying some companies in Iran, we found Raveshmand Company with our favorable characteristics.

Raveshmand Company was established in 1999. This firm has 53 workers. Four business units (BU) exist in this company, as follows:

- Software development BU.
- IT consulting BU.
- Software architecture & planning BU.
- Hardware and network BU.

After this short introduction for Raveshmand Company, we start describing the execution of the suggested framework in this company step by step according to the proposed framework.

Step 1

As mentioned, in this step the business strategy of the firm should be surveyed and the relevant knowledge requirements should be identified. The senior managers in Raveshmand Company usually plan a three-year strategic program for whole company. According to the last strategic plan of this firm which has been articulated in the early months of 2009, the firm summarily has these main strategies for the future.

- Software programming based on newest Microsoft technologies and achieving a position from first to third among competitors.
- Consult about web-based activities, at least consulting one private bank and one private insurance institute.
- Developing a specialized methodology for software architecture and planning in the Iranian market.
- Entering the hardware import market, especially import data center equipments and ultra laptop.
- Promoting the present position of the firm in developing and maintaining internal and wireless networks to top ten companies.

After surveying these strategies, we planned some interviews to senior managers and experts who are working in the company to determine what kinds of knowledge are required to execute these strategies. Finally, we identified these main knowledge fields as tools for the organization to achieve its strategic goals:

- Microsoft .Net Framework 3.0 (WCF, WF, Card Space)
- Microsoft .Net Framework 3.5 (Silver light)
- SQL Server 2008
- Linq

- AJAX
- JQuery
- dojo
- e-Banking
- Core Banking
- Customized software architecture and planning methodology
- Data center equipment knowledge
- Ultra portable laptop knowledge
- Wireless equipment knowledge
- Import and custom laws
- e-Marketing
- Customized project management methodology
- Customized software development method
- BPMN

The levels of these knowledge fields needed for the organization have also been determined and in the third step will be illustrated.

Step 2

As illustrated in the framework, in this step we should perform two main tasks. First, we should prepare a knowledge map for the industry. As noted, the Raveshmand Company does its business in the IT field, so in this step we should prepare a knowledge map for this industry. In order to achieve this purpose, we select the top ten companies which are the main competitors for Raveshmand and according to their performance, products, services and future plans, the industry knowledge map was prepared. We gathered this information from their websites and official documents and also arranged interviews with their managers. Finally, we summarized the main information in Figure 10.

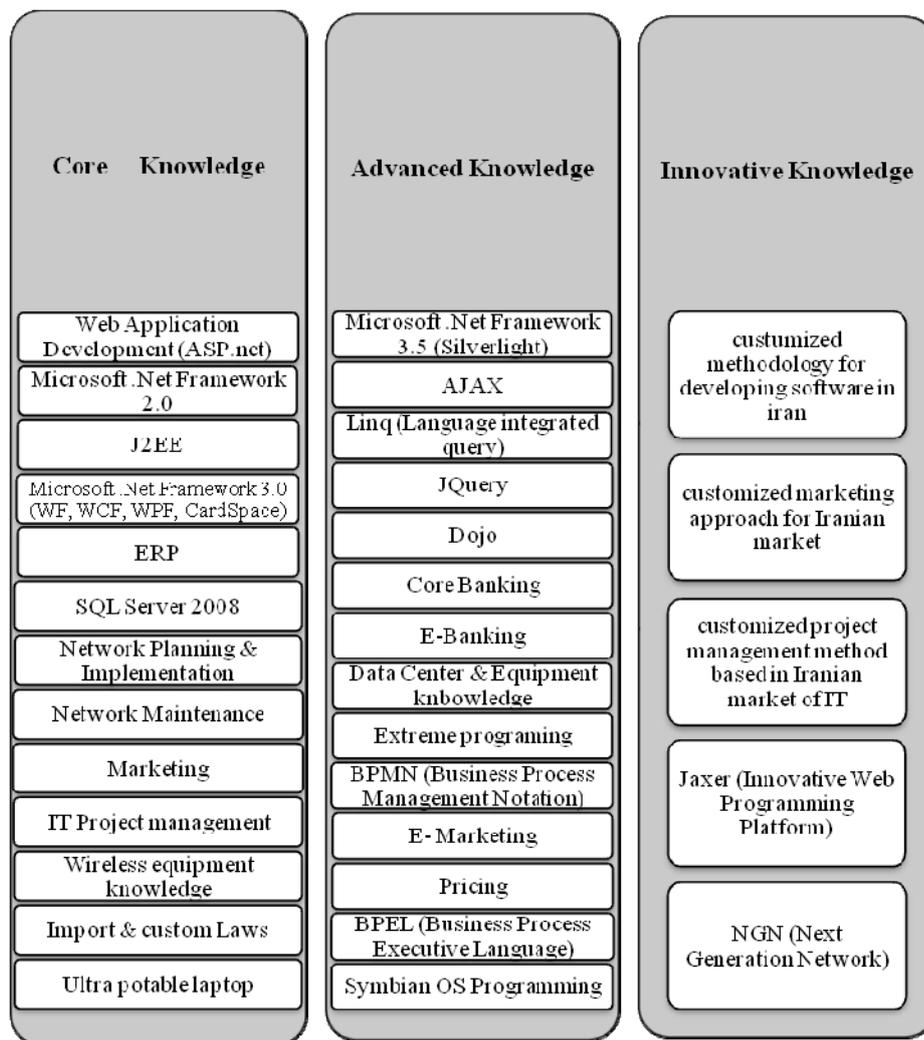


Figure 10. IT industry knowledge map for Raveshmand Company

As shown in Figure 10, the knowledge fields are according to the fields in which Raveshmand Co. is working. For example “AJAX” in advanced knowledge is related to software programming and “specialized marketing approach for Iranian market” is related to hardware import and sale.

The second task in this step is finding potential knowledge workers and knowledge sources based on Raveshmand Co.’s knowledge requirement which was identified in the first step. To gather this information we surveyed the available database in the organization about applicants

who had been interviewed in the organization for jobs and also we gather this information from some sources like work agencies' information, ready to work advertisement, workers' advice etc. In the end we classified this information in Table 4.

Table 4 Potential knowledge workers and sources

Microsoft .Net Framework 3.0 (WCF, WF, Card Space)	Workers	15 persons
	Sources	8 sources
Microsoft .Net Framework 3.5 (Silver light)	Workers	5 persons
	Sources	4 sources
SQL Server 2008	Workers	7 persons
	Sources	3 sources
Linq	Workers	3 persons
	Sources	1 source
AJAX	Workers	13 persons
	Sources	6 sources
JQuery	Workers	5 persons
	Sources	5 sources

dojo	Workers	2 persons
	Sources	1 source
e-Banking	Workers	13 persons
	Sources	8 sources
Core Banking	Workers	9 persons
	Sources	2 sources
Software architecture and planning Methodologies	Workers	17 persons
	Sources	12 sources
Data center equipment knowledge	Workers	11 persons
	Sources	16 sources
Ultra portable laptop knowledge	Workers	6 persons
	Sources	1 source
Wireless equipments knowledge	Workers	12 persons
	Sources	9 sources
Import and custom laws	Workers	9 persons

	Sources	2 sources
e-Marketing	Workers	14 persons
	Sources	6 sources
Project management methodologies	Workers	16 persons
	Sources	12 sources
Customized software development method	Workers	4 persons
	Sources	5 source
BPMN	Workers	8 persons
	Sources	10 source

The content of the rows in the first column of Table 4 is required as the knowledge for the organization which was determined in the first step and in the third column we can see the number of the related workers and sources which have been identified in the environment (industry). For simplicity, we avoid mentioning the name and characteristics of them and just note the number of them.

Step 3

The first defined task in this step is categorization of the organizational required knowledge through the industry knowledge map. So we compared required knowledge with the industry knowledge map in which the situation of each main knowledge field among the competitors has been shown. Table 5 shows the result of this scrutiny.

Table 5 The future knowledge fields characteristics

Knowledge field	Level			Category		
	High Level	Intermediate Level	Low Level	Core	Advanced	Innovative
Microsoft .Net Framework 3.0 (WCF, WF)	✓	✓		✓		
Microsoft .Net Framework 3.5 (Silver light)		✓			✓	
SQL Server 2008	✓	✓		✓		
Linq		✓			✓	
AJAX		✓			✓	
JQuery		✓			✓	
Dojo		✓	✓		✓	
e-Banking	✓	✓			✓	
Core Banking		✓			✓	

Customized Software architecture and planning Methodologies	✓					✓
Data center equipment knowledge	✓				✓	
Ultra portable laptop knowledge		✓		✓		
Wireless equipments knowledge	✓			✓		
Import and custom laws		✓		✓		
e-Marketing	✓				✓	
Customized Project management	✓					✓
Customized software development method	✓					✓
BPMN		✓			✓	

In Table 5 we show the level of knowledge fields which were determined in the first step and also the category of knowledge which is appointed according to the industry knowledge map.

The second task in this step is capturing the present condition of the organization about knowledge and preparing a knowledge source map. We did this task as it has been illustrated in the article. In this part we show its result and mention that its process has been quite similar to explanation of this step in the article. Table 6 shows the organization's knowledge source map. In this table, in order to facilitate the display, the names of the staff have been withheld and instead, the number of them in each field is listed. Therefore, the number in each column is

asserting the number of available staff with the knowledge of the corresponding cell in Bona Company.

Table 6 Organization's knowledge source map in Raveshmand

Available knowledge field	experts	Specialist	Beginners
Microsoft .Net Framework 3.0 (WCF, WF)		5	
Microsoft .Net Framework 3.5		3	5
Web Application Development (ASP.net)		5	
SQL Server 2008	3	4	
Linq		3	
AJAX	2	2	
JQuery		1	
J2SE	2		
PHP Language	3		
Delphi Language	3		
Data center equipment knowledge	1	2	
Ultra portable laptop knowledge	1		

Wireless equipments knowledge		3	
CRM	1		
Customized software development method		2	
BPMN			2

Step4

In this step, we compared the organization's knowledge inventory with its future need. This process, in accordance with what was said in the description of the model, has been conducted. Figure 11 is a schematic view of this process.

Table 3 Organization's knowledge source map

Available knowledge field	experts	Specialist	Beginners
Microsoft .Net Framework 3.0 (WCF, WF)		5	
Microsoft .Net Framework 3.5		3	5
Web Application Development (ASP.net)		5	
SQL Server 2008	3	4	
Linq			3
AJAX	2	2	
JQuery		1	
J2SE	2		
PHP Language	3		
Delphi Language	3		
Data center equipment knowledge	1	2	
Ultra portable laptop knowledge	1		
Wireless equipments knowledge		3	
CRM	1		
Customized software development method		2	
BPMN			2

Extracted from table 2: The future knowledge fields characteristics

Knowledge field	Level		
	High Level	Intermediate Level	Low Level
Microsoft .Net Framework 3.0 (WCF, WF)	✓	✓ 5	
Microsoft .Net Framework 3.5 (Silver light)		✓ 3	
SQL Server 2008	✓ 3	✓ 4	
Linq		✓	
AJAX		✓ 4	
JQuery		✓ 1	
Dojo		✓	✓
e-Banking	✓	✓	
Core Banking		✓	
Customized Software architecture and planning Methodologies	✓		
Data center equipment knowledge	✓ 1		
Ultra portable laptop knowledge		✓ 1	
Wireless equipments knowledge	✓		
Import and custom laws		✓	
e-Marketing	✓		
Customized Project management	✓		
Customized software development method	✓		
BPMN		✓	

Figure 11 Information comparison

Numbers in each cell of Table 5 show that the Raveshmand Company has workers in that knowledge field who are expert in the same or higher level of the future need. After this process we can articulate the table of strategies for the Raveshmand Company according to Hax and Majluf (1996) major categories of decisions link to human resources..

<p>Employment (Position 2)</p> <p>Dojo, e-Banking, Core banking, Customized Software architecture and planning Methodologies, Import and custom laws, e-Marketing, Customized Project management</p>	<p>Support, Encouragement and Promotion (Position 1)</p> <p>Specialists in MS 3.0 & 3.5, Specialists and experts in SQL 2008, Specialists and experts in AJAX, Specialists in JQuery, experts in data center equipment, experts in ultra portable laptop,</p>
<p>Training and Development (Position 4)</p> <p>Some specialists in MS 3.0, Beginners in MS 3.5, Beginners in Linq, Specialist in data center equipment, Specialists in wireless equipments, Specialists in software development method, Beginners in BPMN</p>	<p>Deport, placement, outplacement (Position 3)</p> <p>Workers in: ASP.net, J2SE, PHP Language, Delphi Language, CRM</p>

Figure 12 Strategy table

White cell

As noted, there are workers whose knowledge is suitable for the organization in the future in this cell and the main strategy here is support, encouragement and promotion. Figure 12 shows workers in Raveshmand Company who are in this position:

- Workers who are specialist in MS .net 3.0 and 3.5: according to Table 6 (Raveshmand knowledge source map) five workers who have MS .net 3.0 knowledge - in specialist level- and three workers who have MS .net 3.5 knowledge are working in this company. On the other hand Table 5 shows that Raveshmand needs these two fields at the intermediate level which coincides with specialist. So the HR strategy about these workers is retaining them. For this reason Raveshmand managers can give promotion or other award to these workers and encourage them to work effectively. Workers who are specialists and experts in SQL 2008, specialists and experts in AJAX, specialists in JQuery, experts in data center equipment and experts in ultra portable laptop are in the same position. In all these groups, worker's knowledge and their level are compatible with the organization's future needs. So, the main strategies for all workers in this position are support, encouragement and promotion.

Hachured cell

This cell contains the organization's knowledge requirements where Raveshmand does not have any worker in these knowledge fields. So, Raveshmand should cover this lack of knowledge in order to reach its strategic goals. Main strategy to cover this lack is employing the new workers in these fields. Table 4 shows the potential workers who are ready to work and the company has their characteristics. This table also contains knowledge sources which Raveshmand can use. The type of each knowledge (core, advanced and innovative) field mentioned in Table 5 can help Raveshmand's managers to employ suitable workers. Core category means that knowledge field is available in the business environment, so the company should select potential workers who have the same level of that knowledge field in this category. On the other hand, innovative category contains fields that do not exactly exist outside (e.g. project management). The important issue in employing in this position is selecting workers who have innovation and creation ability. Company should select workers through Table 4 who are adventurer, innovative

and risk taker so that they can be useful for the company to create a new field of knowledge or new application of a knowledge field in the industry.

We should mention this important point that the number of workers who will be employed should be determined by the company's human resource managers according to requirement and other related issues like budget.

Black cell

There are some workers in Raveshmand whose knowledge is not among the company's future knowledge fields. These knowledge fields are ASP.net, J2SE, PHP Language, Delphi Language and CRM. In fact, the Raveshmand Company has no program in these fields in future. So, workers whose main efficiencies are in these knowledge areas cannot be useful for the company. Therefore the main strategy in this position is stopping the cooperation with them (eject them). If some of these workers have other abilities that are useful for the company, managers can replace them in the organization and assign suitable tasks to them. In Raveshmand, the main ability of most of these workers was in fields which have no effectiveness for the company in future and so managers had to eject most of them (13 people). Just one person who works in the CRM field was retained because managers identified that he can help Raveshmand in one of the future strategies which is consulting insurance institutes.

Gray cell

Some of the workers in Raveshmand have related knowledge to the strategies but their level of proficiency in these knowledge fields is lower than needed. Managers can improve their level through development and training programs. Workers who need training and development in Raveshmand are some specialists in MS 3.0, beginners in MS 3.5, Beginners in Linq, specialists in data center equipment, specialists in wireless equipments, specialists in software development method and beginners in BPMN. There are some ways to train these workers like: using the knowledge sources which was found in the second step and their information in Table 4, setting the training careers in each field for workers, on the job training and so on. For each knowledge field, according to its conditions we have suggested these ways:

- For specialists in MS 3.0: five workers have this knowledge in Raveshmand and their level has been assessed as specialist. On the other hand, the company needs the high and intermediate level of this knowledge. So, some of the specialists should be promoted to expert level. In this field we advised that some workers should attend the identified classes in step 2.
- For beginners in MS 3.5: Raveshmand has five workers who are beginner in this knowledge while future strategies need intermediate level of this knowledge. So, these workers should be promoted to specialist. In this knowledge, our advice was similar: beginners should attend the identified classes in step 2 as knowledge sources.
- For specialists in data center and wireless equipment: five workers are specialist in these two fields. The company needs high level. So, the company should facilitate the promotion for workers towards expertise. The advised approach in this situation is using document source of this knowledge available in Table 4. On the other hand, as Raveshmand has one worker in data center who is expert in this field, so managers can plan on the job training for specialist in this field.
- For specialists in software development method: Raveshmand is supposed to plan a customized software development method for the IT situation in Iran. Two specialist workers are working in Raveshmand. They should climb to expertise level, then they can contribute to this plan. This field is innovative. So, it is hard to find it outside. We find five sources in the second step about software development methodologies. Our advice about this situation was using and surveying the available sources by workers in this field to grasp utter knowledge about this field so that they can plan customized methodology.

Conclusion

The main objective of this research is suggesting a framework for human resources strategy formulation according to knowledge aspect. Knowledge aspect of workers in today's organizations is very important. This framework, with regard to this aspect, attempts to improve previous models. The worker's knowledge condition is assumed as the basis of this framework.

So the knowledge-based organizations can use this framework widely because the prominent capital of these organizations is knowledge.

In this framework, firstly, we notice to this rule that the success of a functional strategy depends on its consistency in businesses strategies. So, one of the advantages of this framework is considering this point. In the first step of the framework, the business strategies of the organization are surveyed and according to them the organization's future knowledge requirements, which are the basis of our strategic decision about workers in this framework, are determined. Another advantage of this framework is considering competitor's activities in strategy planning. This is one of the main benefits of the suggested framework that warrants successful implementation of the human resources strategies.

The other important subject in developing this framework is setting it in some obvious and practical steps. In each step, all tasks are defined clearly so, in the implementation phase, we should do tasks which are defined in steps after each other and step by step.

Studying the knowledge maps as efficient tools in knowledge management is the strength point of the framework.

This framework was applied and implemented in a company as a case study. It assured us that it can be reliable in the real business world. Senior managers of Raveshmand Company were satisfied from the result of implementing this framework in their company. Most of the suggestions that were developed at the end of this process about human resources as future strategies have been accomplished till now and this fact shows the acceptable vision of this framework.

To strengthen this framework, we can combine the knowledge aspect of human resources with other aspects of them in HR strategy planning in this framework and enrich it. Of course, more implications are needed for better evaluation of this framework in similar and other kinds of companies.

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