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Designing a Model for Maturity of Commercial Soft Technology with a Cognitive Mapping Approach (Case: Poultry Cluster of Golestan Province)*

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Abstract

This paper aims to present a model for maturity of commercial soft technology with a cognitive mapping. The research is based on the cognitive study of poultry cluster, soft business technology model and cognitive mapping approach. The research was done using field study and documentary research methods. The results indicate that there are critical procedures at work for supplying inputs, production process and marketing technology. In conclusion, industry performers can develop competitive advantage in an unbalanced and unsustainable internal and external economy, with the development of collective participation, the formation of buying and selling networks, and by gaining skill-based knowledge.

Keywords: Maturity Model, Commercial Soft Technology.

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Diseño de un Modelo de Madurez de la tecnología blanda comercial con un enfoque de la cartografía cognitiva (caso: Las aves de corral Cluster de la provincia de Golestán)

Resumen

El objetivo de este artículo es presentar un modelo para la madurez de la tecnología comercial con un mapeo cognitivo. La investigación se basa en el estudio cognitivo del cluster avícola, el modelo de tecnología empresarial blanda y el enfoque de mapeo cognitivo. La investigación se realizó mediante estudios de campo y métodos de investigación documental. Los resultados indican que existen procedimientos críticos en el trabajo para suministrar insumos, procesos de producción y tecnología de marketing. En conclusión, los actores de la industria pueden desarrollar una ventaja competitiva en una economía interna y externa desequilibrada e insostenible, con el desarrollo de la participación colectiva, la formación de redes de compra y venta y la adquisición de conocimientos basados en habilidades.

Palabras clave: modelo de madurez, tecnología blanda comercial.

1. INTRODUCTION

This paper aims to present a model for maturity of commercial soft technology for poultry industry of Golestan province with a cognitive mapping approach. Cognitive mapping is a combination of techniques for studying, recording and organizing correlated information and knowledge. It is also a tool to represent knowledge in a graphic manner. The aim of cognitive mapping is creating a cognitive map. Cognitive map is a representation of the ideas about a subject or

issue. The uses of cognitive mapping include organizing and integrating knowledge, creating new knowledge and representing different learning patterns and predicting. This can help in simplification of information in a complicated system to turn it into a knowledge map to create a perspective. In the field of organizational studies, cognitive mappings could be used to extract structure, the content of the mental process and mental model of individuals (Adelazar et al., 2014).

Cognitive mapping approach has 6 stages of preparation, phrase creation, phrase structuring (contextual and structural descriptions), group similarity matrix formation, the cognitive map drawing, and using the mappings (Adelazar et al., 2014). The current study aims to draw the cognitive map for the important procedures of commercial (business) soft technology in the poultry industry. The poultry business of Golestan province consists of 969 units, including 961 small and medium Poultry farming and 8 Poultry production chains. Their main product is chicken meat and subsidiary products include eggs, fertilizer and feather. Business firms have developed greatly in Golestan Province in recent years regarding the number of units, production capacity and production technologies. They produce 212 thousand tons annually. This is 10 percent of the production in the whole country which makes Golestan the second biggest producer of poultry products in Iran. Yet, these business firms face challenges like market fluctuations and liquidity shortage. The results of the cognitive study of poultry cluster in Golestan Province indicate that the majority of the problems that chicken house owners face arise from the lack of supply

and demand management skills that leads to surplus supply and consequently price drop for the products. This decreases the added value gain for the producers. This study intends to identify the major challenge for the main chain of poultry value in the Golestan poultry industry and correct the business soft technology criteria and processes. Dylan Walsh believes that learning soft skills like communicative skills, decision making, time management, etc. increase the organizational efficiency. Eastwood (2017) emphasizes on soft skills as efficient components for creating connections in different economical sections. Researchers at Massachusetts Institute of Technology believe that soft skills can help the realization of organizational goals.

Soft technology is an empirical science system which derives from social science, unnatural science and non-scientific (traditional) knowledge. It aims to solve different scientific problems (Jin, 2002: 2004). Business soft technology, economic activities and effectiveness improvement technology of economic activities include components like money technology, accounting technology, advertisement technology, management technology, and financial technology and so they like. Brinker and McLellan (2014) focus on the improvement of marketing technology and define it as a combination of strategy, information technology, etc. Also, Brinker and McLellan (2014), senior managers of Mckinsey Company, define marketing technologists as people who use technology in design and activity of marketing and connect the consumer experience with market demands. Draker says the difference between the developed and developing

countries in the technologist workers who are the workers with theoretical science and practical skill.

Regarding the mentioned items, we can conclude that the difference between business firms is in the level of technology maturity. The evaluation of the technological maturity level is related to technological readiness and technological progress. It has many uses, including the evaluation of the current state of an existing technology, determining technological bottlenecks, technological supply strategies, technology selection, phasing, and monitoring plans and projects (Fouladi, 2007). The evaluation of the technological maturity level started in 1980s and following it continued to technology maturity model, readiness model and procedural maturity of the technology (hard). Also, the maturity model of the research and technology and marketing procedures maturity model Ahmadizad et al. (2011) are developed as the procedures of business soft technologies by researchers.

Different methods are proposed to evaluate the level of technological maturity including Technology Readiness Levels (TRL) Model and Manufacturing Readiness Levels (MRL), any of which evaluates one aspect of technology maturity. Moslehshirazi and Nazari (2018) proposed a technology maturity level based on 5 levels (primary maturity, repeatable, defined, quantitative managed and efficient).

The current study is required because of the increasing role of technology and soft skills in competitive circumstances, especially in the information Age. In another perspective, expertise and skill are the only sources of competitive advantage in the fluctuating and unbalanced world of economy (Thurow, 1996). Technology provides organizations with technological advantages. The aim of strategy is attaining a sustainable technological advantage that follows a specific competitive advantage (Khalil, 2000). In fact, one can say that technology in general and business soft technology in particular, play an important role in the competitive advantage of the firms in the Third Wave of the Industrial Revolution. So, it is necessary to evaluate and define the role of business soft technology in the realization of organizational goals and their connection with organizational components. The internal analysis of an organization starts with identifying the strong and weak points of the organization. It is formed based on the existing activities in the chain of value and the main and supportive operations of the organization (Schilling, 2008). The primary question of this paper is proposed as follows: What are the main challenges of the value chain of poultry industry in Golestan Province? What are leverage points?

In the other words we seek to assess the challenges that face the value chain of the poultry industry to define processes and important components of business soft technology to achieve a maturity model for business technologies of Golestan Province poultry. So, the main question of the research is: What does the business technology maturity model of poultry industry in Golestan Province consist of?

The subsidiary questions are: What properties do the major and subsidiary activities of the value chain of poultry industry businesses have regarding the level of maturity? In the studied value chain what procedures need to be improved and upgraded? The important components in the maturity model are key process areas. So based upon this, maturity level evaluation is done using business processes. A process is defined as a group of correlated activities, which are defined, designed and implemented for one or more changes (Safari and Moradmoghadam, 2013). Yet, business processes are different from work processes. Work processes are the ones that are completely under the control of one segment and are confined to duty limits. One of the major classifications of processes is the one based on the Value Chain of Michael Porter (Ibragimova et al, 2018).

2. RESEARCH FINDINGS

2.1 Value cycles

In order to study value and its creation method, the value chain is used. The value chain is a strategic tool represents the activities that are done to create a value. Porter proposed value chain model and divided the activities in production organizations into two parts of main and supportive ones. In this case the operational activities are the main and headquarter activities are considered supportive activities (Turban et al., 2006). The major activities include internal logistics, production and operations, external logistics, marketing and services

and support activities including company infrastructures, supply, human resource management, and technology development. In the current study, value rings of poultry chain include producing broiler Hen and value ring of the poultry industry in Golestan is considered the same as the whole country.

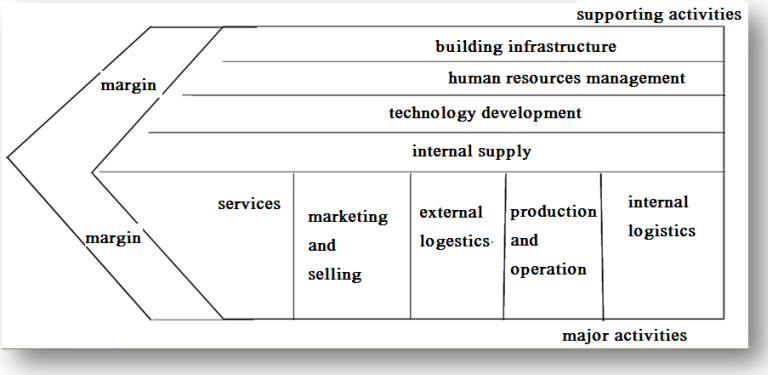


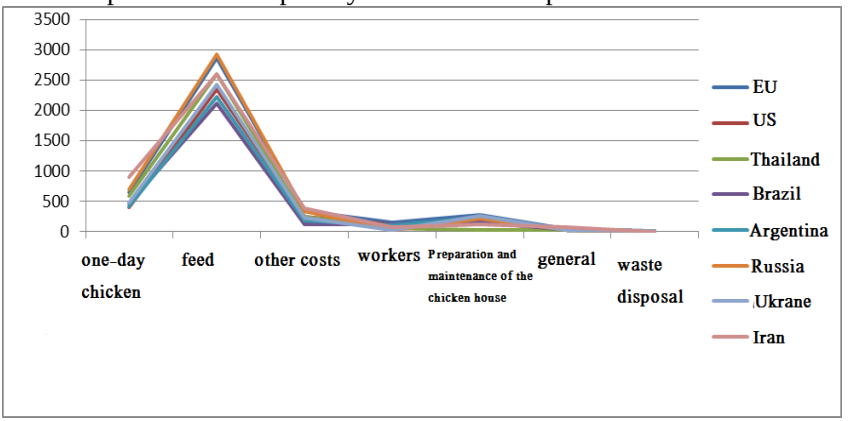
Figure 1: types of activities in value chain model

2.2 Value chain analysis of Iran's poultry industry

According to studies in 2017, the net price of chicken in Iran is higher than countries like Brazil, China, and US. The reasons for this include the high price of chicken feed, low ratio of turning feed to meat, long period of aviculture, dying in the process of production, low quality of feed, etc. Studies show that US, Brazil and China create about 50 percent of the chicken meat produced in the whole world. Statistics show that chicken feed is 30 percent more expensive in Iran

in compare with reference countries like Argentina. Also, one-day chickens are 10 percent more expensive. Also, the ratio of turning in Iran is 20 percent higher than Europe. According to studies Brazil and Argentina are the premiere producers of poultry products due to having vast fields of soya and corn and low price of one-day chicken. Graph 1 shows that the majority of the cost in poultry industry is due to feeding and one-day chickens.

Graph 1. Different poultry cost sections in premier countries



Source: Research findings

2.3 Analysis of critical procedures of business in value chain of poultry chain of Golestan Province

According to the findings, supply of chicken meat in Iran is 2.3 million tons and demand is 2.1 million tons. So, there is 10 percent surplus. Also, this extra amount is predicted in the future (Nazari, 2018). So, the main leverage point in the poultry industry of Golestan is the inappropriate management of supply and demand and the lack of export

spirit. In order to manage the main leverage point and increasing the quality of product, three related areas of upper supply chain, internal supply chain and lower supply chain need to be reorganized.

2.3.1 Upstream supply chain critical procedures

-Fluctuations in the price of chicken feed, being dependent on production of mother hens and one-day chickens, low quality of drugs and vaccines, low quality of feed, one-day chicken price fluctuations.

2.3.2 Internal supply chain critical procedures

- High rate of dying in the aviculture period (10 percent in comparison with 2 percent in developed countries), high age of slaughter (about 50 days), low turning ratio of feed, inappropriate keeping and manufacturing circumstances, lack of coherent and coefficient organizations in the chain of industry, and ineffective supports from the government.

2.3.3 Downstream supply chain critical procedures

- Low quality of the slaughterhouses challenge, not meeting with the standards of target markets like Russia, financial

challenges of chicken house owners, lack of production plans and a coherent system for product supply, consumer market challenges (lack of enough attention to branding by manufacturers and customers).

3. RESEARCH METHODOLOGY

3.1 Methodology

The research consists of two stages. The first one was a cognitive study of poultry cluster in Golestan Province. The second one was analysis and determining the maturity level of business processes and analyzing the importance of the relationships. In the first stage, a study of the literature of the poultry industry was done based on the Industrial Cluster Development Methodology of the United Nation Industrial Development Organization (UNIDO). Primary information was extracted from the poultry industry of the world, Iran and Poultry business in Golestan, using library study. Information was from Agriculture Jihad bureau reports, Iranian Statistics Centre and internet websites.

In the cognitive stage of the study, interviews and questionnaires were used to explain the critical processes and the value chain evaluation. Information from library studies, questionnaires and interviews were revised and criticized by the industry experts during numerous meetings. In the field study, chicken house owners, poultry-related managers, experts, managers of small and medium industries, poultry cluster developers and observers, and experts of export companies were

interviewed who were with more than 20 people. Some experts were interviewed as much as 5 times. Then, the information was given to experts in the form of individual meetings as well as a group meetings and necessary feedback was received.

In the second stage, in order to determine the business procedures maturity levels and cognitive mapping analysis and extraction of the maturity method interview and questioning were used according to cognitive mapping method. Methodologically speaking, the present research is considered to be a development research (Proposing business soft technology maturity model for business firms). Since the objective of the conceptual model is to improve the position and performance of business units, this research can be considered as an applied one. This paper, being a data collection method, is a non-experimental research that aims to explain the important components of business soft technology maturity in business firms. Therefore, in this respect, the research method is descriptive. The present study is also a qualitative research in terms of the nature of data. The present study was conducted since the autumn of 2017 to the summer of 2018.

3.2 Methodology of critical procedures Extraction and stages of cognitive plan implementation

The Golestan poultry industry faces complexity in internal relations and external communication in the value chain and supply chain components. A cognitive mapping approach was used to understand the relationships and the complexity of relationships. Cognitive mapping is a research technique of soft operations in the

area of problem-structuring. It can depict a hierarchical image of the causative factors and their implications by extracting the mental map of the experts. Cognitive mapping is a way of representing the causal relationships between decision elements in an issue and can describe the tacit knowledge of the experts. It is proved that cognitive mapping can be useful in solving unstructured problems with multiple variables with causal relationships. The explanation of the cognitive mapping approach with the six stages can be done with the participation of one person to eight people. (AdelAzar, 2012). In this study, five experts were used.

Cognitive mapping is a way of representing the causal relationships between decision elements in an issue. It can describe the implicit knowledge of the experts. It is verified to be useful in solving unstructured problems with multiple variables and causal relationships. An explanation with the cognitive mapping approach with the six stages can be done with the participation of one to eight people (AdelAzar, 2012). In this study, the ideas of five experts were used.

I. Preparation (forming a group of contributors and designing the realm of conceptualization and creation of a Concentration). At this stage, the elites and experts in the field of the Poultry industry in Golestan province were identified. They were asked for guidance regarding key business processes.

II. Creating phrases and concepts, connecting concepts using the directed lines

III. Formation of the relationship matrix and re-structuring

IV. Re-expression of phrases and clustering of phrases

V. Interpreting maps

VI. Implementation of maps (AdelAzar et al., 2013).

4. RESEARCH FINDINGS

4.1 The strategies of poultry cluster

Regarding the main leverage point of the system which is the need for exporting the products and proper management of the main product supply, strategy design consisted of 3 groups as follows:

1. Participation strategy, including confidence building and sensitization in cluster members and creating networks

2. Product development strategy, including quantitative and qualitative upgrading of the ingredients and upgrading the level of technology and product quality

3. Market development strategy, including the promotion and development of the market, production of organic products in the appropriate size and weight for export.

The important question was: Which business processes should be upgraded to realize these strategies? Which activities in the value chain, including core activities and support, should be considered? In order to explain this need, according to the results of cognitive and cognitive research, a group of 5 veteran experts was selected. According to the Delphi technique and the storm of thought, the most important steps were taken to realize the strategy. The actions were grouped into different process groups. Then, a matrix questionnaire and a questionnaire for assessing the level of preparedness of the poultry industry processes were collected and analyzed.

The important question was, what business procedures need to upgrade for the realization of these strategies? What activities of the value chain, including main and subsidiary ones need to be addressed? In order to account for these necessities, according to the results of cognitive research and with a cognitive mapping approach, a group of 5 experts in the field was selected. According to the Delphi technique and brainstorming, the most important steps for the realization of the strategy were determined. The actions were grouped into different process groups. Then, a matrix questionnaire and a questionnaire for assessing the level of readiness were collected and analyzed.

4.2 The results of assessment of Maturity Level of organizational procedures in the poultry industry

In the research process, the questionnaire for assessing the level of readiness and maturity of the 13 procedures at the business level was completed. According to experts, the procedures that had the lowest level of readiness and maturity to the third rank were: the status of export networks, the input purchase network, branding situation. However, the components of the status of nutrition technology, the efficiency Agricultural Jihad Bauru and the status of the input supply process were moderate at the level of maturity and readiness (Table 1).

Table 1. The evaluation of maturity level and readiness of important procedures of the poultry business

R	Critical procedures	The average score (out of 5)	Non-maturity ranking
1	Export networks' status	1.4	1
2	Input purchase network	1.6	2
3	Branding situation	2	3
4	R&D situation, BDS situation	2.2	4
5	Packaging situation	2.4	5
6	Heating and chilling systems situation, financial support	2.8	6
7	Slaughterhouse situation	3	7
8	Feeding technology, Agriculture Jihad Bureau role, veterinary	3.2	8

Resource: research findings

4.3 The results of the analysis with cognitive mapping approach

In the research procedures, the following results were obtained according to the cognitive mapping:

1. Preparation: At this stage, the elites and experts in the field of poultry industry in Golestan province were identified. They were asked for advice regarding key business processes. The experts, individually and as groups, chose the concepts with most relevance to the original idea.

2. Creating phrases and concepts, connecting concepts: The experts described the concepts and concepts of the topic. They defined the main processes of the poultry industry in accordance with the components of the supply chain, and mentioned the practical measures necessary to enhance the maturity level of the soft business technology. This included 13 business processes. Major processes include issues such as the status of input-purchase networks, the importance of the R&D unit, the inputs process, and medicines.

3. Re-structuring of the concepts: following, 13 phrases in the communication matrix were reconstructed to form the communication matrix and the relationship between the concepts. First, individual views were formulated in the form of the communication matrix of 0 and 1, and then a group similarity matrix and a combination of five expert opinions was done.

4. Re-expression of phrases and clustering of phrases: Depending on the group matrix formed, the relationship between the concepts was formed; based on which clusters were identified and named. The results show that three clusters were composed including the production technology clusters, R&D, input supply cluster and the cluster of the elements of the modern market-oriented components.

5. Interpretation of the maps: According to the results of the group similarity matrix, the interpretation of the findings was made. The resulting cognitive map can be explained as follows: Golestan poultry cluster must update the production technology (main supply chain) to develop its maturity level. Also, it needs to facilitate the procedures of supplying inputs and it should modernize marketing processes according to market demand.

6. Implementation of the maps: The results of the findings were considered for the planning and development of the maturity model. Action plans compatible with strategies were adapted for the poultry industry to develop soft skills and soft business technologies; programs such as familiarizing with modern technologies in the poultry industry, workshops on building a network of purchasing inputs, branding, etc. (Figure 2).

code		1	2	3	4	5	6	7	8	9	10	11	12	13
code	title	creating and reinforcing input buying	creating R&D	constant supply of input	special BDS's	improving feeding and chicen	heating / chilling	Jihad and Ved	standard Slaughter house	modern packagin	branding	Export Net	finance	practical education center
1	creating and reinforcing input buying	5	2	5	4	2	2	5	0	0	0	1	5	0
2	creating R&D	2	5	3	5	5	5	3	2	4	3	4	2	5
3	constant supply of input	5	2	5	3	1	1	5	0	0	0	2	5	0
4	special BDS's	4	5	2	5	4	5	4	1	2	5	5	3	3
5	improving feeding and chicen	2	3	1	4	4	3	4	0	0	2	2	4	3
6	heating / chilling	1	3	0	4	3	5	3	0	0	0	0	3	4
7	Jihad and Ved	5	4	5	5	5	5	5	5	3	3	2	4	2
8	standard Slaughterhouse	0	2	1	1	1	0	5	5	4	3	4	3	3
9	modern packagin	1	4	1	4	0	0	5	5	5	5	4	3	3
10	branding	3	4	1	5	1	1	4	4	5	5	5	3	3
11	Export Net	4	3	4	5	1	1	4	5	4	5	5	4	4
12	finance	4	3	5	3	4	5	4	2	3	2	4	5	2
13	practical education center	0	5	0	4	4	4	2	3	4	3	3	2	5

Figure 2. the group similarity matrix for business procedures of poultry industry. Resource: research Findings

4.4. Drawing the cognitive map of the research

Based on the findings of the group similarity matrix, the cognitive map is formed based on three conceptual clusters. They include input cluster consisting of the variables of 1, 3, 7, 12 and cluster of manufacturing technology and R&D components consisting of the variables of 2, 4, 6, 5, and 13. And the conceptual cluster of marketing technology consisting of the variables of 8.9, 10, and 11. (Figure 3)

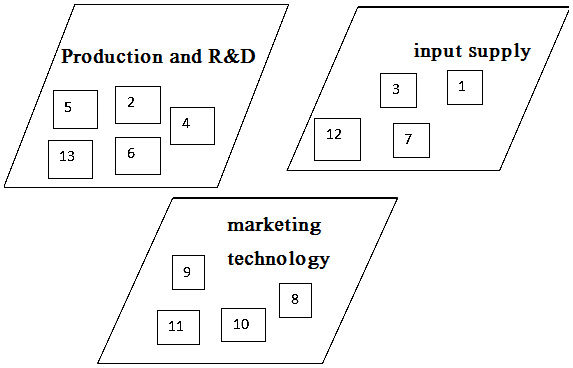


Figure 3. drawing the cognitive map- resource: research findings

4.5 Presentation of the Commercial soft technology maturity model

The cognitive map and the level of connection between the concepts are the main components of the technology maturity model.

In fact, in order to improve the level of readiness and soft skills maturity in the poultry industry, a model is formed based on three components of maturation of inputs processes, production processes and research and development processes. Thus, business soft technology maturity model is based on the three main components. However, the role of the component of manufacturing technology and R&D processes (because of having five variables) is more important (Table 2).

Table 2. Key Components of the Maturity Model of Commercial Soft Technology of Poultry Industry

Conceptual cluster 1 (component of manufacturing technology and R&D)	Conceptual cluster 2 (component of input supply)	Conceptual cluster 3 (component of marketing technology)
R&D unit	Input purchase network	Standard slaughterhouse
Creating expert BDS for the poultry	Providing input and medicine	Modern packaging
Improving feeding and keeping technologies	Agriculture Jihad Bureau and Veterinary role	Branding
Heating/chilling technologies improvement	Financial support	Creating export networks
Specialized Applied Scientific Center		

Resource: research findings

5. CONCLUSION

The Commercial soft technology maturity model of the poultry industry has been developed according to the findings of the research and the views of the experts. Survey results show that the level of maturity of the skill and technology of the business of the poultry

industry in the supply chain has been one of the lowest in the industry with a score of 1.6. Regarding the domestic supply chain challenges, the promotion of manufacturing technologies, including hardware and software, have been emphasized. However, in recent years, the main part of the Golestan province poultry farms, have experienced hardware upgrades. But in the area of soft business technologies such as network and group working, resource management, product planning and supply, the level of maturity of business technology is at an introductory level. According to the responses of the experts of the poultry industry, weakness of research and development units with an average readiness of 2.2 and low maturity levels of BDSs were noticeable.

Assessing the lower supply chain level indicates that the technology of export networks in the poultry industry is at the lowest level of maturity according to the experts (mean 1.4). Also, brand status and packaging status were at low levels of readiness. The results of the cognitive map of the business soft technology maturity model include three components of maturity enhancement of inputs processes, production process technology, research and development, and the component of marketing technology. In fact, Golestan Poultry Industry has to upgrade its production technology (supply chain) processes, facilitate its input processes, and modernize the market processes in line with market demands. The cognitive mapping results and the resulting model were considered in the planning and development of the maturity model. Action plans were used for familiarizing modern technologies in the poultry industry, like visiting

the exhibition industry of poultry, workshops on building a network of purchasing inputs, branding training workshops. So that as Thurow (1996) says industry performers can develop a competitive advantage in an unbalanced and unsustainable internal and external economy, with the development of collective participation, the formation of buying and selling networks, and by gaining skill-based knowledge.

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