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The Systematic Model (ESFE) for Implementation of open innovation in Yuchai Group in China

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Received: 15 December 2018 Accepted: 2 January 2019 Published: 15 January 2019

Abstract

on the case study of Yuchai Group's practices to illustrate the knowledge input and output in the open-innovation model.Design/methodology/approach: The systematic model of open innovation is constructed based on Yuchai Group's practices in the People's Republic of China from a grounded theory approach.Findings: The results show that, from the systematic view, the dynamic process of open innovation is divided into four interconnected parts: elements, integration, evaluation of performance and adjustment to the environment. For Yuchai Group, the element acquisition are much more vital than the development of ideas.

Index terms— systematic model, open innovation, organizational change, chinese experience of change

1 Introduction

It is vital if not pivotal for firms to exchange knowledge, ideas and concepts with entities operating in the ever-changing environment in open innovation, and the breath and the depth of the search for the elements are emphasized by Terjesen and Patel (2017). It is important to invest in relationship with partners by gathering, developing, controlling and disseminating external knowledge in the dynamic process of innovation **??**Bakiciet al., 2013; **??**ahalander and Gahnn, 2010;Howells, 2006). Some scholars suggested that firms should systematically cultivate favorable inner environments, such as IT infrastructure, attitudes to risk, innovation and open belief, willingness to share, good governance, and rule of training, to create knowledge and capture business values (Oliveira et al., 2017; **??**uannan Xu et al., 2017; **??**ratzeret et al., 2017). We could thus deduce from the literature that open innovation is a dynamic process involving new knowledge in and out of the boundaries of firms and influenced by many factors, such as the elements for input, relationship with the environment, and the inner activities, but there lacks models to illustrate the dynamic process with multiple factors. Open innovation would increase labor division, improve market institutions for trading ideas, and foster collaboration across geographical distances with new information technologies in the era of globalization **??**Carayannis and Campbell, 2009; **??**ahlander and Gann, 2010). Firms could attain pecuniary and indirect benefits because oportunities let them gain access to exogenous expertise, to reduce time and cost, to promote learning, to enhance technology competence, and to share odern enterprises rely on updating knowledge and innovation to sustain their competitive edge instead of by static skills or resources. In this regard, the concept of open innovation introduced by Chesbrough (2003) underpins the use of not only both external and internal ideas but also internal and external paths to the market applicable to the firms' innovation. Within the approach of open innovation, the inflow and M outflow of knowledge may create opportunities for cooperative innovation for partners, customers and suppliers (Gassmann and Enkel, 2004), which would, therefore, accelerate internal innovation **??**Chesbrough, 2006). **??**wo Findings: The results show that, from the systematic view, the dynamic process of open innovation is divided into four interconnected parts: elements, integration, evaluation of performance and adjustment to the environment. For Yuchai Group, the element acquisition are much more vital than the development of ideas. Moreover, the structural integration consists of internal integration and external integration according to the relationships of knowledge under the value chain. Additionally, the evaluation of performance focuses on knowledge production, not only about pecuniary results related to patent production, but also the change

of modules as the knowledge base. The adjustment of open innovation in both the market and the political environment is a long but gradual process. Therefore, it is appropriate for organizations to adopt a systematic model for management of open innovation.

Originality/value: The authors have built a systematic model Gassmann, 2009). Nonetheless, contention exists in the literature, of which the most controversial is on the performance, because many uncertainties are involved for economic or innovative returns, to the point that the concept of -paradox of openness? was suggested (Arora et al., 2016). Some scholars found that open innovation could increase the transaction cost, damage the interests of the innovators due to weak protection for intellectual property, and lead to knowledge leakage Innovation has gradually stepped into the central stage of economic activities since the industrial evolution, with the development of economic and social environments, since the ideas and models of innovation exert potential influences on firms' success (Villarreal and Calvo, 2015). Those innovation activities confined in the boundary of the firm are referred to a closed model such as the linear model (Bush, 1945) or the chainlinked model (Kline and Rosenberg, 1986). From the beginning of 1990s, openness of innovation has become the frontier of research. Since knowledge is distributed and fragmented among persons and institutions, the innovation activities need coordination and integration of the actors with dispersed knowledge in different institutions or different departments. Hence, the knowledge production of model 2 **??**Gibbons et al., 1994), integrated model (Rothwell, 1994), technoeconomic network model (Callon, 1994), or National Innovation System (Freeman, 1995) emerged in the literature, which emphasized not only inclusive innovation but also partnerships and linkages in a network of innovation agents. Since the early 2000s, the environment of innovation got much attention, Chesbrough **??**2003) generalized open innovation to illustrate the internal and external relationships and the process of knowledge exchange. Nowadays, some models with the systematic views are emerging, such as model 3 of knowledge production in the Glocal age **??**Carayannis and Campbell, 2006) and the Quadruple Helix Model **??**Carayannis and Campbell, 2009, 2011 to explain the more complicated process and the influence of numerous factors.

From the closed model to the open model, then to the systematic model, the principle and feature of innovation has been adapted to coordinate and integrate the internal business functions with the adaptability to the environment(see Kübra Simsek, Nihan Yildirim, 2016). The elements for input are extended, including whether the type or the scale and the derivation of profit have been pluralism, whether the priority between technology and market focuses on the joint, and whether IP strategies are always mixed to attain the foreseeable payoff and to decrease the uncertainty in innovation. As the core of innovation activities, the model of knowledge production has changed from Model 1 to Model 3 **??**Carayannis and Campbell, 2011; **??**ibbons et al., 1994) (see Table 2), and the appreciable progress has been achieved on knowledge management. Model 1 is on the basis of closed innovation: while Gibbons et al. (1994) emphasized knowledge is produced in transdisciplines and trans-organizations, **??**arayannis and Campbell(2011) found the spatial dimension of knowledge innovation in the context of knowledgebased and knowledge-driven, global economy and society. The concept of knowledge fractals proposed by **??**arayannis and Campbell (2011) implies that knowledge owned by persons or institutions is only a part or fractal of the micro-subsystem and the openness is the inherent character of innovation. The innovative organization, even full of knowledge, needs to obtain information from the environment, develop the flexible ability to coordinate and cooperate with the other institutions to conceptualize, design, and manage the "knowledge stock" and "knowledge flow" to exploit the effect of innovation synergy. Accordingly, open innovation is always on the evolutionary path of coexistence, co-evolution, and co-specialization of different knowledge paradigms. materials and energy. Function represents the dimension, efficacy and ability with which the system interacts with its environment, and affected by the quality of the elements, feature of structure and environment, often measured by the scale, growth, efficiency, et cetera. System is dynamic, and it is the function of the system that decides whether a feedback is positive or negative. The concept of the innovation system was introduced by Lundv all in 1985, and has been extended as the national system of innovation (Freeman, 1995) and industrial innovation systems or regional innovation systems **??**Cooke et al., 2004). So innovation systems could be analyzed at different levels: firm, cluster, sub-regional, national, and international.

This paper focuses on how firms in a specific industry implement innovation activities in the open system. In essence, knowledge production is the core work in the innovation system, and as a dynamic system, there are huge flows of technology and information along with capitals and human resources. Moreover, the function of innovation mainly results from the interactions between the actors to realize an idea into a process, product, or service on the market.

2 c) Processes for Open Innovation System Management

Loasby (2000) argued that an organization is a knowledge-interpretation system that creates knowledge from the division of labor and evolution in the open world. Chesbrough (2003) defined the processes of open innovation: 1) forming relationships, 2) relying on venture capitalists, 3) managing intellectual property, 4) the metabolism of new knowledge; and 5) establishing new architectures and business models. Lane et al. (2006) simplified the process of open innovation into exploratory learning, transformative learning, and exploitative learning, and suggested that three processes for the absorption by a firm is identifying, assimilating, and applying external knowledge.

According to the general system, we could build the systematic model of open innovation (ESFE) as a skeleton for analysis of the relationship and mechanism in open innovation.

3 1) Element Acquisition: With information technology, it

is not difficult for firms to collect the information on the market, and on the social, political, and administrative milieu to filter, judge, diagnose and integrate for innovation. Acquiring knowledge, especially the intellectual property, is imperative for open innovation, but under the protection of intellectual property, there is a little hope to attain the real innovation patent. Acquiring talents is the main aims for searching activities because talents with ideas are the main sources of the thoughts for core innovation, and head-hunting behavior always involves a wide-range search on the targeted university or personnel via social relations, information networks, and excellent communication skills. It is also important for firms to search for such exogenous R&D, not only to increase funding, but also to discern the trend of innovation.

2) Structure Integration: According to Porter's view of the value chain, every organization in an enterprise could be viewed as a knowledge base to modularize the enterprise knowledge and has its functions. In a systematic model of open innovation, every module with its special innovation activities in the value chain has the chance to obtain exogenous knowledge with with special demands. When the exogenous elements outside are put into the firm, the management activities need not only to distribute into different modules, but also ascertain in the most necessary chain. So the firm could develop the most efficient absorptive ability and found the solid base for its innovation performance.

3) Function Evaluation: The evaluation of performance is the core of the management of innovation, and the key performance index (KPI) is always seen as the benchmark to adjust or even change of the management activities. The KPI mainly consists of economic performance (such as the yield, volume of production, profit, etcetera), knowledge output (such as patent production, knowledge diversity, ideas change in organization, etcetera), and social effects (such as the salary level of the staff, enthusiasm enhancement, entrepreneurship enhancement, etcetera). elements, the relationships between which characterize the structural feature. A system is always defined by its boundaries, and the world out of the boundaries for a given system is regarded as the environment; there are exchanges between system and its environment via regional, national and global), and types (inner environment, industrial, and trans-industrial).

4 b) A Research Framework of a Systematic Model for Open Innovation

A system is an entity with interrelated and interdependent parts (Bertalanffy, 1968) Hence, the ways in which an open-innovation system adjusts to the uncertain environment or even surmount the environmental constraint is also an issue. Entering a higher platform, being a leader of the industry, and acquiring honors would richen the intangible asset and enable more opportunities to take advantage of environment for elements.

II.

5 Methodology a) Case Study Method

As a research method, case studies can be used for an up-close, in-depth, and detailed examination of open innovation, and its related contextual conditions in a company. Hence, we chose Guangxi Yuchai Machinery Group Co. Ltd. (Yuchai Group), production introduction, operation data, production quality reports, innovation processes, annual innovation reports, meeting notes, memos and annual reports. From the indexed archives of the Yuchai Group, we created categories for filing, searched and retrieved the appropriate issues, remarked the milestone in the process of open innovation to clear the path of open innovation, and analyzed the difficulties, challenges and successes in the open innovation from the systematic view. By analyzing the archival data, we found major problems of concern to the firm included relationship building with external organizations, effective management of changes, proper judgement on the performance and optimal ways to adapt to the environment, which could be inducted as a systematic model: channel of elements input, absorption and assimilation of the knowledge structure, and the performance with environmental challenges.

6 2) Semi-structured interviews

Unlike rigorously-structured interviews that do not allow diversion of topics, a semi-structured interview offers an open framework of themes which allows the interviewer to explore new ideas. We conducted indepth semi-interviews twice for searching information on the open innovation in the Yuchai Group. The characteristics of the interviewed participants are listed in table 3. We also had the opportunity to conduct non-participant observation on some operating situations in the laboratory and production departments for supplementary information. The first round of interviews was conducted from15th to18th in January in 2015 with the main aims of judging whether open innovation happened in the Yuchai Group and the ways in which it took place. The interviews consisted of two parts: 1) we ran a one-hour group interview with 25 members from production and innovation management departments including the vice president, product manager, directors of sales, director of human resources, directors of product research and project; 2) in the following days, we conducted individual interviews with the respective managers from the group to explore the information on innovation in each modelof the value chain in the Yuchai Group, with the focus on where and what the open innovation involved.

The second round of interviews was conducted from 5th to 8thin March in 2016 with the main aims of obtaining detailed information on implementation of open innovation, identifying the challenges in its implementation, and collecting more comprehensive experiences on the successes or challenges of open innovation in the Yuchai Group. The interviewees included 30 people, including the vice president, and production and innovation management department from the first interview, while the others were new interviewees from whom were solicited more detailed information on the implementation of open innovation, such as the technical director, technical worker, R&D personnel, production director, marketing personnel, etcetera. Each interview was conducted individually and lasted approximately one and half to two hours, and designed to elucidate the interviewees' perception and opinions of their own department or agency for open innovation. In line with the qualitative nature of our research and for avoidance of digressing into trivial conversations in the process, the semi-structure interviews were designed with sets of questions on open innovation management which were divided into three parts: where, which and how or why, as summarized in Table 4. The first set of questions was designed to Volume XIX Issue VIII Version I organization's evolution. We collected 65 documents in the Yuchai Group, including reports, articles, media reports, stories and Web materials: some were downloaded from the official website, others were offered by the general office of the firm. Those documents contained general introduction, innovation in a company, archives represent the most comprehensive channel to acquire effective information and data, because archives contain primary-source documents that have been accumulated over the course of an organization's innovation and its environment and reflect the b) Data Collection Data collection was conducted from January 2015 to March 2016. Archival data, semi-structured interviews were used in the process as in figure **??**.

7 1) Archival data

In order to trace the historical path of open How about the change of market of the internal combustion engine? How to get along with the change of the political environment, or of regulations?? How to adjust or control the environment most effectively?

The Systematic model (ESFE) for Implementation of open innovation in Yuchai Group in China the practice. Although the interview protocol was designed with major themes in mind, during the interviews, questions were governed by the actual situation instead of any specific orders (Gummesson, 2000). collect basic information on where the open innovation took place and what the scale of openness was; the second set was designed to elicit the depth of content of open innovation; and the third set to explore how the breadth and depth of innovation were interwoven into Where What(which) How c) Data Analysis A testable, relevant and valid theory would be developed without the intimate connection with empirical reality **??**Eisenhardt, 1989). Through constant comparison **??**Glaser and Strauss, 1967) and content analysis (Krippendorff, 2004), researchers may enhance data interpretation and transform an empirical process into scientific results (Golden-Biddle and Locke, 2007). Through the systematic, iterative comparisons of data, we made data coding into categories and constructed an integrative, theoretical framework by the steps below. Firstly, we collated and sorted the raw data for the most information on the implementation of innovation in the Yuchai Group, especially on the ideas, cognition, behaviors, and routines evolved during the innovation process which indicated similar meanings into first-order activities or categories. Secondly, based on the collected information, we sought to illustrate the relationships, such as the channels, linkages and interactions with the environment, in the dynamic inputoutput process of innovation to capture the flow of innovation activities and evolution of organizational routines, which could lead to the development of second-order themes by formulating researcherinduced concepts at a more abstract level. Finally, with the method of constant comparison (Strauss and Corbin, 1990), we analyzed the ways in which existing shared schemata of innovation was overturned and then recreated by focusing on two aspects: internal innovation activities, and changes of management, in which a systematic framework was formulated to characterize open innovation based on the secondorder themes of innovation; additionally, we discerned some special experience in the Yuchai Group.

8 III.

9 Results

10 a) Element Acquisition with Five Models

The Yuchai Group used four basic models to collect the specialized information and ideas on the technology on diesel engines from the relative organizations inside and outside the Guangxi Province as follows:

1) Purchase directly and then re-innovate Owning to the intellectual property, the original knowledge underlying the innovative product could hardly be obtained but the innovative product itself could be purchased. Accordingly, firms could purchase the product and make a second-hand innovation to rapidly master the new technology. For example, in order to improve the production efficiency of the diesel engine, the Yuchai Group bought the complete set of equipment and the full set of product technology worth 120 million US dollars from the Ford Motor Brazilian diesel engine plant in 1992. Through intensive studies, the Yuchai's technical teams improved the technological capacities, adopted the advanced technical knowledge, upgraded the current products and technologies, and finally made great progress in combustion technology, electronic control technology, structural design, fuel injection technology and emission control technology.

11 2) Collaborative innovation based on entrusted project

As for the original ideas, based on the entrusted project, the Yuchai Group established strategic cooperative relationships with enterprises such as AVL, FEV and BOSCH from Germany and research institutions including UK's Brunel University, China's Tsinghua University, Shanghai Jiao Tong University and Tianjin University, etcetera. By the means of technological transfer, entrusted design and joint development, the Yuchai Group's R&D teams learned the high-quality knowledge from the exogenous institutions, and made the external knowledge localized. It followed that such new knowledge was helpful for the cultivation of the independent innovation capacity of the firm.

12 3) Production alliance and information sharing

The production base is always seen as the knowledge cluster for information-sharing. By cobuilding the production base with suppliers in and out of China, the Yuchai Group has utilized differential knowledge for obtaining the comparative advantage, to lower the cost, strengthen the functions of production, and satisfy the market needs of different regions with more diverse products and services. More importantly, strategic alliances could expand its R & D network and its cooperation with other companies?induce information sharing, integration and utilization, and increase the efficiency in the knowledge flow.

13 5) Talent hunting and training via projects

Talent hunting and cultivation is the foundation for innovation. The Yuchai Group has usually recruited employees from Chinese universities, especially for those joint laboratories, often take projects as a flexible work for many technicians and talents with domestic institutions. The firm has also created strong R&D platforms for the cultivation on independent R&D technologies that are geared to world cutting-edge technologies. As for the R&D projects of core engine technology, the relative technicians would be sent overseas for training to grasp the international standards and learn advanced ideas and designs.

14 b) Structure Integration According to Knowledge Relationship

Although innovation relies heavily on the outside world of a company, it is the internal innovation activities that underlie the selection of the best knowledge among the alternatives, configure the best model to integrate the new technology into production, and create the best market opportunities for further development. The scale of open innovation includes the international, domestic and local ones. As in the value chain, the scale of open innovation of each model is determined by the knowledge quality comparable to the rivals at the different levels. Only those models with high-quality knowledge could enter the large-scale open innovation. In the company, the knowledge models with high quality and in the high competitive level could dominate the others, and they spearhead the enterprises' model innovation. Although each model in the value chain has chances for innovation, there are differences on their quality of knowledge. In the R&D model, the quality of knowledge in the Yuchai Group is lower than that in Europe but higher than that in the domestic setting, implying that it needs to acquire high-quality knowledge out of the country and could disseminate some ideas to the domestic companies. In the production model, the Yuchai focuses on the domestic scale for competition. In its sales and after-sales model, the knowledge is higher than that of other regions in western China. The Yuchai Group could outflow its know-how to compete with other firms in the regions (See table 5). Inbound innovation: adopt knowledge of high quality and establish strategic cooperative partnerships to co-build talents cultivation bases with well-known universities and research institutions both local and abroad. 1) Take the projects as platforms and make joint efforts in innovation.

2) Build high-level laboratories and technical centers and attract knowledge-oriented talents with appealing payments and welfares.

Inbound innovation and sharing the technology for manufacturing: 1) Introduce production equipment for the diesel engine from Ford Company U.S.. 2) Be geared to re-innovation in order to satisfy market needs; 3) Establish strategic cooperative partnerships with institutions in and out of China, constructed a production base. 4) With standardized knowledge of production, cooperate with the suppliers of various modules of the Yuchai Industrial Park to co-produce and

The quality of knowledge is higher than that of domestic ones, but lower than the international ones.

The quality of knowledge in production module is slightly higher than that of regional ones Sales modeland after-sales service module

15 Regional level c) Function evaluation on three indexes

According to the experience from the Yuchai Group based on the quality management, the performance management of open innovation focuses not only on the dominant tangible indices such as new knowledge production and monetary profits but also on invisible indices such as diversity and specialization of modules in the value chain.

16 1) Patents, scientific and technological achievements

The Yuchai Group has accumulated practical experiences in operating major national projects, consolidated its leading position in technology domestically, and contributed to the technological progress of the industry on internal combustion engines. By 2015, the Yuchai Group has had 2300 patents in force, of which over 120 were inventory patents. As a technology core department, the Yuchai R & D Center accounts for more than 60% of the number of patents each year. In addition, the firm won two national prizes for progress in science and technology in China in 2012 and 2013 respectively.

2) Economic achievements With the implementation of open innovation strategy, the Yuchai Group insisted on satisfaction-oriented profit management but not the optimal profit management in innovation performance management, which nurtured the free air for innovation. Table 6 shows the profitability and the sale volume of engines and the internal combustion engines in the Yuchai Group. Gradual progress may be discerned and are higher than the average in China by 1998, 2006 and 2013. 3) Evolution of modules in value chain With the development of open and innovation, the Yuchai Group has expanded its scale tremendously, the internal technologies grow more advanced, and the modules are diversified and more refined. Such modular diversification translates into more bases for the production of new knowledge, and the modular refinemeny translates into more competition for core values and can make more apexes for innovation. Table 7 illustrates the evolution of the modules in the value chain in the Yuchai Group.

17 d) Environment impact mainly on two dimensions

In an open environment, the innovation of a firm needs to not only adjust the environment, but also influence or master the environment with the innovative power.

18 1) satisfied the needs for environmental protection

With the core concept of "Green Development & Harmony Win-win", the final aim for open innovation of the Yuchai Group is to satisfy the market needs. As shown in Figure **??**, following international standards, the Yuchai Group satisfied the market needs with environmental protection requirements as the domestic pioneer. The engine, as the maple product in the Yuchai Group, is the key module for innovation; against this background, the group has always kept in line with international standards, paid more attention to technological innovation on more energy-saving in combustion, and spearheaded the domestic technological standards and requirements of the internal combustion machines in China. In sum, the Yuchai Group has used the power of innovation to direct the domestic market needs.

2) Adjustment to the economic system reform in China Alongside the economic system reform in China, the Yuchai Group has re-formulated its organization structure in accordance to the evolution of innovation. The active adaptation to changes may thus have laid a solid foundation for its open innovation to succeed in the institutional reform and product upgrading (See The internationalized Yuchai Group started to transform into a mixedownership enterprise with diverse shareholding structures and adopted the combination of internal and external resources in research, development, production and sales. It built an R&D center, and established strategic alliances with many enterprises and research institutions.

IV.

19 Conclusion and Limitations

According to the literature review and the deduction from the systematic philosophy, the systematic model of open innovation was built to consider all the fragmented factors and the multilevel environment to holistically illustrate the procedure of knowledge input and output, and explain the dynamic process for open innovation. The results show that the dynamic process of open innovation could be divided into four interconnected parts from the systematic view: elements, integration, evaluation of performance and adjustment to the environment. We chose the Yuchai Group as a case study of such an implementation of open innovation: with the mixed tools of the experience analysis of historical records and interviews under the content analysis, we developed an implementation of the systematic model for open innovation in the People's Republic of China. In the case study of the Yuchai Group, the element acquisition are much more than ideas, and the structure integration is bidirectional according to the internal and external relationships of knowledge under the value chain. In addition, the KPI of performance evaluation focuses on knowledge production, not only about the patent production, but also the change of modules as the knowledge base. It is a long and comprehensive process to adapt to changes in both the external marketing environment and the political environment. Therefore, it would be appropriate for organizations to adopt the systematic model for more judicious management of open innovation. Some limitations of this research are of note. The first limitation is the quality of the sample. As only one company was investigated in the case, the representativeness of the sample needs to be amplified and strengthened in future. The second limitation is that our sample is limited in only one of the contemporary state-owned Chinese organizations, which is insufficient to represent all Chinese companies with different types of innovation. Our analysis does not preclude different interpretations in other settings since this research focuses only on inbound open innovation in China. The third limitation of this research is the lack of an econometric model to analyze the relationship between performance and factors affecting it. Although our findings are consistent with the

systematic model, the dynamic process still needs to be further refined, thereby making the causal relationships between related variables more convincing.

Volume XIX Issue VIII Version I The system reform in China

The organizational changes and innovative evolution of the Yuchai Group

From 1953 to 1977, China was under the policy of planned economy.

The Yuchai Group was a labor-intensiveenterprisein 1951.The power machine was the main product of the enterprise in 1969. As the plans of production and categories were formulated by the government, the Yuchai Group lacked independent innovation and produced only the diesel engine which met the basic needs for production.

From1978to 1992, China From 1978, the Yuchai Group had become a self-management enterprise established a market economic system.

with full financial responsibility with its independent innovation, and started the innovation journey according to the market rules.

From 1993 to 2001, China stepped from the age of partial opening to the age of full opening.

Transformed into a Sino-foreign joint-stock limited company in April, 1993, the Yuchai Group became a listed company in New York Stock Exchange to target at foreign funds, cooperated with large foreign enterprises, and promoted internal systematic innovation.

With the flow of foreign capital and knowledge, it has changed its paradigm from imitating to adapting and exploring new methods to improveits innovative capacity, and grew to be a leading enterprise in the production of internal combustion engines in China. [1] [2]

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Figure 1: table 1

[1]The Systematic model(ESFE) for Implementation of open innovation in Yuchai Group in China

[2]Year 2019 © 2019 Global Journals The Systematic model (ESFE) for Implementation of open innovation in Yuchai Group in China

Feature of knowledge Production	(1) Basic university research;(2) -pure -basic research?; (3) with in a single firm;(4)basic university research that is interested in delivering comprehensive explanations of the world, structured in a -disciplinary logic	Universities and -? entrepreneurial university over ial: (1) -Knowledge produced in the context of appl ication ?;(2) -trans-disciplinarity? ;(3)-heterogenei ty and organization diversity ?; (4)-social accountability reflexivity? ; and (5) -quality control?	Socioeconomic, political, technological, and cultural trends and conditions can shape the co-evolution of knowledge with the -knowledge-based and knowledge-driven?, Glocal economy and society.
Organization of knowledge Production	Single discipline-based; Hierarchical and conservative team organization	Trans-disciplinary, involving a diverse range of specialists. Non-Hierarchical and transient team organization	Flexible organization networks within a multilateral, multinodal, multimodal, and multilevel systems approach to the conceptualization, design, and management of real
Evolutionary path of knowledge innovation	Innovation seen as production of -new? knowledge; Research practice should be -good science?. Newtonian model of science specific to a field of enquiry. Research practice conforms to norm of discipline's definition of -scientific?.	Innovation also seen as reconfiguration of existing knowledge for new contexts; universityre presents a partial extension of the business elements to the world of academia, the academic firm could serve as an example for an extension of the world of academia to the world of business.	and virtual, -knowledge stock? and -knowledge flow? modalities. The knowledge is -relativity of truth? in essenceand the path is -pluralism?, such as coexistence, co-evolution, and co-specialization of different knowledge paradigms and different knowledge modes of knowledge production, knowledge use and their resultant co-specialization.
Context	Problem formulation governed by interests of specific communities. Problem set and solved in (largely) academic context.	Problem formulation governed by interests of actors involved in the practical problems. Problem set and solved in application-based contexts.	Problem formulation governed by Glocalsystems within the simultaneous processing of knowledge and innovation at different levels (for example, global, national, and subnational) and the stocks and flows of knowledge with local meanings and global reach.

Figure 2:

2

	Model 1	Model 2	Model 3
Knowledge type	Normative, rule-based, scientific knowledge. Separate knowledge production and application. Dissemination is through discipline-based channels. Quasi-permanent, institutionally-based team.	Knowledge structure of discipline; consensual, continuous, negotiated knowledge. Integrated knowledge production and application. Dissemination is through collaborating partners and social networks. Short-lived, problem-defined, non-institutional team.	Knowledge fractals: -Knowledge fractalsl emphasize the continuum like bottom-up and top-down progress of complexity. Each sub -component (sub-element) of a knowledge cluster and innovation network can be displayed as a micro-level sub-configuration of the knowledge clusters and innovation networks.

Figure 3: Table 2 :

innovation ecosystem,
environment cultivated at the national level.
Experiences from China are typical and useful not
only for the nations that are catching up, but also
most companies that are likewise, because in the
age of fractal knowledge, only a few knowledge tha
company has is leading in the fragmentation of
knowledge.
2) The Yuchai Group has made a great technologi
progress since China's economic reform and
opening up to the world. As a large-sized modern
enterprise, the Yuchai Group has not only integra
the engine-industry chain with the petro chemical

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spectrum of products in China, and the company
processes of knowledge creation has shifted from learning, imitation to innovation, and today many Chi

Innovation thinking models and experience by ideas, behaviors, collatingsemi-structured interviews

Internal innovation by R&D, production, change t

Adaption to open innovation environment

Figure 1: Three Steps for Data Coding

Figure 4:

3

	Number	Gender		Position		Length of employment (year)				Immigration	
		Male	Female	Manager	Worker	?5	5-10	10-20	?20	Local	Immigr
First time	25	20	5	18	7	4	11	8	2	7	16
Second time	30	24	6	20	10	5	10	12	3	7	23

Figure 5: Table 3 :

4

Year Element 2019 8	Where does the R&D(talent, information, knowledge, etc.) come from? University, other companies, National Internal Combustion Engine Association,or government? Does the Yuchai Group have information infrastructure for innovation?	What types of R&D (talent, information, knowledge, etcetera) are of the greatest concern? What is the main channel or derivation of the technological-market information?	What special tools to establish the R&D (talent, information, knowledge, etc.)? How about the technological training of the skilled workers?
Volume XIX Issue VIII Version I (E) - Global Journal of Human Social Science	Structure Functional Environment	Where tocombine the external R & D (talent ,information, knowledge, etc.) into the internal innovation and production process? Which moduleismainly focused on for innovation? Where is the value chain that affects the function to the greatest extent? Does the information technology satisfy the need of the enterprise? Does the Yuchai Group have strategic planning for the industry of internal combustion engines? Where are the opportunities and challenges in the environment? Where is the market for the Yuchai Group? What level are the Yuchai Group competing for, local, regional, national, or international? What do you think about the political environment? What do you mainly think the market adaptation of Guangxi Yuchai Group?	What standards to use and combine the inbound elements? What standards to outbound R&D (talent, information, knowledge, etc.)? What are the dimensions for performance management ? What are the problems in management for the innovation in the industry of internal combustion engines? What problems have the Yuchai Group encountered in open innovation? What is the technologi callevel of the Yuchai Group? Compared with the same industry, to what extent dotechnical gaps exist in the Yuchai Group? What is the position of the company in the competition environment? What mainly are the customers' new requirements for Guangxi Yuchai Group? What are the reasons for the success of Guangxi Yuchai Group industry of internal combustion engines? What is the threshold for entering the industry of internal combustion engines?	What tools can be used to combine the elements and the products? How to implement outbound in novation and inbound innovation? What is the special in performance management in open innovation? How about the quality management in internal combustion engines? How about the speed of production for new products of the enterprise? How about the O2O logistics development of the industry of internal combustion engines??

Figure 6: Table 4 :

of heavy commercial-vehicle diesel engines" in 2008, "key technology research and prototype development based on

In 2011, the Yuchai Group established a production base for marine engines in Zhuhai and Ziyang with Wärtsilä Corporation and China South Locomotive & Rolling Stock Corp. Ltd. respectively. 4) Public R&D acquiring It is an important channel to apply for public funds for open R&D which could enrich the capital for innovation.By2010, the Yuchai Group had acquired more than 110 million RMB sponsored by the government to focus on the technological innovation,

technology transfer and standards, which dictate the trend of demand for innovation and the foreseeable market. For example, during 2004-2012, the Yuchai Group had had 10 projects from 863 National Science and Technology Innovation Programs(such as "product development of the CNG engine for large-scale buses" in 2006, "technology development

Figure 7:

5

Year 2019 10 Volume XIX Issue VIII Version I E) (Global Journal of Human Social Science -	Module R&D module Production module © 2019 Global Journals	Scale for Competition International level Domestic level in China	Relationship of Knowledge	Model of Open Innovation

Figure 8: Table 5 :

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Year	The rate of gross profit of the Yuchai engine	The average rate of gross profit in China	The sales volume of the Yuchai diesel engine	The average sales volume of diesel engines by firms in China
1998	-	-	50268	23828
2006	9.50%	6.29%	104674	72857
2013	12.34%	8.80%	178620	155721

Figure 9: Table 6 :

7

	The quality of sales knowledge is superior to the ones in west China.	Outbound for business model innovation: 1) Increase the number and service networks of its agents and distributors out of the region via information technology. 2) Build a market end integrated with sales, service, accessories and information and assess the agents regularly
		3) Export standardized sales and service knowledge to the other regions via training in training centers and distribution of service centers and accessories logistic centers.
		Year 2019
		11
		Volume XIX Issue VIII Version I
		E)
		(
		Global Journal of Human Social Science -
	Diversity of modules	
Development stage	*represents the newly added modules	Specialization of modules
The initial stage(1978-1992)Strategic enterprise	R&D module Production module: including Engine module, Automotive	R&D module: Developed the turbo-diesel direct injection engine. Production module: The production ability is 6000 YC61050Q
		diesel engine. The conversion to the 6105QC
		© 2019 Global Journals

Figure 10: Table 7 :

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			The Systematic model (ESFE) for Implementation of open innovation in Yuchai Group in China automotive diesel engine was a success. Sales module: Exported the engines to Vietnam and Singapore for the first time. After-sales service: First released the three guarantees for engines, which was a pioneer in the industry. R&D module: Established the systematic reliability engineering of refined production
Year 2019	The development stage (1993-2001) Sino-foreign joint-stock company	R & D module Production module: including Engine module, Automotive module, Mechanical engineering module, Energy chemical module, Parts module; Logistic module Sales module After-sales service module	and adopted the project of replacing the diesel engine with gasoline engine and firstly explored the electronic control technology of diesel engine and reached the standards of Euro? and Euro ?. Production module: Produced rear-engines equipped with buses. Sales module: Developed five more specific markets including heavy machinery, light-
12			industry machinery, buses, engines for general purposes, and export markets. After-sales service module: Established a customer service center and pioneered the repair process of engines. R&D module: Developed three core technological plat forms of the combustion system, calibration system of electronic
	The mature stage (2002-) A mixed-ownership enterprise with a diverse shareholding structure	R & D module; Production module: including Engine module ,Automotive module, Marine power module, Mechanical engineering module, Energy chemical module, Parts module;	control engine, and power train packaging. Also developed smaller and lighter engines. Production module: Developed 27 series of products with a total of over 2000 kinds of products, covering the markets of trucks, buses, passenger vehicles, mechanical engineering, industrial equipment, agricultural

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