

# The Affection of Independent Innovation on Employment

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**Abstract:** The paper reviews the theories on the relationship between innovation and employment, and finds that innovation can provide more employment opportunities in the long run and promote the upgrade of employment structure. Then considering the particular situation of China and its present strategic target, we analyze the features of independent innovation, a kind of innovation, and its affection on China's employment. On this basis, we give some suggestions for government to reduce the impact of independent innovation on employment.

**Key words:** Independent innovation; Employment

The concept, "innovation", was first introduced by Joseph Schumpeter into economics. In Schumpeter's theory, innovation is to build a new production function, which means a new combination of production factors or production conditions. Schumpeter (1939, 1961) viewed innovation as a creative destruction, because increasing investment in new products and new technology will wipe out the employment opportunities offered by old industries and old technology. Industry variations continually change the economic structure thoroughly from within, continually destroy old industries and create new industries. One batch of enterprises after another was washed out by the wave of innovation, while one batch of enterprises after another rises in the wave of innovation. The combination of capital, labor and other production factors is optimized in the process of innovation, however, rigidity and inertia of the old investment pattern will impede capital investment transferring from the "static" sectors to the innovative sectors, and then lead to capital mismatch and structural unemployment. Furthermore, as the technological innovation drives society and economy forward in waves, its impact on total employment and employment structure is cyclical. In the initial stage of innovation, total employment grows slowly or even declines, while employment structure does not change significantly; In the continual development stage of innovative, there are rapid increases in total employment and marked changes in employment structure; In the final stage of innovation, changes both in total employment and employment structure are gradually diminishing and a next innovation is going to brew. Economic structure constantly shifts in the periodic cycle, while relations between employment structure and technological innovation circularly switch from coordinated to uncoordinated and then once again to coordinated.

Neo-Schumpeterian represented by Carlota Perez, Christopher Freeman, et al. have amended and

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developed Schumpeter's study on the employment effects of technological innovation. Perez (1983) believes that a significant technological innovation will inevitably cause social institutions to change, but adjustments in social institutions are fairly stagnant. Therefore, the old social system can not adapt to the requirements of new techno-economic paradigms (TEPs). Consequently, a crisis caused by structural maladjustments emerges and unemployment goes up. The crisis persists until social institutions adjust to fully fit the new technologies. Hence, the emergence of new technologies asks for a comparative reform in social institutions in order to meet the requirement of new TEPs. Furthermore, technological innovations are constantly emerging. Thus TEPs always departs from social institutions. The exact match is just in an ideal state. Therefore, it is inevitable in economic cycles that the loss of old technologies and employment opportunities and the emergence of new employment opportunities. In order to deal with the aggravating unemployment caused by social institution adjustments in TEP conversions, neo-Schumpeterian especially emphasize the necessity of combining innovations in technology and in social institution under the situation of severe technological innovation, and put forward the concept of national innovation systems (Freeman, 1987), which is defined as the national institutions, the incentive structure and the competitiveness which determines the direction and the speed of the technology learning within a country. To build a national innovation system is to attach importance to national factors, and to particular social institutions and cultural backgrounds of the country. It also carries the idea that innovation is the result of complex interactions among various individuals and organizations, and needs government for the system arrangements to get cooperation and coordination among all departments and organizations. To eliminate the negative impact of structural adjustments in the evolution of TEPs on employment, Freeman suggested that government should set up proper industrial policies to promote economic restructuring and develop community education and training system.

The new growth theory has also studied on the relationship between innovation and employment. Represented by Aghion and Howitt(1994a), Pissarides(1990), and Acemoglu(2002), the studies suggest that innovations can directly promote employment growth by creating new products, new processes, and new industrial sectors, and can expand the production scale to indirectly promote employment growth by increasing return on capital and income levels to induce more capital accumulation and effective demand, but they also suggest that innovations will lead to structural adjustment in employment market, which will increase unemployment as well. This shows that in the new growth theory technological innovation is a "double-edged sword" to employment. On the one hand, technological innovation, promoting the capital expansion and the emergence of new department, can creates new employment opportunities; on the other hand, it leads some industries and sectors to decay and excludes a large number of workers into the ranks of the unemployed.

Marx (1990) has also analyzed the relationship between technical progress and employment. He has pointed out that as the improvement of technology and equipment in enterprises, machine automation replaces human labor, thus technical composition of capital being raised and relative surplus population and unemployment increasing. However, he also believes that the technical composition of capital does not necessarily move in the same direction with its value composition. In order to improve productivity, the capitalists utilize new machines and equipments, increasing the technical composition of capital, but in the meanwhile if the changes of the ratio between the amounts of the production means and the labor are offset by the opposite changes in their values, the value composition of capital will remain unchanged. In other words, technological progress not only affects the relative quantity between the means of production and the labor, but also changes the relative value of the labor. Marx's theory actually implies that technological progress impacts employment both in quantity and quality.

Although the above theories give us various interpretations on the inherent mechanism of the impact of innovation on employment, some on the premise of Schumpeter's "creative destruction"(Aghion & Howitt, 1994b), while others based on job-creation mechanisms(Petit, 1995; Pissarides, 1990), they generally admit that the effect of innovation on employment is manifold and thus should be viewed separately from various angles — such as the long-term and the short-term, the total volume and the structure. At present, the majority opinion argues that there is an interval from the introduction of new technology to the increase in employment. During the interval, technological innovation has a

"crowd-out effect" on employment, which leads to frictional / structural unemployment, but in the long run, innovation will provide the community with more employment opportunities. In terms of employment structure, with promoting the upgrade of industrial structure, innovation can promote the upgrade of employment structure and thus improve the quality of employment, while its negative impact on employment is the employment mismatch during the process of economic structure adjustment. Government plays an important role in promoting structural adjustment and reducing friction. Through institution innovation in investment, education, employment and so on, government can ensure that employment market, employment structure, education system, labor quality and skill levels of the workforce follow the changes in economic structure to make corresponding adjustments as soon as possible in order to reduce the crowd-out effect of innovation on employment.

At its present stage, China's strategic target in economic development and technological innovation is to improve the capability of independent innovation and build an innovation-oriented country, through independent innovation to upgrade technology level and promote the change of economic growth pattern. Independent innovation requires enterprises by their own learning activities and research & development to explore the frontier technology, to make technological breakthrough, to research and develop technologies with independent intellectual property rights, and on this ground through their own capabilities to propel innovation into the following stages, in order to commercialize technologies, to get profit, and to achieve the desired objectives of innovation activities.

As a type of innovation activities, independent innovation has the same direct result as other types of innovation have — improving technology level and promoting technological progress. Viewed from the historical traces, the growth of employment in China is not consistent with that of technological progress. In most years, the more the technological progress contributes to economic growth, the smaller the employment elasticity is, and this trend has become more obvious after 1990s. This shows that the crowd-out effect of technological progress in China on employment in the short term is significant. That is because that the technological progress, achieving industrial upgrade and great-leap-forward development, will lead some industries to decay and some other industries to emerge, and thus eliminate some jobs with low technical level and meanwhile create some new jobs asking for higher technical level. However, due to the overall low quality of labor as well as the slow adjustment of labor structure in China, the requirements of technological progress for the workforce can be fulfilled. Hence, the development of independent innovation in the near future would reduce the employment in China. But usually in the short term the beneficial effects of independent innovation on employment are not apparent. In the long run, independent innovation promotes employment through three ways. 1) Independent innovation can create new jobs through developing new products and new industries; 2) Independent innovation can improve production efficiency and then increase return on capital and income level. Thus, it induces more capital accumulation and consumption demand to expand production scale and compensate for employment; 3) Independent innovation can promote the upgrade of industrial structure and labor structure. It is conducive to the improvement of the quality of employment, especially after the labor structure catches up the request of the technological progress. Therefore, independent innovation will promote employment both in terms of quantity and quality in the long-term.

Independent innovation, which is different from imitational innovation or cooperative innovation, is based on a country's or a region's independent abilities for R&D, with such features as self-reliance, exclusion, continuity and knowledge-intensive. A) Self-reliance. Independent innovation requires that all the core technologies and processes must be outcomes of domestic research and development, and the main work of innovation must rely on the own knowledge and capability of the country or the intra-industry. B) Exclusion. All of the innovation achievements must be in possession of the country, the intellectual property rights exclusively belong to the country, and the core technologies of innovation should serve for the national interests in the first place. C) Continuity. The following process of independent innovation must be push forward by the country or the enterprises self, therefore, a complete independent innovation should include all the links, such as R&D, design, manufacturing and so on. D) Knowledge-intensive. In each stage, independent innovation of a country needs its own knowledge and ability to support. Thus, knowledge and creativity is quite important, especially in the

innovation sector. Due to these features, the independent innovation will drive China's demand structure for labor changing as the following. Firstly, the demand for innovative talents will increase. The features of independent innovation, self-reliance and exclusion, requires all the core technologies came from the breakthroughs and the innovations of the domestic enterprises, and completed on the basis of the R&D activities of domestic scientists and engineers. Therefore, independent innovation needs a large number of producers and R&D personnel for new technology, and needs the original R&D personnel to enhance innovation capabilities. Secondly, the demand for comprehensive and learning-oriented talents will increase. To apply the technological achievements of independent innovation production, the workers should constantly acquire new knowledge and new technologies. They must enhance their individual self-cultivation and the capability of independent learning to a certain degree, in order to constantly improve their own capabilities through "learning by doing", and to meet the new requirements in the continuously technological progress and the continuously movement the industrial structure. Thirdly, the demand for intellectual talents and technological talents will increase. Independent innovation promotes the upgrade in technologies and industrial structure. The original labor-intensive industries will gradually convert to capital-intensive and technology-intensive industries. Thereby, the workers must have a higher level of knowledge and skills to meet the need in the changes of labor market.

To sum up the above arguments, independent innovation is conducive to expanding employment and improving the quality of employment in the long-term, while its impact on employment in the short-term depends on whether the employment structure could be adjusted as quickly as possible to adapt to technological progress, especially whether the supply of the talents is adequate. To reduce the impact of the structural imbalance caused by independent innovation, we should start from improving labor quality, and paying attention to human capital accumulation, and reform on fiscal system, education system, employment system, social security system and other supporting systems.

#### *Fiscal System Reform*

Apart from the direct support for R&D, government should pay more attention to the investment in education, especially compulsory education, community education, and vocational training, in order to improve the universal quality of the whole population, and then provide the most important driving force for independent innovation.

#### *Education System Reform*

It is necessary to reform the education methods and the training contents in order to establish a more autonomous education system. First of all, the education must be prescient and advanced, and pay attention to the training of independent innovational talents, so that the level and the contents of education change in step with the input and the development of the innovational industries. Secondly, we should develop secondary and higher vocational training to cultivate skilled workers and technicians at secondary-level or high-level, so that the structural contradiction in labor supply and demand brought by independent innovation could be alleviated. Thirdly, it is important to cultivate the overall quality and the independent-learning abilities of the labor, so we should construct a system of lifelong education.

#### *Employment System Reform*

The mechanism for labor mobility must be improved. Independent Innovation will lead to changes in industrial structure, so the labor must be able to freely transfer from the old departments and industries to the new ones, otherwise, there will be asymmetry between supply and demand in the employment market. In addition, the unemployed engendered by independent innovation should be guided for their reemployment training.

#### *Social Security System Reform*

Unemployment insurance system should play a more significant role in the employment guidance to promote re-employment. On the one hand, we can adjust the expenditure structure of the unemployment insurance, and increase the input in employment guidance and skills training to help the worker to be re-employed; on the other hand, by providing the innovational sectors loans or subsidies to encourage on-the-job training for their staff, we can ensure that the skills and the knowledge of the existing workers

could adapt to the changes in innovation activities, in order to prevent the dismissal.

*Thought Reform*

Workers should be guided to convert their thoughts to recognize the importance of knowledge and to learn new knowledge and new skills actively. Independent innovation continually promotes the development of science and technology. The workforce cannot keep up with the pace just relying on one-time education. They must constantly learn and improve their comprehensive capabilities to adapt to technological innovation and development, in order to avoid being edged out in the changes of technology and the update of industry.

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