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Problems and Strategies in the Development of Liaoning Equipment Manufacturing Industry

Zou Hua and Sun Jian
School of Management, Shenyang University of Technology, Shenyang 110870, China

Abstract: Equipment manufacturing industry is the strategic industry and reflects the development level of industrialization. According to the problems are existing in the process of liaoning equipment manufacturing industry development, such as new type of equipment manufacturing S and T innovation being weakness, lacking of senior R and D staff and technology upgrading. We provide some policies from S and T innovation and technology upgrading affecting, production-study-research cooperative innovation and policy support and so on. At the same time, using the factor analysis model to analyze the status of liaoning equipment manufacturing industry and its S and T innovation level. The core innovation is "three stages: of S and T innovation and technological upgrade coupling development, compared with the previous research work of equipment manufacturing industry related innovation.

Key words: Liaoning equipment manufacturing industry, S and T innovation, technical upgrading, coupling

INTODUCTION

As the 18th National Congress of the Communist Party of China puts forward the deepening of reform and opening up development goals and implementing innovation drive industry. S and T innovation will be on the global development the core position of the national. Liaoning province is an important part of northeast old industrial base. The effective development of science and technology innovation is the main driving force of rejuvenating northeast old industrial. Liaoning approved as a pilot province by the national technical innovation project in 2010. Its theme is around liaoning equipment manufacturing industry base construction. The goal is improving equipment manufacturing enterprise technological innovation ability and core competence. Consolidating the position advantage of liaoning equipment manufacturing industry and realizing the industry structure adjustment. The product and industrial structure adjustment of liaoning province as the main direction of scientific research program in 2011. Especially it has overcome many of the key components and core technology in the field of equipment manufacturing. Liaoning equipment manufacturing industry improves competitiveness and scale cluster development from the function of technology innovation system on the degree of approximation of new combination. Forming technology upgrade and coordinated development of S and T innovation strategy. Ultimately promote the market competitiveness and sustainable development ability.

Scholars on S and T innovation in the equipment manufacturing industry carried out the corresponding research Shao and Tao (2009) pointed out that there were some certain problems in the system innovation of liaoning manufacturing and promote independent innovation to form the equipment manufacturing industry of high-end innovation mechanism Wang and Sun (2007) used the principal component analysis to build the equipment manufacturing industry technological innovation ability evaluation system, through the analysis found that equipment manufacturing industry of S and T innovation needed improving. Meng *et al.* (2012) analyzed the development situation of liaoning equipment manufacturing-industry and pointed that Liaoning equipment manufacturing industry cluster road from promoting technology innovation is the key (Li and Jiang, 2010) used the horizontal and vertical comparative analysis of the current situation of liaoning equipment manufacturing industry technological innovation and pointed out that the important reason for the slow development of liaoning equipment manufacturing industry's technology upgrades below the level of innovation and there were some problems in the development of the S and T innovation.

PROBLEM ORIENTED RESEARCH

Facing the problems of liaoning equipment manufacturing industry technological innovation: For fist of all, the equipment manufacturing industry of the

Corresponding Author: Zou Hua, School of Management, Shenyang University of Technology, Shenyang 110870, China

new-type industrialization'S and T innovation is needing to break through the bottleneck. The focus of liaoning equipment manufacturing industry development is a major technical equipment. However,new type of equipment manufacturing industry is relatively slow, such as environmental protection equipment and software and so on. Its innovation ability and social influence are small. New type of equipment manufacturing industry in liaoning accounted for 4.36% of total assets now, which is the national average of 68.8 and 44.8% of Shanghai. Although the new type of equipment manufacturing industry in liaoning has a certain foundation in science and technology innovation, but the existing S and T innovation's ability could not support the liaoning equipment manufacturing industry the implementation of the new type. Existing innovation industry development pattern and the traditional equipment manufacturing industry upgrade and renovation of the matching degree is low.

What is more,the equipment manufacturing industry is being lack of high-end R and D technical personnel and leading enterprises. According to the statistics of 2012, Engineering and technical personnel are on proportion of the total number of staff that are only 6.9% in liaoning equipment manufacturing industry and the brain drain phenomenon is more and more serious. Because of high-end professional R and D talents are insufficiency, many companies have not established jointly by all kinds of talent support of engineering and technology center. With the international first-class level of leading enterprises is deficiency. Production incomes in the leading enterprises are only a fraction of the giant enterprises in the same industry in the developed countries now. So that its self-sufficiency rate of liaoning equipment manufacturing industry of the core technology is low and the technology upgrade is slow.

Finally, technological upgrading investment is insufficient and the introduction of advanced technology digestion and absorption utilization ratio is low. According to statistics, Liaoning equipment manufacturing enterprises' technology introduction and absorption are on low proportion, which is only 1:0.07. There are lacks of trust during liaoning equipment manufacturing enterprises, information asymmetry and innovation resources sharing are difficult to achieve. Leading to the liaoning equipment manufacturing industry in technological upgrading is slow and innovation resources allocation efficiency is low.

Status analysis of liaoning equipment manufacturing industry: The relevant data of equipment manufacturing industry reduce the dimension by using factor analysis method. Though looking up relevant yearbook data in this paper and finding a competitive position of liaoning province in the national equipment manufacturing industry. According to the China industrial economic statistical yearbook 2012, it includes seven equipment manufacturing industry of the country's industrial output data. Dealing with the data by SPSS software, then obtain the result of comprehensive scores by using the factor analysis method. Extract the top 10 results as shown in Table 1.

We can see from the table that liaoning equipment manufacturing industry is on the top. But, seven branches industry development are not synchronized. Individual equipment manufacturing industry development lags behind and has an obvious gap in jiangsu province. Now we still have not into the ranks of innovative country. Only six provinces or cities entered the stage of innovative region. These regions include jiangsu, guangdong, Shanghai, Beijing, tianjin and zhejiang.According to summarize The Regional Innovation Capability Report, innovation ability is ranked the top seven: jiangsu, guangdong, beijing, shanghai, zhejiang, shandong, tianjin. We find that the position of them have no change. Liaoning has been from nine to eight. This is because many major projects of liaoning equipment manufacturing industry have made historic

Table 1: A typical regional equipment manufacturing parallelism

Region	Manufacture of general purpose machinery	Manufactu-re of special purpose machinery	Manufact-ure of transport equipment	Manufacture of electrical machinery and equipment	Manufacture of communi-cate on computer and other electronic equipment	Manufacture of measuring instrument, machinery, for cultural and office work	Manufacture of metal products	Comprehe nsive factor score	Ranking
Jiangsu	6492.06	3930.77	7639.20	11653.06	14862.25	2454.89	3829.26	2.825186	1
Guangdong	2138.14	1626.43	5498.96	10021.38	21496.20	1533.17	4377.84	2.685521	2
Shandong	6974.96	3671.01	5783.81	4588.44	3608.06	438.14	2274.36	0.939067	3
Zhejiang	3918.90	1324.08	3867.98	5099.90	2181.56	727.44	2089.82	0.560577	4
Shanghai	2596.90	1254.24	5024.93	2164.37	6085.22	361.14	917.45	0.436875	5
Liaoning	4249.71	1784.58	3306.24	1805.09	931.00	190.45	1402.49	0.169351	6
Henan	2208.27	2130.89	1919.32	1542.10	699.33	241.88	785.10	0.066868	7
Hunan	1206.62	2493.25	1142.63	928.54	719.72	270.79	564.88	0.035690	8
Sichuan	1874.07	1002.93	1501.73	985.90	2029.60	79.09	758.33	-0.029054	9
Fujian	794.210	560.890	1223.49	1190.95	2683.63	234.07	560.52	-0.034092	10

Data from China industrial economic statistical yearbook 2012

achievements on S and T innovation. From what has been discussed above, we can see that the development level of the equipment manufacturing industry has close relationship with S and T innovation investment. Liaoning equipment manufacturing industry S and T innovation development pattern have not attained the standard of the innovative area. Most of the equipment manufacturing industry's upgrade technology input and technological innovation are not synchronized. It has influenced liaoning equipment manufacturing industry market competitiveness and sustainable development ability. Therefore, coming up with an idea that liaoning S and T innovation and technology upgrading coupling's synchronous development. Pointing out the direction for development of liaoning equipment manufacturing industry.

COUPLING DEVELOPINT OF "THREE PHASE" STRATEGY IN LIAONING EQUIPMENT MANUFACTURING INDUSTRY

Liaoning is a big province in equipment manufacturing industry. The development of S and T innovation is the key to the liaoning towards an innovative region. In order to further study the liaoning equipment manufacturing industry development status and technological innovation and technological upgrading of synchronous development. This article refers to the data on China statistical yearbook of S and T 2012.

We can be seen from Table 2. Liaoning equipment manufacturing industry of S and T innovation and upgrade technology have a deep gap among those domestic equipment manufacturing industry have developed rapidly provinces. On the one hand, R and D personnel are shortage in liaoning equipment manufacturing enterprises. The equipment manufacturing industry research institutions is insufficient. Industry-university-research cooperation mechanism is imperfect. R and D project investment in scientific research and innovation should be enhanced. On the other hand, liaoning equipment manufacturing industry technology upgrade costs 468.87 million yuan. The investment is greater than guangdong, shandong and zhejiang. The technology upgrading of equipment manufacturing industry in liaoning in finance ranks high in the country. We can see from the above analysis that the status of liaoning equipment manufacturing industry is technology upgrading greater than the magnitude of the S and T innovation investment.

S and T innovation and technology upgrading of equipment manufacturing industry have the effects on coordination development. The equipment manufacturing industry technical transformation and absorption are on behalf of the level of coordinated development, such as data showed in Table 2. The equipment manufacturing industry competitiveness is following technology absorption and transformation of the input costs change. Both of that are low in liaoning equipment manufacturing industry. This suggests that the coordinated development of S and T innovation and technology upgrading are shortage.

Therefore, liaoning equipment manufacturing industry should enhance S and T innovation and technological upgrading coordinated coupling development. Only promote technology upgrading, it would lead the progress of the R and D research and innovation to drag technological upgrading. Finally, it will hinder the development of liaoning equipment manufacturing industry.

The analysis shows that S and T innovation and technological upgrading is not coordinated development in equipment manufacturing industry. It is an important factor to restrict the development of liaoning equipment manufacturing industry. As a result, liaoning equipment manufacturing industry technical upgrading and S and T innovation coupling development mode in this paper. We call it "three phase" strategy. As shown in Fig. 1.

The first stage is the present stage development model. Its main characteristic is having some S and T innovation base. The investments are more in equipment manufacturing industry technology upgrade to some

Table 2: S and T innovation and technology upgrading of the typical equipment manufacturing industry in contrast

Region	Equipment enterprise R and D personnel	No. of equipment manufacturing enterprise R and D institutions	Expenditure for assimilation of technology (million)	Spending on R and D project (million)	Equipment manufacturing enterprise technical renovation costs (million)	Cost of technology upgrades (million)
Jiangsu	79683	1229	73868	18249272	960814	198574
Guangdong	179117	1111	12117	45250804	196631	43284
Shandong	29244	362	19098	8553119	182130	21246
Zhejiang	41738	935	13871	8078933	284663	22462
Shanghai	19051	206	16268	5253120	94274	65658
Liaoning	7066	77	471	3852407	100955	46887
Henan	9827	190	1936	1170623	46128	20849
Beijing	18049	256	1504	5177883	41750	58739

Data from China S and T statistical yearbook 2012

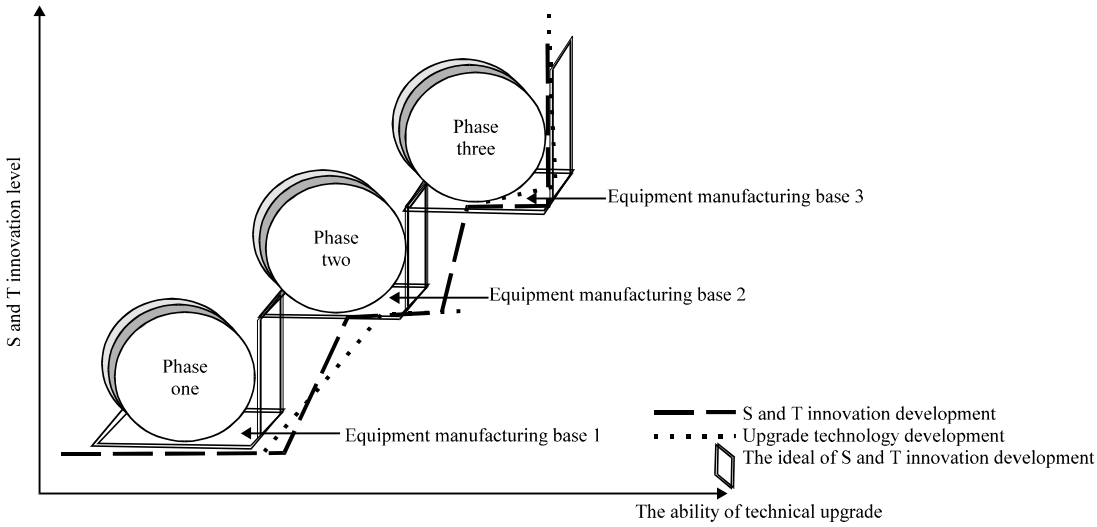

Fig. 1: S and T innovation and technology upgrading coupling development "Three Phase" in liaoning equipment manufacturing industry

extent. Some enterprises of equipment and key technologies still maintain the state of more than a decade ago. Equipment manufacturing enterprises in technological innovation and technological upgrading are rarely synchronized development. Equipment manufacturing enterprise technological innovation and technological upgrading to the intersection point in Fig. 1. This point is called the "coupling point".

The second stage is the domestic leading development model. Enterprise on the technology upgrading, equipment updating and S and T innovation have developed to a certain extent in this stage. Equipment manufacturing enterprises' development begins to take shape and get considerable economic benefit. The equipment manufacturing industry is the leading market position in the domestic. Most of the equipment manufacturing enterprise technological innovation and upgrading have synchronized development.

The third stage is the internationalization development model. It is also known as "catch-up", means that catch up with European and American country advanced equipment manufacturing industry development pattern. Equipment manufacturing enterprises' technological innovation and upgrading have synchronized development in this stage. It has reached the final requirements of coupling developing. At this time, the equipment manufacturing enterprises' S and T innovation not only can achieve the desired level, but also can updating rely on independent innovation and technology. It could be changing the state of technology import to outsourcing and technological monopoly. Eventually it will enhance China's place in the world.

According to the above conclusions of the model that liaoning equipment manufacturing industry want to break through present status, S and T innovation and technological upgrading coupling development are imperative.

DISCUSSION

Policy suggestions: Based on the quantitative analysis and the development of S and T innovation and technology upgrading coupling three phase model, it will be from the equipment manufacturing enterprise's policy, market, culture and other aspects in this paper. Giving some countermeasures to improve the development of S and T innovation and technology upgrading coupling development countermeasures.

At first, the position should be set up the development of S and T innovation and technology upgrading. Laoning equipment manufacturing industry wants to have a position in the international market and be on road of creation in liaoning. It should give full role of S and T innovation and technology upgrading coupling development. The more S and T innovation investment, the more coupling develop. More economic profit will gain by the equipment manufacturing enterprises. Hence, S and T innovation increase investment, technology upgrading widen the channel and establishing S and T innovation and technology upgrading coupling development system is the key.

Secondly, paying attention to industry-university-research cooperation innovation and strengthening S and T innovation talents team construction. Liaoning equipment manufacturing industry's S and T innovation and technology upgrading coupling development cannot leave the cooperation with universities and research institutions. Form a perfect resource sharing among industry-university-research and collaborative innovation mechanism. Meanwhile, liaoning equipment manufacturing enterprises should continuously introduce and train high-tech talents. Innovation teams are provided to the liaoning equipment manufacturing industry in the development of S and T innovation and technology upgrading coupling.

Finally, policy support and shape innovation culture is effective guarantee. The government's policy plays an important role in S and T innovation and technology upgrading coupling development of liaoning equipment manufacturing industry. Innovation culture also can promote the liaoning equipment manufacturing industry S and T innovation and technology upgrading coupling development. S and T innovation and technology upgrading coupling development can get understanding and support from the employees. Ultimately, it is promoting the equipment manufacturing industry process in the development of S and T innovation and technology upgrading coupling.

CONCLUSION

S and T innovation and technology upgrading coupling is the refining of S and T innovation. It will be playing a significant role in liaoning industrial economic development. According to relevant information in this study, coming to the conclusion that S and T innovation and technology upgrading coupling development is dominant for liaoning equipment manufacturing industry to go internationalization. Innovation culture is connotation. Scientific research and talent introduction is power. The government's policy support is essential, Cooperate with industry-university-research is the key and setting up our own S and T innovation strategy is the foundation. Three phase" strategy of S and T innovation and technology coupling should be further development liaoning equipment manufacturing industry. S and T innovation and technological upgrading coupling development of liaoning equipment manufacturing industry still has a long way to go.

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