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Human Resource Competency Structure For Organizational Innovation Leadership In Engineering-Based Research And Development Institutions In Tanzania

Lawrence Joseph Kerefu, Beatus A. Kundi, and Emanuel A. Mjema
Department of Mechanical and Industrial Engineering
College of Engineering and Technology
University of Dar es Salaam.
Dar es Salaam, Tanzania.
Email: ljkerefu@gmail.com

Petro Ndalila
Department of Mechanical Engineering
Mbeya University of Science and Technology.
Mbeya, Tanzania
Email: ndalila05@gmail.com

***Abstract*—The unique pace of today's globalization process, with a huge impact on innovation, has attracted much attention in recent years. Literature show that Research and Development plays a vital role in innovation since it functions as the technological 'gatekeeper' in organizations. Many studies show a considerable relationship between innovation and R&D activities. Innovation needs competent leadership to make it happen. However, there are limited and disjointed studies on innovation leadership competencies and in the available body of knowledge, the importance appears to be discipline rather than a broad review of the core competencies required for innovativeness. This article proposes a human resource competency structure for organizational innovation leadership derived from research in engineering-based Research and Development institutions in Tanzania. The structure includes human resource competencies identified in a core sample of leaders whose leadership resulted in the successful technology adaptation or development, and the adoption of these by intended recipients in public applications, commercial and non-commercial. The study proposes a competence structure which may become a model through further research. Beneficiaries from this study, include innovation leaders, trainers of innovation leadership and the authorities who appoint innovation leaders.**

Keywords—organizational innovation leadership; research and innovation; leadership competencies

I. INTRODUCTION (*Heading 1*)

Innovation in science and technology, at national policy level, is considered to be vital for developing a more competitive grip in the global economy, and to attend pressing developmental needs. However, the Least Developed Countries (LDCs) South of Saharan are following slowly behind because they have yet to mobilize innovation effectively in support of economic growth. The LDCs will continue to fall behind developed countries and face deepening insignificance in the global economy unless they implement policies to motivate technological catch up, and achieve economic diversification through innovation [1].

Currently, it has been observed that innovation in Africa is getting serious traction leading to thinking that Africa may be able to catch-up soon and may go side by side with the band of cutting-edge innovator nations and regions. However there are enormous challenges Africa has to surmount before its graduation to this band. Among these is the challenge of making engineering based Research and Development (R&D) institutions to innovate in a diverse way. Since R&D institutions in developing countries are the only potential dependable official sources of innovations that could provide solutions to a number of national economic problems, there is a need of studying organizations' factors that influence the development of organizational innovations in engineering based R&D institutions.

It is essential to note that most of the R&D activities in the LDCs are financed by respective governments which have inadequate financial resources. However since engineering based R&D institutions are centered at the core of business development, strategy and innovation, it is necessary to have a means for assessing their leadership capabilities in order to sharpen them for the stiff competition in the complex and changing market environment [2], [3].

One of the main drivers of innovation is leadership competency. Leaders operating in environment consisting of challenges require effective thoughts to provide solutions [4]. There are challenges and opportunities that require extraordinary creativity and successful execution of innovative solutions. Most of these challenges are extremely intricate by nature,

interconnected and they need more than quick and simple solutions.

It is essential that leaders become accustomed to their practice to the context of the situation. According to Kouzes and Posner [5], there are five core practices for leaders. They state that leaders should: "model the way, share vision, challenge the process, enable others to act, and encourage the heart". Leaders model the way by ensuring that they do what they say in relation to their guiding principles. Leaders understand what makes their staff to become creative. They know how to stimulate enthusiasm for the vision in others.

Conventional leadership is characteristically linked with size, in charge of, reducing risk and equal treatment of all. This type of leadership needs to be substituted by new professional and unconventional leadership practices. Apple and Facebook have thrived because of adapting unconventional leadership. Leaders need to recognize, support, promote and reward qualities like deviance, inventiveness, enthusiasm and commitment for their success. The conventional leadership leaves a knowledge gap on which human resource competences might be required for successful implementation of Organizational innovation in R&D institutions in Tanzania. There is a need for transformation and appraisal of business practices of leadership [6].

From the above discussions, some elements of leadership competencies that could be put together into a structure is proposed in this paper for the purpose of inspiring and improving organizational innovation leadership in engineering based R&D institutions in Tanzania.

II. RESEACH OBJECTIVES

The main research objective of this study was to develop a human resource competency structure for organizational innovation leaders in engineering-based research and development institutions in Tanzania. The resulting structure may be useful for practicing innovation leaders, trainers of innovation leadership and the authorities who appoint innovation leaders. The success of the research goal would contribute to the body of innovation knowledge by adding more clarity on the human resource competencies related to successful organizational innovation leaderships.

III. PREPARE YOUR PAPER BEFORE STYLING

The growing importance on innovation has been contained to some extent by the wide field of management. Knowledge on management has progressively been influenced by the modern knowledge based institutions and the need for transformation in management methods and practices to meet new demands. Technological breakthroughs that help institutions amend their rules or create entirely new ones, challenges management to learn how to establish and manage institutions with the capability of predicting the future, translating visions into technologies, processes and products [7].

Although literature provides some information to make managers conscious of the need for organizational innovation in management practices, some managers of R&D institutions in LDCs such as Tanzania have not yet been introduced to better ways of managing innovation and they are not well prepared to lead organizational innovation. R&D institutions in Tanzania need to be considered as an area of focus because some of them are also involved in providing consultancies to industries. Therefore they need new human resource competencies and have to identify what comprises most excellent practices, and to find out which types of leaders, governance and organizational structures that would be suitable for leaders. This is also the case for managers in all other organizations where new solutions need to be obtained. Literature review in this study was thus used to address the current perception of innovation, organizational innovation, leadership, innovation leadership and human resource competency to serve as basis for developing the organizational innovation leadership competency structure, as discussed in the following sections.

A. Innovation

We find different methods to define innovation in the literature, depending on the use. Porter [8] defined innovation as any new technologies and new processes. Prajogo and Ahmed [9] defined innovation as a process of turning opportunities into practical use. Modern literature consider innovation as a process with dynamic, social, arising from multifaceted and complex interactions between individuals, organizations and their operating environments for creating new technologies, applications, markets and organizational practices aimed at value creation [10], [11].

Although there are several types of innovation, the Organization for Economic Co-operation and Development (OECD)/Euro static [12] provides four main types of innovation which include product, process, marketing and organizational innovation.

The main requirement for innovation is coming up with new ideas. A new idea could be a new product, service or method of production (technical innovation) or a new market, organizational structure or administrative system (administrative or organizational innovation).

"Newness," in all definitions of innovation, is a relative term. In past studies of innovations in organizations, what is considered to be "new" has often been left for executives or experts to judge. An innovation can be new to the individual adopter, to most people in the unit of adoption, to the organization as a whole, to most organizations in a country, or to the entire world. The degree of newness can be used to differentiate the generation of innovation from its adoption.

Another important requirement for innovation is implementation of ideas, commercially and non-commercially. The new idea or technology must be used. Imitation as one of the type of innovation has also been accepted and some have benefitted from adapting this method by replicating leading innovations rather than working out their own which, in most cases, made them to innovate more rapidly, inexpensive and at lesser risk [13].

B. Organizational innovation

Similarly, the existing literature on organizational innovation is diverse and scattered. There is no agreement reached on the definition of the term ''organizational innovation'', which remains ambiguous [14]. Edquist *et al.,* [15] define organizational innovation as "new ways to organize business activities such as production or R&D" and as innovations that "have to do with the coordination of human resources". Furlani [11] points out that organizational innovation is a broad concept that combines strategies, structural and behavioral dimensions. Lin et al [16] define organizational innovation as "the organizational capacity to encourage employees to look at problems in different ways and integrate knowledge, technology, and creativity to develop new products, materials, processes, or services".

Economists use the term "organizational innovation" to distinguish between managerial and technological innovations [17]. For instance, reference [18] distinguishes new products and processes from new ways of internal organization while reference [16] distinguishes embodied technology from disembodied technology.

Reference [13], 3rd edition, defines organizational innovation as "the implementation of a significant change in business practices, workplace organization or external relations, intended to improve the firm's innovative capacity or performance characteristics, such as the quality and efficiency of work flows". The present study drew on two literature reviews in reference [20] and [13], 3rd edition, to build on the definition of organizational innovation relevant to R&D institutions in Tanzania. Building upon these reviews, organizational innovation is defined as a process in problem solving, involving activities like coordination among product innovation departments, product design, product development, research and the integration of institution resources and strategies.

Based on the above analysis, organizational innovation was considered in its wide-ranging sense of integrating new knowledge generation or ideas with the implementation aspect. It follows therefore that this consideration was used as the basis for the selection of the competencies for organizational innovation leaders.

C. Leadership

Management of R&D institutions involves planning, organizing, leading and control activities for the purpose of achieving set goals and objectives. There is very little change in the conventional management principles and practices while an enormous change has taken place in the field of management in general. According to Hamel and Breen [21], years of conventional management which is based on decision-making practices could not make organizations avoid reforms. In fact it is argued that the ability to manage is responsible for the capability to change the world [22].

Due to the new challenges facing institutions, management practices have changed to include more leader-specific features. The new changes which are considered to be very important include organization change management systems, conflict management ability, leadership channels, gender leadership, purpose, emotional intelligence, commitment and shared accountability.

Based on the literature reviewed, researchers in innovation prefer to use innovation leadership instead of innovation management because the former is people centered while the later is machine centered. Literature also indicates significant innovation leadership attributes including credibility, honesty, ability to inspire, creativity, ability to cope with reality. It can also be seen from literature that the concepts of leadership and management have different starting points but are interlinked [23], [24].

D. Organizational innovation leadership

Literature reviewed show that organizational innovation leadership is a new field in innovation studies. Reference [25] examined the significance of organizational innovation leadership on creativity in R&D institutions for LDCs and established that there is a positive relationship between organizational innovation leadership and employees' creativity. The research however did not address the significance of human resource competence structure for organizational innovation leadership.

Organizational innovation leadership needs new skills to develop friendly environment for innovations in institutions. The skills include, among others, coaching followers (Leaders have followers and not subordinates), strong charisma to attract followers to the desired cause, motivate and inspire followers instead of controlling them and facilitating collaboration between departments. Inspiring institutional imagination is becoming imperative and this is not easily practiced by many leaders. It involves overcoming the existing institutional culture which is a very demanding task. However it provides opportunities for new orientation of institutions [26].

Apart from the various researches that have been done on the subject matter, the accessible literature on organizational innovation leadership is undeniably very varied and is not well joined together into a consistent theoretical framework. The theory behind

organizational innovation is subject to different interpretations within the different strings of literature [14], [27]. Despite all this the main question need to be answered, namely what it is that organizational innovation leaders are required to do to cause accomplishment in innovation. In this study this question is being addressed.

As discussed above, the concept of organizational innovation leadership is still comparatively new in the field but it is accepted due to its importance. Very few researches in this field have been conducted and therefore this study is a modest contribution to the body of knowledge in innovation.

E. Human resource competency

Weinert [28] describes competence in general, "as a roughly specialized system of abilities, proficiencies, or skills that are necessary or sufficient to reach a specific goal". In the vocabulary made by the European Commission for communication [29], competence is defined as "the capacity to use effectively experience, knowledge and qualifications". Björnavold and Tissot, [30] define competence as "the proven individual capacity to use know-how/experience, skills, qualifications in order to meet usual and changing occupational situations and requirements". The focal point of the UK's system of the National and Scottish Vocational Qualifications (NSVQ) is on "occupational competence", which is described as "the ability to apply knowledge, understanding, practical and thinking skills to achieve effective performance to the standards required in employment" [31].

Cartwright, [32] describes job analysis as one of the oldest management tools although it is not addressing the concept of leadership competencies. Therefore it is necessary to complement job analysis by competency modeling to meet the obligations of the changing world. This study considered organizational innovation leadership competency by spotting out the competencies seen and practiced by leaders.

IV. Research Methodology

A brief look at the way innovation practice is growing in Tanzania reveals a differentiated image with different levels, quality and degree of existence calling for a research to find out in reality an appropriate human resource competence structure for organizational innovation leadership in order to improve innovativeness in R&D institutions.

Although the significance of human resource competencies is emphasized by various scholars, there is no any agreed method for the formulation of competencies. Due to lack of such an agreed approach, and owing to the nature of this study, the appropriate method to carry out the research is a "theoretically based empirical work". The methodology aims at fully utilization of the empirical premises while ensuring that theoretical analysis continues to be free from limitations that the empirical premises may inflict. This would guarantee that the developed structure of the research will be flexible enough to have room for the fast changing state of affairs in engineering based R&D institutions in Tanzania. Therefore the empirical approach commenced by considering a wide set of competencies and then narrowed down to the most suitable set of competencies.

Fig. 1 below illustrates the research design. The wide end of the tapered tube represents a relatively big list of leadership competencies obtained through the collected data, literature and researcher observations. The listed leadership competencies were put together in a questionnaire which was intended to establish the perceived importance of each in the accomplishment attained by the organizational innovation leaders being appraised. The organizational innovation leadership competencies which were considered as most important were analyzed, classified and arranged into four descriptive groups according to similarity of meaning.

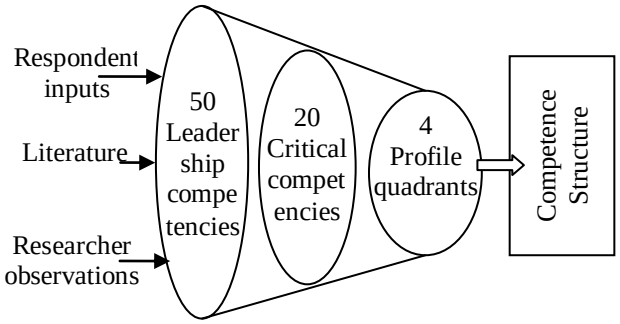

Fig. 1. *Organizational innovation leadership competencies formulation*

A. Data Collection

The leaders with official responsibilities for research/innovation in engineering-based R&D institutions in Tanzania were used as the units of analysis for this research. The strategies for realizing the Tanzania development vision 2025 include transforming the economy through science and technology. This can be achieved through intensification of the engineering based R&D institutions which are the only reliable official source of innovation in Tanzania.

The Engineering based R&D Institutions in Tanzania have approximately 68 members in managerial positions with responsibility for innovation leadership. They include Tanzania Engineering and Manufacturing Design Organization (TEMDO), Centre for Agricultural Mechanization and Rural Technology (CAMARTECH), Technology Development and Transfer Centre (TDTC), Tanzania Industrial Research Development Organization (TIRDO) Tanzania Automotive Technology Centre (TATC), National Housing Bureau Research Agency (NHBRA), Small Industries Development Organization (SIDO). Fig. 2 below illustrates a general picture of an innovation process and for purposes of the current study,

successful innovation leaders are those who have gone through to the end of the process where the impact in the society (user) can be seen.

Data collection from the respondents was done through a structured questionnaire. The respondents were asked to assess the leadership behaviors of the selected successful leaders in their institutions. The results of research were used to construct an organizational innovation leadership competency structure which may be seen as the core of the contribution of this study towards the existing body of knowledge.

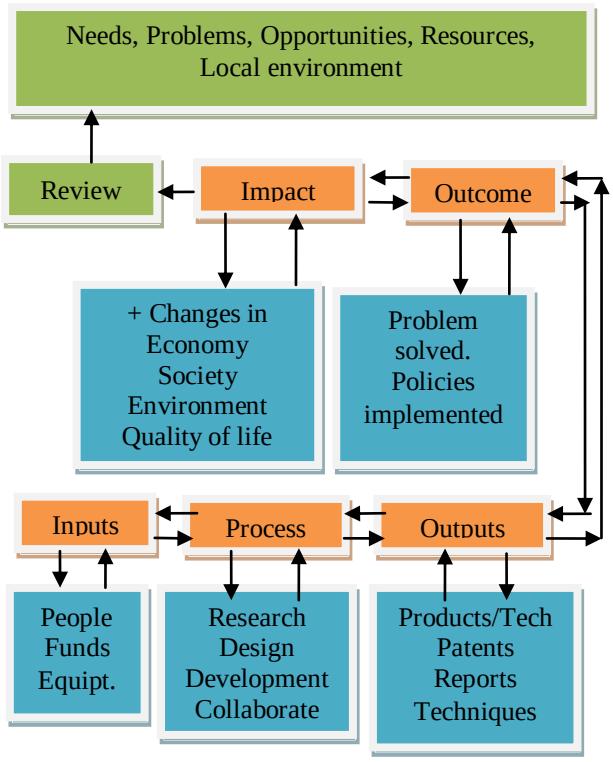

Fig. 2. *The Process of Innovation*

B. Data analysis

Both qualitative and quantitative methods at different phases of the research have been employed. Literature reviews were used to evaluate the work done in the field and structured questionnaires of leaders that are perceived by respondents as possessing high impact on organizational innovation results.

Respondents conducted the rating by selecting one of five items in the scale, namely; excellent, good, average, fair and poor. This was followed by the calculation of an average/mean weighted average index (WAI) for each item based on a lecherous scale response [33]. Averages for each item were calculated for each leadership competency clusters to the respective institution. The averages were then sorted in descending order by dimension the competency elements within each institution in order to form an index of weighted averages. This was done to facilitate the exploration of the importance of each variable within each dimension and within each institution.

The weighted average index as in (1) for each item was calculated by dividing the sum of the responses for each item (a value between 1 and 5) by the number of responses. The formula below was used in the calculation of the WAI:

$$WAI = \frac{\sum_{1=1}^{5} F_i W_i}{N} \quad (1)$$

Where F equals the frequency of a specific value (between 1 and 5) selected by the respondents, W equals the actual value selected, that is weight (value between 1 and 5) and N the number of responses.

V. RESULTS

A. Findings

The names of the institutions which replied the questionnaire will be represented by letters A, B, C and D because we did not get the consent of the institutions which took part in this research. The study scrutinized the four core practices; strategist, capability builder, matchmaker and achiever, which were earmarked as group 1, 2, 3 and 4 respectively. These core practices are useful for organizational innovation leaders to set way forward, develop followers for creativity and continuous improvement of the institution. Using the four core practices for assessing the leaders, the study showed that each institution (A, B, C and D in Table I. Below), had varying success in improving leadership performances.

Examination of the Weighted Average Index (WAI) for the total sample revealed the strong and expected trend toward the competency structure of a leader. The analysis showed that institution “C” had emphasis of responsiveness, at least on each group of competency profile, the highest frequently WAI was 4.25 and lowest frequency WAI was 2.25 on the second group as shown in Table I below. Except for institution A, the other institutions B and D had maximum score of WAI only on one group out of four (3.25, and 3.5). The principal component analysis of this type of relationship confirms that Institution “C” had strong responsiveness on practicing the human resource leadership competency profile compared to the other participated institutions.

The elements depicted in Fig. 3 represent the comprehensive innovation leadership structure of competencies which have high impact on organizational innovation success. Each group forms a critical and integral part of the structure and a description of the critical leadership competency elements on each is captured within.

A. Discussion

From the preceding sections we learned that R&D institutions in developing countries such as Tanzania

are among the major dependable official sources of innovations that could solve a number of problems in the society, and therefore there is a need for the R&D institutions to improve their innovativeness in a diverse way. It was established that one of the main drivers of organizational innovation is leadership competency. Furthermore, we learned that, most empirical reviews indicate that, a few organizational innovation researches related to R&D activities have been undertaken in developing countries South of Saharan.

TABLE I. ORGANIZATIONAL INNOVATION LEADERSHIP COMPETENCIES AND WAI SCORE OF INSTITUTIONAL RESPONCE.

Competency Group	Critical leadership competency elements	WAI			
		A	B	C	D
1.Strategist	1. Formulate and communicate an inspiring vision	2.00	2.50	4.00	3.00
	2. Provide leadership which is expressing thinking that is original and different	3.25	3.25	3.25	2.80
	3. Encourage and maintain collective thinking	2.75	2.50	4.25	2.80
	4. Facilitate and moderate high-impact decision-making	1.50	2.75	4.00	2.50
	5. Lead by example	2.00	3.00	3.50	2.80
	6. Demonstrates exceptional leadership skills/abilities	2.75	2.75	3.75	3.00
2.Capability builder	7.Assess and manage across the innovation value chain	3.25	3.25	3.75	2.80
	8. Develop and maintain an innovation-enhancing environment	1.75	2.88	4.00	2.80
	9. Spearhead improvement, learning/development	1.50	2.50	4.00	2.30
	10. Facilitate knowledge management	1.50	3.00	4.00	2.50
	11. Develop and maintain high-performance teams	2.25	2.63	4.25	3.00
	12. Build and maintain high-impact networks	1.50	2.63	3.50	3.30
3.Matchmaker	13. Understand the contextual environment	2.75	2.75	2.25	2.30
	14. Apply entrepreneurial thinking	1.75	2.13	4.00	2.80
	15. Use clear and compelling communication skills	2.50	2.88	3.00	2.30
	16. Well-known influencer in the external environment	2.75	2.50	3.50	2.00
4.Achiever	17. Motivate others to high performance	1.50	2.75	4.25	3.50
	18. Develop and maintain a high-performance culture	2.25	2.63	3.00	2.50
	19. Manage individual and group performance	2.00	3.00	3.00	2.80
	20. Achieve desired results	1.75	2.75	4.00	2.00
Maximum WAI		**3.25**	**3.25**	**4.25**	**3.50**
Medium WAI		**2.16**	**2.75**	**3.66**	**2.69**
Minimum WAI		**1.50**	**2.13**	**2.25**	**2.00**

From the study findings presented, the knowledge gap expressed in the literature and the aim of the study to provide a human resource competency structure for organizational innovation leadership, have both been deliberated through the creation of the competency structure. The structure comprising the keystone elements was introduced as a skeleton for signifying the interrelationship and consistent workings of these elements. Further research may be carried out using this structure to establish a model.

The general overview of the research results in the participated institutions shows that the institutions with high WAI are more innovative compared to those with low WAI. This is a reflection of the critical leadership competency structure groups as described in the preceding sections. As a result, institutions which are not innovative can be assisted to improve their innovativeness by engaging/employing leaders using the developed organizational innovation leadership competency structure.

VI. CONCLUSION

Comprehensive and systematic innovation leadership competency studies for LDCs South of Sahara, including Tanzania are conspicuously missing in the innovation literature. This is a gap which this work is a modest contribution to this gray area in literature. It has been established from literature that the innovation field requires innovation leaders for leadership competencies. It is important for management to innovate its management methods for managers to attain the capabilities to address the innovation leadership matter boldly. From these deliberations, a leadership competencies structure has been developed for organizational innovation leaders and for other types of innovation such as product or process innovation and other fields.

This study provides further understanding of how leadership practices can affect the sustainability of innovation in an institution. Visions, missions, objectives and authorizing leadership were significant factors for sustaining institutions. The study revealed that leadership practices differ from institution to institution and must be flexible to adapt to the situation

and culture of the institution. In order for the innovation to take place and be sustainable, institution leaders need to agree on leadership's purpose and how it will sustain innovation.

Studying leadership by considering practical examples on the ground offers opportunities to grow leaders in the context of innovations as well as support in sustaining the innovation. The literature review portrayed the perception of leadership practices with the aim of indicating the practices associated with sustainability of innovation. The major leadership competency structure practices seen throughout the leadership literature were strategist, capability builder, matchmaker and achiever.

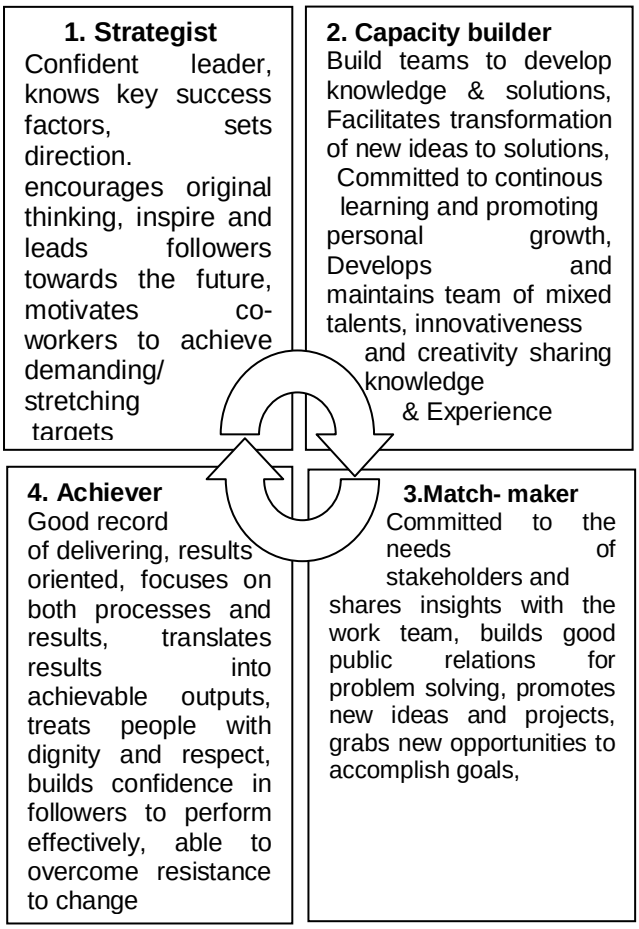

Fig. 3. *Organizational Innovation Leadership competency Structure*

The competency elements rated as most significant were arranged to form four groups which were used to develop the organizational innovation. It is emphasized that each group in the structure is important and therefore during applications, none of them should be ignored. The structure can be used to compare practices of experienced and inexperienced leaders to promote personal leadership development.

The results of the research were used to establish an organizational innovation leadership competency structure which is the essence of the contribution of this study in innovation literature.

The study has some limitations which may be caused by using a relatively small sample size of organizational innovation leaders. This situation may limit the extrapolation of the findings to innovation leaders in other innovation fields.

VII. RECOMMENDATIONS

Further research into organizational innovation leadership is encouraged and specifically it is recommended that the organizational innovation competency structure be applied in other types of innovation and also other organizations to establish its relevance to innovation leaders in a wide range of organizations and leadership spectrum.

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