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Human Capital and Innovation Ability in Medical Education: An Empirical Study

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ABSTRACT

In such a rapidly changing era, technologies are faster than those in the past. To cope with environmental changes and rising consumer knowledge, the business environment in medical industry is facing violent changes, and high competition appears in medical industry. Medical industry has to strive for sustainable management or promote the competitiveness. Aiming at a hospital in Shanghai city, the managerial level, physicians, and employees in the primary hospital of School of Medicine, Shanghai Jiao Tong University, are distributed 300 copies of questionnaire. Total 238 valid copies are retrieved, with the retrieval rate 79%. The research results conclude the positive relations between 1. organizational learning and human capital, 2. human capital and innovation ability, and 3. organizational learning and innovation ability. According to the results, suggestions are eventually proposed, expecting to assist domestic medical industry in promoting the organization innovation ability.

Keywords: medical education, organizational learning, human capital, innovation ability

INTRODUCTION

The 21st century is a rapidly changing era, when technologies are faster than those in the past. To cope with environmental changes and rising consumer knowledge, it is critical for organizations in medical industry maintaining the excellent advantages under the changing environment and understanding the drive of successful innovation. Creativity is the basis of innovation ability that an organization's innovation ability relies on individual creativity. Nevertheless, it is necessary to consider whether an organization could provide good environment for individuals developing the creativity. In other words, an individual could be induced the creativity under the environment in a creativity-oriented organization. The innovation climate in an organization is the key factor in the achievement of organization objectives. Medical industry refers to organizations aiming to provide medical services, and the provision of medical services is a highly knowledge-intensive process (Hansen et al., 1998), in which knowledge related to medical treatment, nursing, administration, and other medical treatment are utilized and integrated. For medical industry, higher profits could be acquired by effectively integrating distinct professional knowledge to further create highly knowledge-based economy.

After entering the national development with knowledge-based economy, medical industry is in a highly competitive knowledge-based economic market. Under such business environments, a hospital could effective

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State of the literature

- Along with shortening life cycle of products, global division of labor, and rapid changes of industrial structure, the original advantages of cost, speed, and quality have gradually become the basic elements of competition.
- Creativity is the basis of innovation ability that an organization's innovation ability relies on individual creativity. Nevertheless, it is necessary to consider whether an organization could provide good environment for individuals developing the creativity.
- Medical industry refers to organizations aiming to provide medical services, and the provision of medical services is a highly knowledge-intensive process, in which knowledge related to medical treatment, nursing, administration, and other medical treatment are utilized and integrated.

Contribution of this paper to the literature

- Human capital is the source of innovation ability in medical industry, which should present human capital with uniqueness and strategic value for the innovation of core competencies and leading medical industry forward to the objectives.
- Medical Education must actively train professional R&D personnel, encourage knowledge expansion and application, invest in more Medical education and training opportunities, and actively promote lifelong learning systems.
- Medical Education has to precede knowledge creation, knowledge expansion, and knowledge value-added activity through innovation investment and innovation systems on the management of rich and high-level R&D human resources so as to effectively enhance the organizational productivity and create high added value.

strengthen the environmental adaptability and competitiveness by effectively integrating distinct professional knowledge and actively proceeding organizational innovation. Although organizational innovation ability is the key factor in the evolvement and performance of an organization, the key factors in the innovation ability of organizations in medical industry are seldom deeply discussed.

LITERATURE REVIEW

Human capital

Michel (2015) regarded human capital as the training, experiences, and interpersonal relationship of employees in a company. Chaudhary et al. (2014) pointed out the source of innovation and update as the importance of human capital that an enterprise faced the challenges to retrieve more human capital and invest in value production. Durmusoglu et al. (2014) further defined human capital as employee ability, meaning the employees' abilities to create tangible and intangible assets, including explicit knowledge, skills, experiences, value judgment, and social network, under various situations. Park et al. (2013) emphasized that human capital was the technical capability of employees in an organization and the value of human capital lied in providing potential contributions to the organization's competitive advantages or core competencies. Accordingly, human capital could be regarded as the resources of an enterprise investing and rooting in individuals, which would move with people (Bhaskar & Mishra, 2014). Kantan et al. (2015) covered the personal ability, knowledge, skills, learning, teamwork learning, and experiences of all employees and managers in a company as well as the value, culture, and philosophy of the company. However, human capital was rooted in people and would move with people. Robbins & Coulter (2015) regarded the knowledge, skills, and experiences of all employees and managers in a company as human capital, in which employees' traits, knowledge exchange, education & training, and seniority were more important factors. Dekoulou & Trivellas (2015) presented the level of human capital stock with the knowledge skills, knowledge transmission, and innovation and attitudes of organizational members and discussed the effect of human capital on organizational performance.

Referring to Yu & Chen (2012), human capital of an organization are measured with value and uniqueness in this study, where the former refers to employees' potential to provide the enterprise with competitive advantages and core competencies, and the latter indicates employees' technologies and abilities, which cannot be imitated by other enterprises.

Innovation ability

An enterprise has to constantly enhance the innovation ability to continuously create value and making profits (Luthans et al., 2015). Robinson & Minikin (2012) advocated the innovation ability required for modern organizations as 1. constantly developing or improving current work processes to improve the products or services. After the improvement, such new products or services would continuously present competitiveness on the market within 2-3 years. 2. Organizations should be able to either utilize internal learning or absorb external new knowledge to develop new products, based on existing products or skills, for the next generate. 3. Organizations had to present innovation process systems, reveal the process of constant innovation, digestion, and re-innovation, and not stick the convention on the basic knowledge, which could result in new knowledge being out-of-date soon and losing the meaning to utilize new knowledge innovation (Sajeva, 2014). In this case, innovation ability could be the factors of individuals, group output, and structure in organizational performing on the knowledge updating process (Buehlman et al., 2012). Osman (2012) defined innovation ability as the ability of 1. developing new products to satisfy the market demands, 2. applying proper processes and technologies to produce new products, 3. developing and adopting new products and processes & technologies to satisfy future demands, and 4. responding to unexpected technologies adopted by the competitors and creating the sudden opportunities. Eris et al. (2012) indicated that the key of innovation ability was to absorb and utilize professional fields and technologies related to an organization. The factors contained communication structure inside and outside the organization, investment in research and development, external environments, and the ability of technological experts in the organization.

Referring to Chen & Miller (2012), technological innovation ability and managerial innovation ability in the organizational innovation ability scale are used for measuring innovation ability in this study. Technological innovation ability refers to a company using new technologies and equipment for the production and manufacturing to conform to the needs in the rapidly changing market. Managerial innovation ability refers to a company applying innovative management measures (encouraging innovative pay systems, novel performance measurement methods, and good use of leadership) to the management system of the company.

Organizational learning

According to different scholars' points of view about organizational learning, OzanOnağ et al. (2014) classified relevant or similar statements into development perspective, normative perspective, and capability perspective. Caruth (2014) pointed it out as the organizational restructuring process when an organization was affected by external technologies and political environments, i.e. the continuous processes of successful insight and thinking when organizational members dealing with problems related to organizational patterns and output. Mansor et al. (2012) regarded organizational learning as the process to find out and correct mistakes, i.e. an organization actively detecting and correcting the gap between the actual outcome and the expected result. Criu & Ceobanu (2013) regarded individual learning as the basis of organizational learning that an organization could learn through good individual learning. Although individual learning could not guarantee the entire organizational learning, organizational learning would not be operated without individual learning. Robbins (2014) indicated that the ability of an organization taking actions could be enhanced by the accumulation of individual learning and the establishment of a structure connecting individual learning and organizational learning through mental models. Hill et al. (2012) mentioned that organizational learning stressed on the dynamic relationship between an organization and the survival environment; the purpose of organizational learning focused on the restructuring and improvement of organizational structure as well as the correction of organizational behaviors or the achievement of organizational efficacy; the content of organizational learning was based on the past experiences;

organizational learning covered the overall learning of individuals, teams, and the organization; and, organizational learning was the process of knowledge management.

Referring to Deng et al. (2012), organizational learning ability are regarded as commitment to learning, shared vision, and open-mindedness for the measurement in this study. Commitment to learning refers to an organization regarding learning as the primary value of the company, shared vision refers to managers in an organization sharing the development direction and vision of the company with the employees, and open-mindedness refers to an organization not being restricted on thinking with familiar methods and being able to exceeding the conventional creativity.

Relationship between organizational learning and human capital

Criu & Ceobanu (2013) indicated that, in the knowledge-based economic era, intangible assets of an enterprise were enhanced the value through knowledge, and organizational learning could expand the knowledge flow and thicken the intellectual capital for the sustainable management of the enterprise. Intellectual capitals could be used for creating competitive advantages, information, experience ability and manpower, structure, and customer value (Wickramasinghe & Widyaratne, 2012). Smith et al. (2013) mentioned that a learning organization, with spontaneous activity, continued the transformation through adaptive learning and innovative learning. In this case, a successful learning organization should present continuous learning culture and provide the employees with an environment for learning to further cultivate the employees' learning attitudes and accelerate all organizational members' learning so as to constantly strengthen the organizational human capital. Caruth (2014) indicated that it was not adequate for an organization possessing the most excellent human capital; instead, an organizational learning environment for supporting the employees sharing knowledge was necessary so that the enterprise could commonly share human capital with the employees. Zahoor (2012) also indicated that, to develop the leverage effect of human capitals, it was necessary to encourage the constant learning or participation in decision-making of the employees to enhance the knowledge skills and organizational commitment. In this case, employees in an enterprise, after the organizational learning, would enhance the abilities and possess low-replaceable and high value-added knowledge to become the most important human capital in the enterprise. Organizational learning presents significant effects on organization personnel training and employee traits in human capitals; that is, a helpful learning organization could enhance the completion of good personnel training programs and cultivate employees' uniqueness and professional abilities to further accumulate the organizational human capital (Bhaskar & Mishra, 2014).

H1: Organizational learning presents positive relations with human capital.

Relationship between human capital and innovation ability

Youssef & Lothans (2013) also indicated that an enterprise would not be easily imitated the human capital by the competitors as the higher quality of human resources engaging in high value-added work could create high profits and present larger contributions to the organization's competitive advantages and core competencies. Chaudhary et al. (2014) stated that an enterprise with rich human capital could propose innovation ideas for the organization, change corporate processes, and timely solve customers' problems. Siminică & Traistaru (2013) considered that the skills presented by human capitals and employees were the primary resources of an organization, with strategic importance; accordingly, the level of skills of human capital or employees was the key basis to promote organizational performance. Robbins & Coulter (2015) advocated that human capital could effectively enhance organizational productivity. For this reason, employees provided value with the organization through various routes; the most obvious one was the employees, through value chain, assisting in transforming various inputs to final products in the process of the organization creating the final added value of products to enhance the added value of products. Smith et al. (2012) further proposed the remarkably positive effects of human capital on organizational innovation (management innovation, skill innovation) and innovation performance (product innovation, process innovation). Apparently, human capital presents certain degree of effects on innovation.

H2: Human capital reveals positive relations with innovation ability.

Relationship between organizational learning and innovation ability

Organizational learning is regarded as a part of organization changes; it not only could induce the organizational changes of knowledge, belief, and behaviors, but eventually could strengthen the organization growth and the innovation power (Luthans et al., 2015). Sorakraikitikul & Siengthai (2014) indicated that learning orientation would be the guidance of innovative culture, when organizational culture presented learning orientation, and the innovative culture would affect the innovation ability and the organizational culture of the organization, such as decision participation, power share, support and cooperation, and learning and development, to influence organizational members' innovation behaviors and further enhance the organizational innovation ability. Dekoulou & Trivellas (2015) considered that an enterprise absorbing and assimilating external environments through learning would assist in the internal innovation activity. When measuring organizational learning to innovative management systems, Škerlavaj et al. (2013) indirectly proved the direct effect of organizational learning on innovative management systems. Yukl (2013) revealed that strong learning ability was not simply used in the strategic level of an organization, but could be used for acquiring competitive advantages; besides, learning ability should be connected with other operating activity of an organization, such as innovation, marketing, competitive intelligence, and environmental scanning, to ensure the long-term survival of the organization.

H3: Organizational learning shows positive relations with innovation ability.

SAMPLE AND MEASUREMENT INDICATOR

Research sample and object

Aiming at a hospital in Shanghai city, the managerial level, physicians, and employees of the primary hospital of School of Medicine, Shanghai Jiao Tong University, are distributed 300 copies of questionnaire, and 238 valid copies are retrieved, with the retrieval rate 79%. School of Medicine, Shanghai Jiao Tong University (originally named Shanghai Second Medical University), located on Chongqing South Road in downtown Shanghai City, is one of the most famous and top national medical university as well as one of the most historical medical university in China.

Reliability and validity test

Validity refers to a measuring instrument being able to really measure the problems which a research would like to measure. Generally speaking, validity is divided into content validity, criterion-related validity, and construct validity. The questions in this questionnaire are referred to the research questions proposed by domestic and international researchers, and the formal questionnaire is distributed after discussing with the tutor and preceding the pretest. The questionnaire therefore presents certain content validity. Organizational learning, human capital, and innovation ability are verified the overall cause-effect relation with Linear Structural Relations Model in this study. The data input is based on the correlation coefficient matrix of observed variables. The Linear Structural Relations Model analysis results show the overall model fit reaching the rational range, showing the favorable convergent validity and predictive validity. Kerlinger (1986) suggested that item-to-total correlation coefficients could be used for verifying the construct validity of a questionnaire, i.e. judging the questionnaire content with item-to-total correlation coefficients acquired in reliability analyses. The item-to-total correlation coefficients of the research dimensions in this study are higher than 0.7 that the questionnaire dimensions present certain construct validity.

Reliability and validity analyses are preceded in this study to further understand the reliability and validity of the questionnaire. According to Cuieford (1965), the higher Cronbach's α showed the better reliability. Based on such a standard to develop the formal questionnaire in this study, the measured Cronbach's α reliability coefficients appear in 0.78~0.91, obviously conforming to the reliability range.

Table 1. Overall Linear Structural Relations Model analysis

Evaluation item	Parameter/evaluation criteria	Result	
preliminary fit	organizational learning	commitment to learning	0.663*
		shared vision	0.675*
		open-mindedness	0.692*
	human capital	value	0.702**
		uniqueness	0.713**
	innovation ability	technological innovation ability	0.726**
		managerial innovation ability	0.719**
internal fit	organizational learning→human capital	0.847***	
	human capital→innovation ability	0.863***	
	organizational learning→innovation ability	0.834***	
overall fit	X2/Df	1.436	
	GFI	0.982	
	AGFI	0.921	
	RMR	0.003	

Note: * stands for $p < 0.05$, ** for $p < 0.01$, and *** for $p < 0.001$

ANALYSIS OF EMPRICAL RESULT

Evaluation indicator of LISREL model

LISREL (linear structural relation) model combines Factor Analysis and Path Analysis in statistics and is added simultaneous equations in econometrics to calculate multi-factor, multi-causal paths. In regard to the evaluation of model fit, Bagozzi (1998) proposed to evaluate the preliminary fit criteria, overall model fit, and fit of internal structural model.

The data in this study are organized in **Table 1**. The preliminary fit, internal fit, and overall fit of the model are explained as below.

From **Table 1**, three dimensions of organizational learning (commitment to learning, shared vision, open-mindedness) could significantly explain organizational learning ($t > 1.96$, $p < 0.05$), two dimensions of human capital (value, uniqueness) could remarkably explain human capital ($t > 1.96$, $p < 0.05$), and two dimensions of innovation ability (technological innovation ability, managerial innovation ability) could notably explain innovation ability ($t > 1.96$, $p < 0.05$). Apparently, the overall model in this study shows good preliminary fit.

Regarding the internal fit, organizational learning and human capital show positive and significant correlations (0.847, $p < 0.001$), human capital and innovation ability present positive and remarkable correlations (0.863, $p < 0.001$), and organizational learning and innovation ability reveal positive notable correlations (0.834, $p < 0.001$). H1, H2, and H3 are therefore supported.

In terms of overall model fit, the standards $\chi^2/Df = 1.436$, lower than the standard 3, and $RMR = 0.003$, revealing that both χ^2/DF and RMR are proper. Furthermore, the chi-square value is sensitive to sample size that it could not be used for directly judging the fit. However, the overall model fit standards $GFI = 0.982$ and $AGFI = 0.921$ are higher than the standard 0.9 (the closer GFI and $AGFI$ to 1, the better model fit) that this model shows better fit indicators.

Table 2. Hypothesis test

Research hypothesis	Correlation	Empirical result	P	Result
H1	+	0.847	P<0.001	supported
H2	+	0.863	P<0.001	supported
H3	+	0.834	P<0.001	supported

CONCLUSION

The research results reveal that the stronger organizational learning ability could better accumulate human capital in medical industry. With stronger organizational learning ability, medical industry could adapt to changing environments and precede innovation. Meanwhile, the organizational member could be enhanced the professional ability through the reinforcement of learning ability and possess low-replaceability and high value-added knowledge to become the most important human capital in medical industry. Accordingly, a helpful learning organization could enhance the completion of good personnel training programs and cultivate the employees' uniqueness and professional ability to further accumulate human capital. The richer human capital in medical industry could help enhance the innovation ability. An enterprise with richer human capital could more easily promote the improvement of processes or engage in high value-added innovation activity to help medical industry create high profits and present larger contributions to organizational competitive advantages and innovation ability in medical industry. Human capital shows the best uniqueness and core value among all intangible assets. In the knowledge-based economic era, innovation ability has become the key success factor of an enterprise. Enterprises with rich human capitals could propose innovation ideas, change corporate processes, and timely solve problems for customers. It reveals that an enterprise with richer human capitals could promote the innovation ability.

SUGGESTION

From the research results and findings, practical suggestions are proposed in this study.

1. It is a major work for organizations in medical industry to accumulate human capital with uniqueness and strategic value in the organization in order to thoroughly develop and create competitive advantages. Besides, medical industry should regard learning as the basic value for the reinforcement of learning ability; meanwhile, an organization should not restrict on thinking with the familiar methods and has to share the future development direction and vision with the employees. Human capital is the source of innovation ability in medical industry, which should present human capital with uniqueness and strategic value for the innovation of core competencies and leading medical industry forward to the objectives.
2. After entering the national development with knowledge-based economy, Medical Education could maintain the continuous economic growth through innovative research and development and the R&D of foresighted technologies. The cultivation of R&D personnel even becomes the important measure for the technology development in medical industry. Medical Education must actively train professional R&D personnel, encourage knowledge expansion and application, invest in more medical education and training opportunities, and actively promote lifelong learning systems to enhance R&D personnel's professional technical capability and accumulate the basic energy to step towards innovative economy. What is more, excellent R&D human resources are also the basis to promote the technology level.
3. Without investing in learning and innovation, Medical Education could not catch up with the technology progress in the industry and cope with customers' needs to further lose the competitive advantages in the market. As a result, medical education has to precede knowledge creation, knowledge expansion, and knowledge value-added activity through innovation investment and innovation systems on the management of rich and high-level R&D human resources so as to effectively enhance the organizational productivity and create high added value.

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