Modeling organizational intelligence using DEMATEL method in Iranian public universities

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Abstract

Purpose – This paper aims to investigate a novel model for organizational intelligence (OI) in Iranian public universities. OI is an effective concept in organizational behavior for reshaping the organizational rules. Multidimensional nature of OI makes it a very useful management tool.

Design/methodology/approach – This model is investigated by using an expert panel opinion and decision-making trial and evaluation laboratory technique based on Iranian university professors' opinions.

Findings – The proposed model consists of eight dimensions: structural, cultural, strategic, communicational, informational, functional, behavioral and environmental dimensions. Each one of these dimensions consists of some components. The results showed that the "Structural", "Cultural", "Strategic", "Informational" and "Environmental" dimensions are the cause dimensions, while the "Behavioral" and "Communicational" dimensions are the effect dimensions. Hierarchical levels of these dimensions are also determined.

Practical implications – Comprehending this model offers a handful of beneficial insights for university managers. These points are synoptically stated in the form of managerial implications.

Originality/value – The paper by using a real case study provides a cause and effect model for OI management in Iranian public universities and can be enhanced for other organizations.

Keywords DELPHI method, DEMATEL method, University, Organizational intelligence

Paper type Research paper

Introduction

Nowadays, organizations are facing rapidly changing markets, global competition, decreasing cycles of technological innovations, worldwide and just-in-time availability of information and subsequently dramatic changes in their cultural, social and political environments. In such highly dynamic environments, many factors need to be combined and coordinated, to achieve effective decision making.

In these circumstances, the classic rules of the management not only can result in a competitive disadvantage, but also put universities at the verge of collapse, which is mainly due to internationalization of universities, increasing economic uncertainty, high-velocity technological evolution, dominance of information technologies and unpredictable macro-environmental changes. These phenomena force universities to adopt new managerial approaches such as organizational intelligence (OI) and revisit

their traditional models of competitive analysis and management. They must adopt and pursue new approaches to cultivate more competitive operation (Boyer and Lewis, 2002; Sum *et al.*, 2004). Also, environmental unpredictability and high velocity of technological evolution have given rise to investigation of a comprehensive model of OI.

The concept of OI

OI has been defined as the capability of an organization to learn and manage the knowledge and apply it for effective decision making, adapting to changes in business environment. As compared to that of the human intelligence, it is defined as the ability to adapt to changing environments and situations and the capability to decide based on the knowledge available on any critical circumstances. It is also the organizational thinking and capacity to treat more rationally and creatively and act consciously (Choo, 1998; Mason, 1996; Weber and Diderleri, 1996; Halal and Kull, 1998; McMaster, 1996; Minch, 1996).

The concept of OI can be considered by two approaches: Senge (1990) and Argyris (1999) set the first one and the other one was proposed by Nonaka and Takeuchi (1995). According to the first approach, a learning organization can be defined as "a group of people who try to create the results they desire" (Senge, 1990). So to build a learning organization, its members must create new thinking models and share the vision of a common purpose. All members of an organization have the capacity to learn, but the organizational structures in which they act are not always flexible and open to learning. Organizations need intelligent people to become successful, but this is not enough. Systematic thinking, personal mastery, mental models, shared vision and team learning are necessary for systematic integration of individual and organizational elements, to enable them to learn (Senge, 1990). People can also influence the structure of organizations which they are a part of and create action frameworks. OI in this approach can be defined as the integrated results obtained in a given organizational environment, due to contextual management (Menkes, 2005).

According to Nonaka and Takeuchi (1995), the intelligent behavior of the organizations can be understood as a function of design and information processing functions that permit adaptation with environmental demands and are related to innovation initiation and implementation (Glynn, 1996). OI is also related to the capacity of organization for computation which can be applied to information externally gained or internally generated to meet survival challenges (McMaster, 1996) and is a function of five cognitive subsystems: organization structure, culture, stakeholder relationships, knowledge management and strategic processes (Halal and Kull, 1998).

The main approaches which are usually used in OI studies are the behaviorist (Melser, 2004), the cognitive (Sternberg, 1984; Jensen, 1998) and the adaptive approach (Laughton, 1990; Plotkin, 1994).

The behaviorist approach refers to setting behaviors suited to the organizational interests and goals that the organization should achieve based on a given set of inputs (Zara, 2004). The organizations learn behavioral algorithms which yield the desired results and like a hybrid system composed of human and cybernetic factors, selects the corresponding methods each time it comes across a situation which is similar to one in the past (Abraham *et al.*, 2003). Cognitive approach as a cybernetic modeling of organizations states that OI can be assumed as the information processing in organization structures to form a single learning loop (Schwaninger, 2003). It is to be

noticed that in the cognitive approach, the intra- and extra-organizational environments in which information is processed are ignored (Rizzello and Turvani, 2000; Perkins, 2003). The adaptive approach for OI study describes its evolution under the impulse of the environmental stimuli, but through adopting a non-linear model (Desouza, 2006).

In all of these approaches, it can be noticed that the focus is on processing information for obtaining knowledge. Knowledge possession and knowledge creation are two different processes contained in organizational knowledge (Gregory, 1994). It seems that an intelligent organization uses knowledge management as an adaptive tool to cope with its environment which is continuously changing. So the definitions of the OI focus on various aspects of these characteristics of organization: gathering, processing, interpreting and communicating the technical and political information required for the decision-making processes (Wilensky, 1967).

OI affects organizational behavior and its management. On the other hand, OI shapes organizational rules and resources. The information processing capability of the organization is influenced and guided by existing rules and resources. Structures can act as information filtering mechanisms that process the information consistent with the current organizational situations. In fact, how information and/or knowledge is gathered, shared and manipulated is related to the signification aspects of OI and depends on existing rules and their interpretation and use by organization members for sanctioning events or behaviors.

University as an organization

Traditionally, researchers regarded universities as either institutions carrying out a prominent social role (Readings, 1996), or communities which were recognized for presenting educational services in a certain society. Today, however, it seems the universities are entities. A university is an entity in charge with setting up and transmitting a national cultural heritage. According to Clegg *et al.* (2003), "the University of Culture was replaced by the University of Excellence, where the logic of performance is legitimating the university, under the pressure of academic capitalism". Neave (2002) believes that universities reformed from autonomous communities to organizations with stakeholders so they no longer work for themselves and must respond to external demands. Colleges and universities have ambiguous goals; they must build decision-making processes to grapple with a higher degree of uncertainty and conflict (Baldridge *et al.*, 2000). Bourdieu and Johnson (1993) state that universities are both positioned and position-taking systems:

> The position-taking actions of the national governments, as well as regional educational policies position universities but they adopt position taking strategies which influence rankings and market shares, positioning them towards their stakeholders.

So a university can become competitive by marketing its knowledge:

> […] knowledge in the form of an informational commodity indispensable to productive power is already, and will continue to be, a major - perhaps the major - stake in the worldwide competition for power (Lyotard, 2004).

So "colleges and universities can and must grow smarter" (Forest, 2002), and "must be considered as organizations seeking to maximize both their revenue and their prestige" (Strober, 2006). It is obvious that universities must extend their OI as well as other organizations.

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Research methodology

The main objective of this research is finding a cause and effect model and investigating relations for its dimensions and components for OI in Iranian public universities. Constructing a causal model is consistent with theoretical basis of modeling because casual modeling requires knowledge and understanding of the theoretical, substantive and philosophical foundations of the specific research subjects; otherwise, the researcher may mistake the model specifications by omitting important variables or significant relations when establishing the path diagrams. Mistakes observed usually arise from model specification errors which mean omitting important exogenous variables in the model, the important link path between the variables in the model, accounting unimportant parameters and inappropriate relation in the model.

A number of studies have indicated that it is more likely to be successful for the amendment by the limited theory-driven model than the data-driven model. Compared to the data-driven model, decision-making trial and evaluation laboratory (DEMATEL) method provided by this study uses theory-driven model as the method of amendment. To re-examine the causal relationships among all dimensions on the basis of the experts' opinions, and then to test the initial model constructed by the researchers to find out the amendment direction for DEMATEL methodology under the reasonably foundation. Thus, DEMETAL provides another tool for examining the accuracy of researchers' initial hypotheses. It will not be confined in the researchers' initial hypotheses and path relation, reduce the model specification errors, minimize the occurrence of capitalization on chance error, maintain the nature of confirmatory and over-fitting model will not occur.

The main steps of this research methodology can be described as follows:

- *Phase 1*: Identifying the dimensions and components that may affect the OI in Iranian public universities and conceptualizing it.
- *Phase 2*: Use of expert panel and DELPHI technique to deduce Iranian public universities' OI dimensions and components.
- *Phase 3*: Applying the DEMATEL to construct a cause–effect model and drawing influence-relation map between Iranian public universities' OI dimensions.

One of the most appropriate methods for investigating this kind of studies is a Delphi panel, which consists of a set of procedures for eliciting and refining the opinions of a group of people. In practice, the procedures must be used with a group of experts (Dalkey, 1967). The key aspect of the Delphi method is respondents' selection. In this method, respondents are selected as experts in a professional field. In the Delphi method, the researcher shares conclusions with selected respondents and asks them additional feedback. So, the respondents have a chance to correct and clarify their opinions during a process which is called Delphi rounds (Dalkey, 1969). A Delphi panel can also serve as an exploratory investigation that provides a springboard into additional research projects and can present an observed expert concurrence in a given application area where none existed previously (Sackman, 1974).

Each round of Delphi method poses a series of Likert questions, the answers are tabulated and the results are used to form the basis for the next round of questions. The outcome of a Delphi method is opinions of the experts who made up the panel.

DEMATEL technique
This study also adopts the DEMATEL technique to determine the casual relationships between dimensions and components of OI in Iranian public universities. In practice, the DEMATEL method is applied to illustrate the interrelations among criteria and to find the central criteria to represent the effectiveness of factors (Fontela and Gabus, 1974, 1976; Warfield, 1976). (DEMATEL) technique can be summarized in four steps as follows:

Step 1: Finding the average matrix (A). If there are m experts in the study and n factors to consider, then each member of the panel needs to indicate the degree to which he or she believes the factor i affects the factor j. This comparison between any two factors is denoted by a_{ij}, which is an integer score ranging from 0 to 4, with 0 representing "No influence", 1 representing "Low influence", 2 representing "Medium influence", 3 representing "High influence" and 4 representing "Very high influence".

The scores which are specified by each expert will give us an n × n non-negative answer matrix:

$$X^k = [x_{ij}^k] \quad 1 \le k \le m$$

$X^1, X^2_{[...]}, X^m$ are the answer matrices for each of the m experts, and each element of X^k is an integer denoted by x_{ij}^k. The diagonal elements of this matrix X^k are all set to zero. We can compute the average matrix (**A**) for all expert opinions by averaging the m experts' scores as follows:

$$a_{ij} = \frac{1}{H} \sum_{k=1}^{m} x_{ij}^k$$

The average matrix $\mathbf{A} = [a_{ij}]$ is called the initial direct relation matrix which shows the initial direct effects that each factor exerts on and receives from other factors. We can map out the causal effect between each pair of factors in a proposed system by drawing an influence map.

Step 2: Calculating the normalized initial direct-relation matrix (D). Now the normalized initial direct-relation matrix (**D**) can be calculated by normalizing the average matrix (**A**) by the following relation:

$$s = \max\left(\max_{1 \le i \le n} \sum_{j=1}^{n} a_{ij}, \max_{1 \le j \le n} \sum_{i=1}^{n} a_{ij} \right) \quad D = \frac{A}{s}$$

The sum of each row j of matrix (**A**) represents the total direct effects that factor i gives to the other factors, and $\max_{1 \le i \le n} \Sigma_{j=1}^{n} a_{ij}$ represents the total direct effects of the factor with the most direct effects on the others. Also, the sum of each column i of matrix (**A**) represents the total direct effects received by factor i, and $\max_{1 \le j \le n} \Sigma_{i=1}^{n} a_{ij}$ represents the total direct effects received of the factor that receives the most direct effects from others. The positive scalar value takes the lesser of the two as the upper bound. The matrix (**D**) is obtained by dividing each element of (**A**) by the scalar s. Each element d_{ij} of matrix (**D**) is between 0 and less than 1.

Step 3: Computing the total relation matrix. Continuous decrease of the indirect effects of problems along the powers of matrix $\mathbf{D}$, e.g. $\mathbf{D}^2, \mathbf{D}^3, \ldots, \mathbf{D}^\infty$, guarantees convergent solutions to the matrix inversion similar to an absorbing Markov chain matrix and $\lim_{m \to \infty} \mathbf{D}^m = [0]_{n \times n}$, so $\lim_{m \to \infty}(\mathbf{I} + \mathbf{D} + \mathbf{D}^2 + \mathbf{D}^3 + \ldots + \mathbf{D}^m) = (\mathbf{I} - \mathbf{D})^{-1}$, where (0) is the n × n null matrix and matrix (I) is the n × n identity matrix. The total relation matrix $(\mathbf{T})$ is an n × n matrix and is defined as follows:

$$\mathbf{T} = [t_{ij}] \quad i, j = 1, 2 \ldots n$$

$$
\begin{aligned}
T = \mathbf{D} + \mathbf{D}^2 + \ldots + \mathbf{D}^m &= \mathbf{D} + \mathbf{D}^2 + \ldots + \mathbf{D}^m \\
&= \mathbf{D}(I + \mathbf{D} + \mathbf{D}^2 + \ldots + \mathbf{D}^{m-1}) \\
&= \mathbf{D}[(I + \mathbf{D} + \mathbf{D}^2 + \ldots + \mathbf{D}^{m-1})(1 - \mathbf{D})](1 - \mathbf{D})^{-1} \\
&= \mathbf{D}(\mathbf{I} - \mathbf{D})^{-1}, \quad \text{as} \quad m \to \infty
\end{aligned}
$$

We can define R and J as $n \times 1$ vectors representing the sum of rows and sum of columns of the total relation matrix $(\mathbf{T})$ as follows:

$$R = [r_i]_{n \times 1} = \left[\sum_{j=1}^{n} t_{ij} \right]_{n \times 1}$$

$$J = [c_j]'_{1 \times n} = \left[\sum_{i=1}^{n} t_{ij} \right]'_{1 \times n}$$

Superscript ' denotes transpose of the matrix. If r_i shows the sum of i-th row in matrix $(\mathbf{T})$, then r_i shows the total effects, both direct and indirect, given by factor i to the other factors. If c_j denotes the sum of j-th column in matrix $(\mathbf{T})$, then c_j shows the total effects, direct and indirect, received by factor j from the other factors.

When j = i, the sum (R + J) gives us an index representing the total effects, both given and received, by factor i. In other words, (R + J) shows the degree of importance (total sum of effects given and received) that factor i plays in the system. In addition, the difference (R − J) shows the net effect that factor i contributes to the system. When (R − J) is positive, factor i is a net causer, and when (R − J) is negative, factor i is a net receiver (Tzeng *et al.*, 2006; Tamura *et al.*, 2002).

Step 4: Setting a threshold value and obtaining the impact-relations map. To explain the structural relation among the factors, while keeping the complexity of the system at a manageable level, we must set a threshold value (p) to filter out some negligible effects in matrix $(\mathbf{T})$. Each factor of matrix $(\mathbf{T})$ provides information on how one factor affects another factor; the decision-maker (DM) must set a threshold value to reduce the complexity of the structural relation model implicit in matrix $(\mathbf{T})$. Only some factors whose effect in matrix $(\mathbf{T})$ is greater than the threshold value should be chosen and shown in an impact-relations map (Tzeng *et al.*, 2006).

Participant selection for Delphi technique
Participant selection for a Delphi method study is a critical step. Experts should be identified and a nomination process is to be used to select participants; therefore, random selection is not acceptable. The researcher needs to locate and target individuals

who have the knowledge and experience in the subject, and are self-motivated. These participants remain anonymous to each other to facilitate the free expression of ideas without bias. The majority of Delphi method studies used between 15 and 20 respondents (Ludwig, 1997), but there is a definite and monolithic increase in the reliability of group responses with increasing group size (Dalkey *et al.*, 1972).

The first questionnaire could take several forms, but would most likely be one or two open-ended questions related to the subject. The second questionnaire is a culmination of information collected from the first questionnaire consisting of a series of structured questions developed by the researcher. Participants rank-order items or use a Likert-type rating scale to prioritize items, and are asked to comment on their rationale and add additional items. The next questionnaire asks participants to re-rate each item, but this time, they are provided with:

- statistical feedback regarding their own ratings;
- feedback on how the group rated the same item; and
- a summary of comments made by participants (Ludwig, 1997).

This process continues until a predetermined level of consensus is reached or no new information is gained.

The recruitment of experts-participants was conducted through the author's personal contacts with the Iranian university professors who are experts in management science and are familiar with academic procedures. Also, these experts have been mostly familiar with universities in other countries.

Fifty participants were invited to form an expert panel in this research. In the first round, 30 members answered the questioners, but in the second and third rounds, only 25 members answered questioners. Therefore, the Delphi panel consisted of 25 participants who were all expert practitioners in the area of management being university professors.

For the first round of the Delphi panel, 100 components (C) in 10 categories as dimensions (D) were summarized and presented to the panelists for approval. In this round, our aim was to identify the dimensions and components of Iranian public university organizational intelligence (IUOI). It is worthy to note that about 200 factors deduced in the literature were refined to 100 factors by several reviewing and coding processes.

The first questionnaire also included four main questions, which correspond to potential contributions of several factors which were identified through the literature review. The participants were asked to answer the following questions:

Q1. Do you agree with the proposed dimensions for university OI?

Q2. Do you suggest any other dimension for it?

Q3. Do you agree with the items as university OI components?

Q4. Do you suggest any other components?

The participants were asked to rely on their knowledge and expertise and to provide some background information as well as their opinion of the biggest challenge in measuring universities' OI. After finishing the determined time, about three weeks, 30 completed responses were returned. In this round, 40 components in eight dimensions

were approved. Also 17 new components were suggested by expert panel members for eight approved dimensions.

In the second round of the survey, respondents were asked to rate the 57 items approved in the previous round on a five-point Likert scale, such that 1 indicated the lowest rating (strongly disagree) and 5 the highest rating (strongly agree). In this round, 36 components in eight dimensions were approved. Again in the third round of this survey, they were asked to rate the second round results. In this round, the expert panel approved eight dimensions and 36 components. Twenty-five completed responses returned in the second and third rounds. Table II shows the results of consensus among panel members.

Determining the level of consensus
To determine the level of consensus among experts using the Delphi method of coordination, Kendall coefficient was used. Kendall coefficient of scale to determine the degree of coordination and cooperation agreement between several categories of rank N is an object or a person. Such a scale, especially in studies related to the "validity of the jury", is useful. This measure is calculated using the following formula (Siegel and Castellan, 1988; Zar, 1999):

$$W = \frac{s}{\frac{1}{12}k^2(N^3 - N)}$$

In this formula, $S = \Sigma[R_j - \Sigma R_j / N]^2$ is the sum of squared deviations of R_j's from the mean of R_j's, R_j corresponding to a total rating factor, K the number of sets of ratings (the number of judges), N number of rating factors and $K^2(N^3 - N)1/12$ represents the maximum deviation from the means of R_j's. The amount of this scale equals 1 in complete consensus and 0 in full disagreement. Table I shows how to interpret the   T1
values of various coefficients.

The process ended at the third Delphi round. Kendall's coefficient in the second round was 0.74 and in the third round was 0.77. So, Kendall's coefficient difference for coordination between the second and the third rounds about dimensions and components of university OI is only 0.03, or the degree of consensus among experts in this coefficient between the two rounds of growth was not significant.

Results
The results of this analysis stage revealed that eight main dimensions (D1 to D8) composed of 36 components (C1 to C36) for university OI *in Iranian public universities can* be identified (Table II). The main dimensions are structural, cultural, strategic,   T2
communicational, informational, behavioral, functional and environmental. To assess OI in a university, eight dimensions must be monitored. These dimensions are as follows:

Table I.
Interpretation of the various levels of coordination by Kendall coefficient

Value of W	0.1	0.3	0.5	0.7	0.9
Interpretation of the consensus	Very weak	Weak	Medium	Strong	Very strong
The average confidence factor	Very low	Low	Medium	High	Very high

Dimensions	First round K = 30, W = 0.53		Second round K = 25, W = 0.74		Third round K = 25, W = 0.77		Components
	Mean rank	Preference	Mean rank	Preference	Mean rank	Preference	
Structural (D1)	3.4	8	3.08	8	3.14	8	Centralization (C1), Specialization (C2), Organization size (C3)
Cultural (D2)	5.48	2	6.00	1	6.00	1	Cultural specifications (C4), Organizational identity (C5), Common ideas (C6), Creativity and innovation (C7)
Strategic (D3)	4.04	4	4.68	4	4.8	4	Strategic alignment (C8), Strategy institutionalization (C9), Strategic advantages (C10), Systematic thinking (C11), Stakeholders identification (C12), Insight and foresight (C13), Environmental adaptation (C14)
Communicational (D4)	5.7	1	5.34	3	5.16	3	Communication continuity (C15), Relation stability (C16), Relation strength (C17), Networking (C18), Feedback (C19)
Informational (D5)	5.12	3	5.56	2	5.56	2	Knowledge management (C20), Intellectual assets (C21), Free flow of information (C22), Level of information security (C23)
Behavioral (D6)	4.94	5	4.12	5	4.18	5	Openness (C24), Quality of work life (C25), Optimism (C26), Perception (C27)
Functional (D7)	3.52	7	3.52	7	3.46	7	Organizational justice (C28), Manager's tendencies (C29), Leadership and management (C30), Cognition (C31), Organizational learning (C32), Decision-making effectiveness (C33)
Environmental (D8)	3.8	6	3.7	6	3.7	6	Environment scanning (C34), Boundary spanning (C35), Attention to uncertainty (C36)

Table II.
Dimensions and
components of
Iranian university
organizational
intelligence

(1) *The structural dimension (D1)*: Organizational structure as the scene of implementation of any strategy is an effective factor in success or failure of any plan or program. Structure represents the amount of fitness and coordination among organizational context, processes and institutional mechanisms to promote and manage the activities of the organization (Cummings and Worley, 2004). The components of this dimension are organizational centralization and recognition (C1), organizational specialism (C2) and organization size (C3).

(2) *The cultural dimension (D2)*: Organizational culture is a set of common mind maps among organization members which affect their interpretations about phenomena and their behavior unconsciously (Hofstede, 1980). Cultural dimension in OI is related to the patronage of organization culture from behavioral necessities and fitness between values, norms, goals and other cultural specifications and climate for effective OI. This dimension consists of cultural specifications (C4), organization identity (C5), common ideas (C6) and level of creativity and innovation promotion in organization (C7).

(3) *The strategic dimension (D3)*: Organizations need information about their goods and services and competitive markets (Cummings and Worley, 2004). Availability of a strategic business plan and other strategic programs in the organization are pre-conditions stipulated for OI. For defining and measuring of alignment, two different perspectives can be considered:

- The first view or rational view controls the coordination between different organizational strategic plans. Based on theoretical principles, concepts and components of a strategic plan include mission or philosophy of existence and survival of an organization and its legitimacy, vision or goals, descriptions of the organization goals and its position at the end of strategic plans (Davari and Shanehsazzadeh, 2001), patterns of strategy or decision implementation (Mintzberg, 1979) and policies and goals which express the purposes in scheduled plans (Scott, 1965).

- The second view or social perspective in assessing strategic alignment reflects the importance of human aspects in formulating and implementing strategies. Assessing alignment according to this view includes the assessment of understanding, shared knowledge and attitudes among managers of different units in the organization and senior executives.

The strategic dimension consists of strategic alignment (C8), strategy institutionalization (C9), strategic advantages (C10), systematic thinking (C11), stakeholder identification (C12), insight and foresight (C13) and environmental adaptation (C14).

(4) *The functional dimension (D4)*: This dimension shows parts of a system that will facilitate the achievement of organizational goals and originates from systems analysis which represents how understanding and perception of different parts of organization affect each other and what are the relations between organization and its environment (Cummings and Worley, 2004). This dimension consists of controls on production procedures and analyzing it. This capability comes from positioning an individual in a position to affect transforming inputs. This factor can become sophisticated and depends on informational abilities (Shermerhorn,

2011b). Components of this dimension are manager's tendencies (C15), leadership and management (C16), cognition (C17), organizational learning (C18) and decision-making effectiveness (C19).

(5) *The communicational dimension (D5)*: Organization means an information processing system and information transfer canal's structure and person's position in organization determine what information can be inputs of communication processes. The interpretation of the communications by individuals is heavily influenced by their positions in the organization. Components of the communicational dimension are communication continuity (C20), relation stability (C21), relation strength (C22), networking (C23) and feedback (C24).

(6) *The informational dimension (D6)*: All managers must solve ongoing problems; collect, retrieve, process and transmit data that are originating from different sources. In fact, one of the most critical skills at the top level of organizations is informational competence, which is retrieving, evaluating, organizing and analyzing information needed in decision-making and problem-solving (Shermerhorn, 2011a). The components of this dimension are knowledge management (C25), intellectual assets (C26), free flow of information (C27) and level of information security (C28).

(7) *The behavioral dimension (D7)*: Studying human behavior in organizations results in behavioral dimension of organizations which helps understand how individual and group behavior influence organization's performance and its members. Behavioral dimension can develop the potential of labor success in accordance with dynamics, mobility and complexity of today's and tomorrow's world. This factor can be very complex and can influence the intelligence (Shermerhorn, 2011b). Its components are openness (C29), quality of work life (C30), optimism (C31), perception (C32) and organizational justice (C33).

(8) *The environmental dimension (D8)*: Environment of an organization consists of all factors which are out of organization and can influence some parts or all of the organization. Environment means work environment, general environment and international environment that is affected by organization territory. Organizations by means of structures, planning systems, imitation from success organizations and trying to change and control environmental factors show reaction to them (Daft, 2005). This dimension has three components: internal and external environment scanning (C34), boundary spanning (C35) and attention to uncertainty (C36).

These results shaped the theoretical body of a model for conceptualizing OI in Iranian public universities. A schematic model shall be proposed to exhibit this archetype as Figure 1.

F1

Evaluation of DEMATEL matrixes

T3-6   Tables III-VI show average matrix (A), direct influence matrix (D), indirect influence matrix (ID), the total influence matrix (T) and degree of total influence for Iranian public

AQ: 1   universities' organizational dimensions, respectively, based on expert panel opinions.
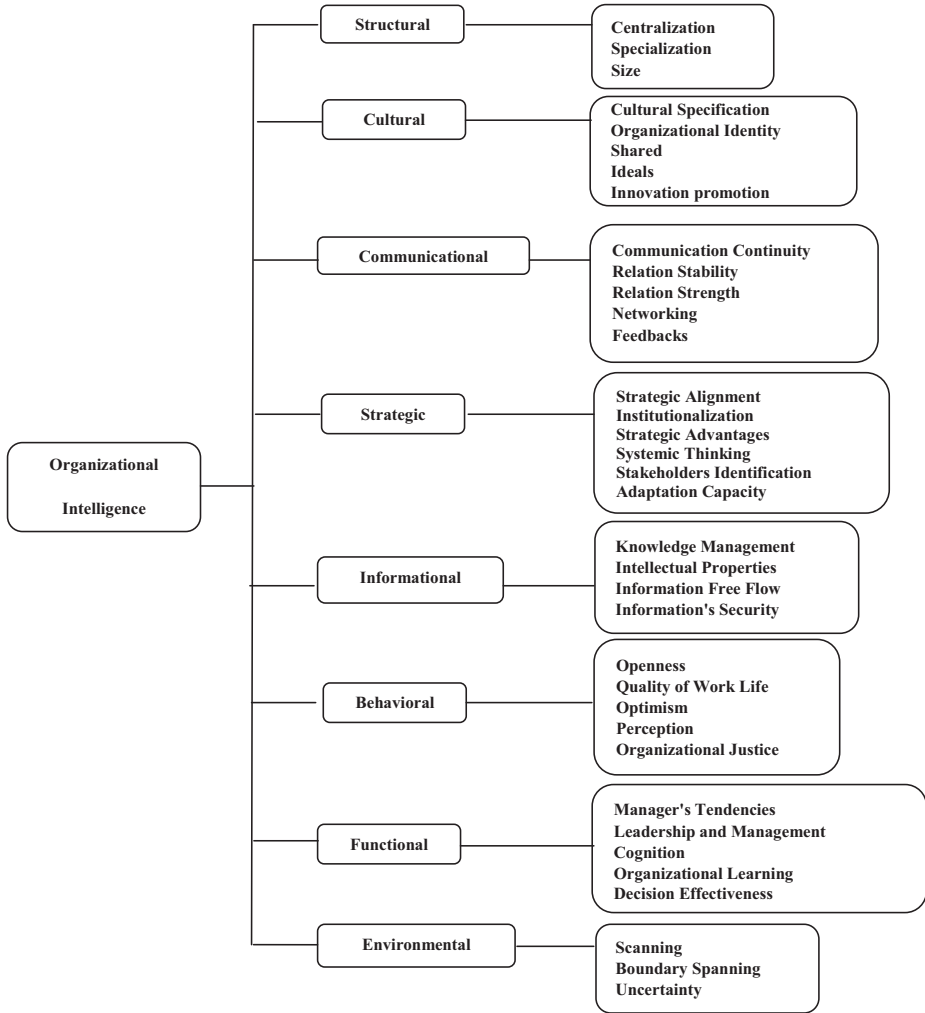
Figure 1.
Proposed conceptual
model

From the causal diagram (Figure 2), it is obvious that the IUOI dimensions were divided   **F2**
into the cause group including D1, D2, D3, D5, D7 and D8, while the effect group was
composed of dimensions D4 and D6. So, "Structural", "Cultural", "Strategic",
"Informational" and "Environmental" dimensions are cause dimensions of IUOI, while
"Behavioral" and "Communicational" dimensions are effect dimensions. Figure 3   **F3**
indicates the cause and effect diagram of IUOI dimensions according to the degree of
total influence for dimensions shown in Table VII.   **T7**

   The dimensions of this model also can be divided into the components
related to each one as Table II. For example, as the "Structural dimension " is
considered as the cause dimension, so all the items related to this dimension, such as
"Centralization", "Specialization" and "Organization Size", can be considered as the

cause items in IUOI. This matter is also true for the items related to the effect OI groups.

From the causal diagram, valuable cues are obtained that could help the university leaders in making decisions and prepare a good view from the OI and introduce the new procedures as rapidly as possible. For instance, it is shown that the environmental dimension (D8), with the largest amount of $(R + J)$, is the most important cause factor for IUOI and could make the significant role in responding to demands. On the other hand, the amount of $(R - J)$ for behavioral dimension (D6) shows that this dimension with the most negative amount of $(R - J)$ is the most important effect dimension of the model.

The final hierarchical sequence of the direct and indirect influences based on the values of R, J, R − J and R + J can be seen in Figure 2, which indicate the location of OI in Iranian public universities,. The dimensions are positioned in eight levels. The

	D1	D2	D3	D4	D5	D6	D7	D8
D1	0.00	3.00	2.00	4.00	5.00	4.00	4.00	3.00
D2	4.00	0.00	3.00	4.00	3.00	5.00	3.00	4.00
D3	4.00	4.00	0.00	4.00	3.00	5.00	5.00	2.00
D4	2.00	3.00	3.00	0.00	5.00	4.00	4.00	3.00
D5	2.00	4.00	3.00	4.00	0.00	5.00	4.00	4.00
D6	2.00	3.00	3.00	3.00	2.00	0.00	3.00	2.00
D7	3.00	4.00	5.00	3.00	3.00	5.00	0.00	3.00
D8	4.00	3.00	4.00	4.00	3.00	5.00	4.00	0.00

Table III.
Average matrix (A) for Iranian university organizational intelligence dimensions

	D1	D2	D3	D4	D5	D6	D7	D8
D1	0.00	0.11	0.07	0.15	0.19	0.15	0.15	0.11
D2	0.15	0.00	0.11	0.15	0.11	0.19	0.11	0.15
D3	0.15	0.15	0.00	0.15	0.11	0.19	0.19	0.07
D4	0.07	0.11	0.11	0.00	0.19	0.15	0.15	0.11
D5	0.07	0.15	0.11	0.15	0.00	0.19	0.15	0.15
D6	0.07	0.11	0.11	0.11	0.07	0.00	0.11	0.07
D7	0.11	0.15	0.19	0.11	0.11	0.19	0.00	0.11
D8	0.15	0.11	0.15	0.15	0.11	0.19	0.15	0.00

Table IV.
Direct influence matrix (D) for Iranian university organizational intelligence dimensions

	D1	D2	D3	D4	D5	D6	D7	D8
D1	0.99	1.14	1.11	1.20	1.10	1.49	1.24	1.00
D2	1.01	1.18	1.13	1.23	1.15	1.53	1.28	1.02
D3	1.04	1.20	1.18	1.27	1.19	1.58	1.31	1.07
D4	0.96	1.10	1.06	1.18	1.06	1.45	1.20	0.96
D5	1.02	1.16	1.14	1.23	1.16	1.53	1.28	1.02
D6	0.74	0.85	0.82	0.90	0.84	1.13	0.93	0.75
D7	1.02	1.17	1.12	1.25	1.15	1.54	1.30	1.03
D8	1.05	1.21	1.17	1.28	1.19	1.59	1.33	1.07

Table V.
Indirect influence matrix (ID) for Iranian university organizational intelligence dimensions

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behavioral dimension is located in the lowest level as receiver, but the environmental dimension is located in the highest level as dispatcher.

Similar results for each of the components of different dimensions are also obtained in a manner similar to the technique used for obtaining dimensions relationship. On this basis:

- In structural dimension, size of organization and specialization are the cause components; centralization in organization is the effect component.
- In cultural dimension, cultural specification, organizational identity and shared idea are the cause components; innovation promotion is the effect component.
- In communicational dimension, feedback and networking are the cause components; communication continuity, relation stability and relation strength are the effect components.

	D1	D2	D3	D4	D5	D6	D7	D8
D1	0.99	1.25	1.18	1.34	1.29	1.64	1.39	1.11
D2	1.16	1.18	1.24	1.38	1.26	1.71	1.40	1.16
D3	1.19	1.35	1.18	1.42	1.30	1.77	1.50	1.14
D4	1.03	1.21	1.18	1.18	1.24	1.59	1.35	1.07
D5	1.10	1.31	1.25	1.38	1.16	1.72	1.43	1.17
D6	0.82	0.96	0.93	1.01	0.91	1.13	1.04	0.82
D7	1.13	1.31	1.31	1.36	1.26	1.72	1.30	1.14
D8	1.19	1.32	1.31	1.43	1.30	1.77	1.47	1.07

Table VI.
Total influence matrix (T) for Iranian university organizational intelligence dimensions
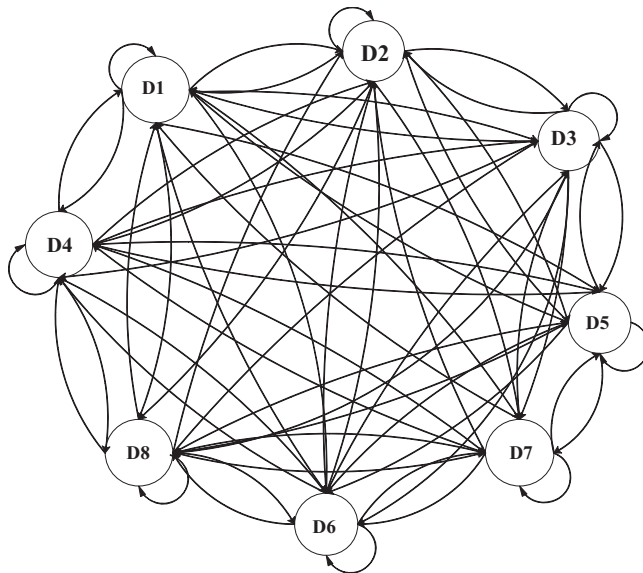
Figure 2.
Cause and effect diagram of Iranian university organizational intelligence dimensions

DEMATEL
method

15
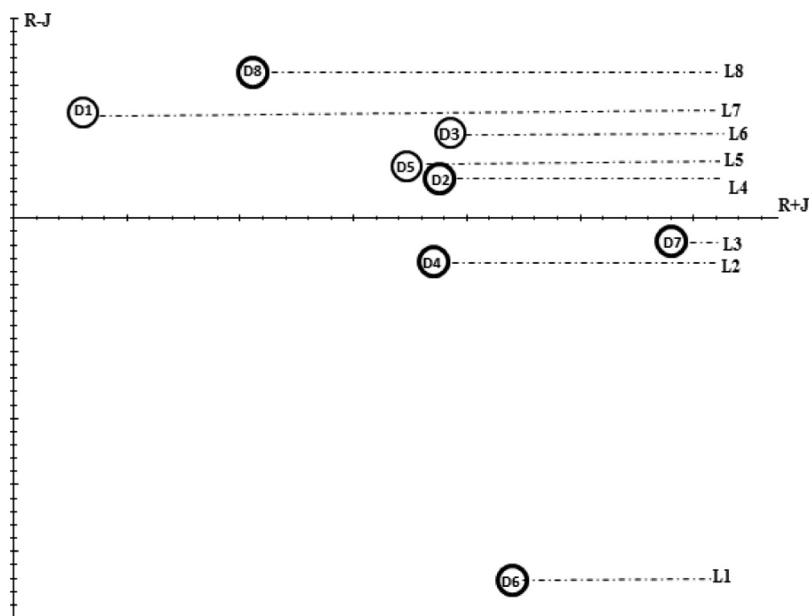
Figure 3.
Hierarchical level of
*Iranian public
university*
organizational
intelligence
dimensions

	R value	J value	R − J	R + J
D1	10.189	8.613	1.576	18.803
D2	10.489	9.889	0.600	20.378
D3	10.849	9.578	1.271	20.426
D4	9.850	10.499	−0.649	20.349
D5	10.510	9.722	0.788	20.232
D6	7.633	13.067	−5.434	20.700
D7	10.531	10.872	−0.340	21.403
D8	10.872	8.683	2.189	19.556

Table VII.
Degree of total
influence for Iranian
university
organizational
intelligence
dimensions

- In strategic dimension, insight and foresight and systemic thinking are the cause components; strategic alignment, institutionalization, strategic advantages, stakeholder identification and adaptation capacity are the effect components.
- In informational dimension, information security and information free flow are the cause components; intellectual properties and knowledge management are the effect components.
- In behavioral dimension, organizational justice is the cause effect; openness, quality of work life, optimism and perception are the effect components.
- In functional dimension, managers' tendencies and cognition are the cause components; leadership and management, organizational learning and decision effectiveness are the effect components.
- In environmental dimension, scanning and uncertainty are the cause components and boundary spanning is the effect component.

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Conclusions

In this study, we established a causal model for IUOI by using the Delphi method to find the dimensions and components of each dimension for OI in Iranian public universities and then applied the DEMATEL technique to determine which dimensions and components are more important and greatly influence the OI in Iranian public universities.

This study attempts to analyze, define and measure OI in a specific context. As a very broad field for research, there are a variety of opportunities to do research. So to do this study, we reviewed the existing mass body of literature in the field of OI to render a comprehensive model for OI in university. The concepts of OI were explored and defined comprehensively to clarify the building blocks of the research. It was found that OI in Iranian public universities can be conceptualized with eight dimensions which are structural, cultural, strategic, communicational, informational, behavioral, functional and environmental.

This study revealed the new relationships between variables in accordance with the result of the DEMATEL analysis, and then recognized environmental dimension as the most significant factor influencing universities' OI in Iranian public universities.

In this sense, universities' OI has long been a way to link organization resources to environmental opportunities to create and sustain a competitive advantage. However, current turbulent environment and its volatility require a constant scanning for strategic opportunities, formulation and implementation of resources in a preemptive aggressive manner. This behavior is based on a dynamic continuous intelligent development, refinement and utilization of resources, capabilities and competencies.

Comprehending this model offers a handful of beneficial insights for Iranian public university managers. These points are synoptically stated in the form of managerial implications. It was shown that the environmental dimension (D8) is the most important cause factor for universities' OI in Iran and could play a significant role in responding to demands, and the behavioral dimension (D6) shows that this dimension is the most important effect dimension of the Iranian universities' OI.

According to research findings, for creating an intelligent university, the following points are recommended:

In terms of the environmental dimension, systems within the university should be opened to the outside environment and absorb the information because they contribute to the organization's strategic decision-making and provides the assumptions necessary to create the required knowledge for the community.

According to the structural dimension, processes of decentralization and reduction of organizational recognition must be accepted by the authorities, the board of trustees, faculty managers, etc., but if they do not consider real organizational decentralization, OI cannot be changed easily.

Based on business processes, it can be seen that organizational structures in university cannot be changed easily. For creating intelligent universities, they must be open to change in accordance with reengineering the existing structures on the basis of suitable business processes and human resources. If not so, organizational information in relation to the elements of the intelligent universities cannot be created easily.

Although some of the academic processes are based on the training individual and group works (research), in spite of this fact, competition among individuals and groups

to access resources persists. So, an intelligent university should stimulate their employees to participate in groups and teams, and through the use of common resources and the new knowledge, to create a new service or product. But some processes are based on individual work and are not affiliated with the university needs to find some other way in a smart manner.

As today's business environment is highly variable, management as the activity of implementing process and shaping people's perceptions, so in creating an intelligent university, the balance between the individual and group working is essential. It means team working must be linked with decision-making processes, knowledge creation and organizational learning.

According to the requirements of the cultural dimension, we can say that the value of the system is formed during the history, and depends on culture and intellectual power (Haug and Keleman, 1996). Accordingly, system of university processes in an intelligent university will produce synergy. This synergistic advantage will become a competition advantage in the world markets.

According to behavioral and information dimensions, smart decisions and executing them with intelligent processes create value which can be observed in the qualitative and quantitative indicators of scientific and educational activities and resources.

Calculating these dimensions for OI and components of each of them can investigate the gap between the ideal situation and existing one, so we can design balanced plans for improving organizational processes.

The proposed model was used to determine the profile of OI in an Iranian public university using a questionnaire which was designed based on this model according to dimensions and components of each dimension. Statistical indicators were checked and the application of the model confirmed.

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Further reading

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