Research on the Pattern of the Responsible Innovation of Dalian High-Tech Enterprises

Jing Yu¹*, Qian Wang² and Li Yingda³

¹Dalian University of Technology, Dalian, Liaoning, 116024, PRC
²Dalian University of Technology, Dalian, Liaoning, 116024, PRC
³Dalian Neusoft University of Information, Dalian, Liaoning, 116024, PRC

*yujing_yj@126.com

Abstract. Responsible Innovation is a new idea about development which has been valued by many countries in recent years. The pattern of the responsible innovation of Dalian high-tech enterprises is discussed with the theory of responsible innovation. It is elaborated firstly from the perspective of the coordination mechanism of enterprise benefit community in Dalian High-Tech Zone (DHTZ) which includes employees’ benefits, the interest relationship between enterprises and consumers, and stakeholder organizations. Secondly, the guidance for responsible innovation from DHTZ is stated from the view of institutionalized guarantee, participation of the public and enterprises in democratic decision-making, and supervision mechanism. After that, through many cases analysis, the process of different kinds of enterprises’ responsible innovation practice within DHTZ is revealed. The last part is the summary and prospect of the pattern of the responsible innovation of Dalian high-tech enterprises.

1. Introduction

"Responsible innovation" theory is an idea about development proposed by international academic fields, it’s the combination of technical innovation and corporate social responsibility, and has been listed into EU 2020 [1]. Many countries embarked on an in-depth and extensive research on the theory and practice. In China, Dalian high-tech zone enjoys the advantages of attracting the investment of Chinese high-tech and foreign industries. With the rapid economic development brought by technical innovation, in the face of the subsequent problems, Chinese government emphasizes that technical innovation should suit for social expectations and values, putting forward "rule by law" also provides an appropriate institutional environment for Responsible Innovation [2]. Recent years have seen the efforts made by DHTZ in attaching importance to social responsibilities, environmental protection, scientific and democratic decision making, systematic and orderly development of technical innovation and so on. Study on the technical innovation in this zone from the perspective of responsible innovation will lead to the agreement between some successful experience and the idea of responsible innovation, as well as some problems that need to be improved. To summarize the experience and problems with the theory of responsible innovation will play a profound role in improving the holistic ability of Chinese industries in technical innovation and constructing a harmonious society.

2. The theoretical foundation of the responsible innovation of Dalian high-tech enterprises

Responsible innovation is mainly about the tight link between social responsibilities of industries and technical innovation, accessing the various elements influencing technical innovation from an ethical
angle so as to ensure the continuity and social acceptance of the innovation. The member of European Commission Von Schomberg describes Responsible Innovation as follows: “A transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the ethical acceptability, sustainability and societal desirability of the innovation process and its marketable products, in order to allow a proper embedding of scientific and technical advances in our society” [3]. Responsible innovation in Dalian high-tech zone has been developed within Dalian society and culture and therefore has carried a specific development pattern, which is as universal as the general idea of international responsible innovation and meanwhile is special and adjusted specifically to Chinese social culture.

From the perspective of responsible innovation, theoretically, the pattern is based on some ideas advocated by the government and agreed upon by many administrators of industries in this zone. They are listed as follows: Firstly, high-tech industries, while creating wealth for the society, are increasingly consuming natural resources and power and exerting great influence upon the ecology. Nature is the foundation of human existence and development and whether it’s good or not will decide human’s living quality. Severe environmental pollution will endanger humans’ survival. Therefore, high-tech industries, with their own advantages of developing new technology, need to take the lead in reducing power consumption and the emission of three wastes, carry out hygienic production, and develop products that save power. In this way, the tension between nature and shortage of resources will be relieved. Secondly, high-tech industries are characterized by their pursuit of innovation in knowledge and technology, which not only requires them to have the ability to innovate but also to choose actively the technology agreeable to social values and the way of realizing this technology. Responsible innovation of high-tech industries mainly includes technical and ethical responsibility, product and service responsibility and environment and resources responsibility. High-tech industries, as the major force in technical innovation, should consider, predict and assess the possible social consequences brought about by the application of scientific knowledge, so as to avoid the threats to the society and human beings posed by improper application of high technology. Thirdly, the biggest difference between the products and service offered by high-tech industries and other industries is that the former are more specialized and it takes some time for common consumers to use and accept them. As a result, the product and service responsibility refer to, on the one hand, providing safe products and service, and on the other hand, making them more user-friendly. Fourthly, high-tech enterprises should focus on the needs of stakeholders and the influences of decision-making in product design and development, solicit the opinions from stakeholders before and during the decision-making process, absorb related opinions into decision-making, and feedback after the event, so as to embody the social responsibility for the stakeholders in the process of technical innovation.

3. Coordination mechanism of enterprise benefit community in Dalian High-tech Zone

Due to their particularity, high tech enterprises should shoulder more social responsibility than traditional enterprises do in terms of the employees’ generality and the products’ social influence, and should coordinate effectively its relations with the stakeholders such as employees, other companies, and consumers etc. Relevant coordination mechanism has been established in DHTZ.

3.1 Coordination mechanism of employees’ benefits

Some enterprises in DHTZ improve high-tech zone government to carry out agency system of employee’s interest appeal, in order to effectively safeguard the rights and interests of employees and stakeholders, and create an fair, just and democratic development environment. Aiming at prominent problems arising from agency, government, together with labor union, political-legaldepartment, socialsecurity institution, safety production supervision institutions, establishes jointconference for employee’s safeguarding their legal rights. This joint conference is benefit for solving main points and difficult points, to combine technology innovation with fulfillment of social responsibility in enterprises organically. Making full use of the trade union and the workers and staff congress, DHTZ carries out the standardization of wage collective negotiation system. After an eight-month research and salary
analysis of 100,000 employees from more than 300 enterprises, through many wage negotiation seminars and coordinative meetings, the collective bargaining agreement was finally reached in 2013. The minimum wages involved in the contract go up 64% ~ 177% higher than the local standards. The enterprises and employees formed a mutual interest adjustment mechanism of income distribution between enterprises and employees [4].

3.2 Coordination mechanism of the interest relationship between enterprises and consumers
DHTZ lead the enterprises to bear a great responsibility in providing consumers with quality and cheap, safe, comfortable and durable commodities to satisfy their material and spiritual needs. Corporate images have a great influence on customers’ buying motivation, which in turn intensifies the competition among companies. The mutual compatibility of enterprises’ and consumers’ profits has become an important criterion for the society and market to evaluate corporate images. For examples, IDT Software Co Ltd (IDT), a high-tech company founded by Dalian University of Technology in DHTZ, has always been adhering to the philosophy of "people-oriented, customer first". IDT solicited customer feedback and made corrections repeatedly by sending professional teams to do on-spot work, which increased the cost significantly. However, IDT won the trust of society and consumers with its high-quality products and responsible attitude, and was selected one of the Top 20 Dalian "high-tech, high-growth" enterprises organized by Deloitte [5].

3.3 Coordination mechanism of stakeholder organizations
DHTZ encourages the enterprises to develop industry-university-research collaboration with universities and scientific institutions. For example, Dalian Rongke Power Co. Ltd (Rongke) started its cooperation in full vanadium flow energy storage technical innovation with Dalian Institute of Chemical Physics of Chinese Academy of Sciences, and attracted suppliers to join in the technical innovation process. In dealing with the relationship with the suppliers, Rongke adopted a "proactive strategy". By bringing the suppliers into the product planning team, it enables the suppliers to better comprehend the process and direction of the company’s technology innovation and to put forward innovative plans that benefit the interest community, this ensured the continuity and stability of large-scale use of renewable energy generation and supply [6]. As the world's largest power and maximum capacity system, which was developed by the stakeholder organizations, the full vanadium flow energy storage system ran successfully in 2013, and had been approved as the national scientific and technological achievement. Dalian Bio Integration Technology Inc. (BIT) included suppliers into the design department, enterprises and suppliers make decisions together and share the profits with each other. BIT attracted suppliers to design and develop cooperatively, they reached a one-stop solution to a variety of issues from the process of oil extraction and pollutants treatment, through the biotechnology methods in conjunction with suppliers’ long-term practice in the oil industry, which achieved win-win for both BIT and the suppliers [7]. Dalian Catalytic Engineering Technology Co., Ltd. adopted similar strategies to make decisions by related stakeholders, which not only reduced the environmental pollution, but also improved the output efficiency. Technical innovation mode of enterprises in DHTZ is changing from being influenced by the stakeholders to being participated in by them, promoting mutual understanding between enterprises and encouraging fulfillment of obligations.

4. Guidance for Responsible Innovation from Dalian High-tech Zone Government
Technical innovation of enterprises not only is the conscious, initiative act by enterprises, but also needs guidance and promotion by government. Guiding role of government still makes a significant difference in the existing economic activities, because China is a developing country transited from planned economy to market economy. Therefore, it is likely that technological innovation model of "government-oriented" is different from technology innovation of enterprises in western countries. The promotion of government to enterprise’s responsible innovation is particularly important in circumstances that it couldn’t depend entirely on self-conscious of enterprises to fulfill the social responsibilities. Actually, the development plan of DHTZ is dominated by local government, and
formulated in conjunction with related business and the public. In the process of making development plan, it emphasizes social responsibility and environmental awareness of enterprises, and pays attention on scientific verification and democratic decision-making, which embodies the idea of "responsible innovation". DHTZ plays a dominant role in policy support, media propaganda, market supervision, international cooperation, and facilitates concrete implementation of enterprise’s responsible innovation.

4.1 Institutionalized guarantee for Responsible Innovation
Based on the sustainable development of the industry, DHTZ innovated its institution, provided institutional guarantee of "responsible innovation". While laying out the industries, DHTZ government put forward three criteria in harmony with the theory of responsible innovation. First and foremost, such basic demands as low carbon economy and environmental protection must be met; secondly, some social benefits should be acquired and after those two goes the pursuit of industrial expansion and economic benefits. Therefore, the zone has severely limited the residence of those high-tech projects with high profits but serious environmental pollution and developed low carbon industries. High-tech zone government constantly expands investment in environmental protection, strengthens ecological environment construction, and executes "one-vote veto of EIA (environmental-impact assessment)" keeping away from pollution sources [8].

4.2 Participation of the Public and Enterprises in Democratic Decision-making
In the course of guiding enterprises to fulfill the social responsibility, DHTZ formulates industrial policies through scientific verification and solves problems arising from executing policies through democratic decision-making. Before decision-making, they hold enterprise forum in order to know enterprises’ opinion about current policy and their expectation and suggestion about new policy. In the meantime, they seek to "think tank" of policy, namely the support of advisory bodies. The "think tank" could communicate with them on the orientation of new industrial policies and the implementation of policies. After forming a preliminary scheme, it will enter the democratic decision-making procedure, in which the public representatives should regularly know the achievement of DHTZ. Since the year 2013, the sections of soliciting public opinions in advance, participating by stakeholders during the process, and publicizing the results after the event are added.

4.3 Supervision mechanism of "responsible innovation"
In DHTZ, the approved projects and industries in the zone should be assessed on environmental impact, and supervised whether their production behaviors have a negative effect on environment or not. Those resource-consumption and low value-added enterprises has been relocated and reconstructed by stages and groups, aiming to develop new industries such as lightly-polluted, cost-advantaged and high value-added industries, and thus optimize the industrial structure further. For major projects, according to, it will be restricted in production and production. Through improving both inspection and reporting system, perfecting the management in environmental monitoring file of major hazards units, and enhancing their capabilities in risk prevention of technological innovation and emergency response constantly. It also need to standardize "inspecting system" and "reporting system", and improve the files of environment supervision of hazardous enterprises, in order to improve ability of risk prevention and emergency disposal during technology innovation of enterprises, the EIA implementation rate of new project reached 100% for many years [9].

5. Responsible Innovation Cases of Dalian High-Tech Industries

5.1 Responsible Innovation Cases of Culture Industries in DHTZ
The zone attaches importance to guiding the technical innovation of culture industries. Take Dalian New Vision Media Co., Ltd. in DHTZ and its product creative development with "AR Magic Cards" for instance. This corporation fulfills corporate social responsibility (CSR) to the utmost in its product development and innovation. "AR Magic Cards" are early childhood learning products developed by
New Vision Media Co., Ltd. Sticking to the designing principle of "children-orientation" and the aim of "children happy, parents relieved" during the research and development process, the enterprise meets not only business needs in terms of product designing, material choosing and manufacturing, but also the needs of society such as safety, environmental protection, scientificty and reasonability. Firstly, the size, shape and material of the cards are in accordance with children’s health and physiological characteristics. Size of the cards was 5.8*5.8cm, 1.2mm thick. After many experiments, the design team enlarges the size and replaces the ordinary paperboard with environmental friendly checkered paper. Although it costs more, the image recognition acuity increases by 30% to suit children better. In case children might put the cards into their mouths, the design team is very particular about the printing ink. It uses safe ink in printing and non-toxic bone glue in binding. The extra cost ensures the health of children users, and meanwhile establishes the good reputation of high product quality and corporation responsibility. Secondly, the details are designed to suit the needs of children more than two years of age. To protect the eyesight of children, 15-minutes eyesight protection reminder is set, so every 15 minutes, soft children’s songs are played to remind the children to rest their eyes. Parents can also control the time to help children protect their eyes. What’s more, safety issue is given priority when designing the holder. Children couldn’t pull up the holder by themselves without parents’ help since it needs some physical strength. And this avoids the accident of hands nipping. Besides, one of the inside joints was un-covered in the original mold of the holder, so it didn’t feel smooth. Although it is inside the holder and children rarely touch it, the designing team destroys the entire mold and makes a new one which covers all the edges of the holder in order to avoid the potential possibility of scratching children’s fingers. Despite the cost increase, the products are safer and more reliable. The hanger has now been patented nationally [10].

5.2 Responsible Innovation Cases of Electronical Industries in DHTZ
DHTZ encouraged electronic enterprises to save energy and emission reduction. For example, Hualu Company strived to achieve common developments in environment, society and business, by promoting green design, development, procurement, manufacturing and operation actively. Since 2003, all the products have been lead-free with a 100% replacement rate of harmful substances. In order to save resources and protect the environment, the company reduced the number of parts and the weight of packages and accessories in development and design of new product, basing on the principle of source reduction. In the process of selecting materials, Hualu emphasized the use of recycled materials, which increased the material recycling rate from 66.9% to 83%. Chinese Hualu Group has introduced advanced equipment in using solar energy and recycling gas heat, adopted low-energy and low-consumption measures, focused on developing energy-saving products. It developed a series of technologies in energy conservation and emission reduction, reducing the consumption of diesel by 10% [11]. Hualu used the green energy mark widely in its product promotions, which educated the consumers easily and clearly of the great harm of heavy metals like lead, mercury and some flame retardants from the electrical appliances to the human body and the soil, and helped the consumers establish a habit to choose green products with benefit to both the people and the environment.

5.3 Responsible Innovation Cases of Logistics Enterprises in DHTZ
DHTZ encouraged traditional companies to take the social responsibility into account while exploring their business model and achieving the transformation and upgrading, as to ensure their healthy and sustainable development. Take Tader Logistics Ltd (Tader) as an example. The company targeted to be a socially responsible corporation. By building green supply chain services and integrating social responsibility into the corporate culture and organizational strategies, Tader provided the customers intensive, efficient and environmentally friendly coal supply chain management services, avoided the serious pollution from the inefficient coal circulation, and achieved energy conservation. Supported by culture based on mutual trust in supply chain management, Tader built and shared the business environment of integrity together with upstream and downstream supply chain enterprises, and a highly competitive strategic alliance has been formed. In the second half of 2008, the profit margins of coal
enterprises have been greatly compressed due to the global financial crisis. But Tader was still stuck with the customer win-win principle, enabling satisfactions of customers and partners on profit distribution. Tader doubled its growth over the past few years, and won the "national corporate culture demonstration base" title in 2009. Tader's strategic thinking and innovative business model has got attention of the Development Research Center of the State Council and has been identified a specific research topic. During the visit to China in July 2009, Peter Senge, one of the world renowned management scholars, said that Tader’s successful business experience has provided a good case for sustainable development around the world [12].

6. Conclusion and Prospect
Now, the responsible innovation activities are still moving in Dalian High-tech Zone. The "responsible innovation" pattern is mainly guided by the government macroeconomic control and secured by relevant policies and regulations. Different protocols and standards of responsibility are proposed for different types of innovative enterprises. It is a responsible innovation process implemented through the participation, coordination and negotiation of all stakeholders for enterprises that innovate in different ways. Proceeding from the reality of economic and social development in China, the government-oriented "responsible innovation" model is convenient for macro-control and the overall benefits. This still need to keep cultivating companies’ consciousness and initiative. The activities of responsible innovation in Dalian High-tech Zone are still evolving. There are some imperfect and immaturity in the depth of understanding the concept of responsible innovation, building the innovative evaluation and incentive mechanism and in the promotion of the institutionalization of responsible innovation, etc., which need to be remedied in future practice.

References
[1] Nicaise I 2011 EU 2020 and social inclusion: Re-connecting growth and social inclusion in Europe Soziale Politik—Soziale Lage—Soziale Arbeit: Springer p 148-68
[2] Wang X 2014 Comprehensively promoting the rule of law and building China under the rule of law Tianjinrenda Journal 148 p 7-9
[3] Von Schomberg R 2013 A vision of responsible research and innovation Responsible Innovation p 51-74.
[4] Propaganda and Education Department of Liaoning Province Union 2012 The "union phenomenon" in Dalian High-tech Zone - an investigation of union work in Dalian high-tech Zone China Gongyun Journal 5 p 29-32
[5] Yitian was once again selected as the top 50 high tech and high growth enterprises of Deloitte [J/OL].Yitian Software Website.2014-11-21 http://www.idt.com.cn/info/1073/2220.htm
[6] Zhang H and Wang X 2013 Latest research progress of all vanadium liquid flow battery technology Energy Storage Science and Technology 2(3) p 281-8
[7] XING M 2009 Aiming at the problems of oil enterprises and take actions China Science and Technology Fortune Journal 8 p 32-5
[8] Ma X and Xu Y 2008 New development trend of high-tech industrial parks in China - take Dalian Hi-tech Zone as an example China Science and Technology Forum 3(3) p 60-85
[9] Dai X 2009 Review and Reflection on the construction of Dalian ecological city Dalian Cadre Journal 25(7) p 11-5
[10] Delegate Speech of Dalian Xinrui Tiandi [J/OL]. Sina Technology. 2010-09-09 http://tech.sina.com.cn/chuangye/2010-09-09/16564639056.shtml
[11] Wang X 2008 Develop green products and conduct green operations Green Olympics and Clean Development Symp., p 102-110
[12] Hou Y and Liu X 2009 Cultural chain, supply chain and value chain - congratulations to Dalian Taide Coal Networks for winning the title of "National Enterprise Culture Demonstration Base" in 2009 China Coal 35(9)p 114-5