

Economic Analysis of Insufficient Enterprise Technology Innovation

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Abstract. Fundamental reason of insufficient enterprise technology innovation was analyzed with basic economic principles applied in perspective of current situation of Chinese enterprises in this thesis. Dominant role of entrepreneurs in the process of innovation was firstly determined and function relation for entrepreneurs not to conduct innovation, to innovate successfully and to innovate in failure was then constructed. Fundamental influence factors on whether entrepreneurs conduct innovation were found through preparation analysis on function relation and reasonable policy arrangement was proposed pertinent to these factors.

Introduction

Great achievements have been achieved over the past 20 years of Chinese reform and the aim for Chinese enterprises to get rid of poverty has been basically achieved, but substantial breakthrough has not been realized, which is mainly manifested in: uncertain subject of technology innovation causes insufficient impetus of enterprise technology innovation and many enterprises, especially state-owned enterprises rely on impetus of national preferential policies to get rid of poverty to some degree. Governmental preferential policies will be gradually cancelled after China joins WTO and then enterprises will face a kind of market environment predominant in variety and uncertainty. Competition among enterprises becomes fierce increasingly and enterprise operation will be internationalized increasingly.[1] Product life cycle will be shortened gradually and technology innovation will become more and more important for existence and development of enterprises. In modern production process of increasingly obvious resource scarcity, new products can be developed or introduced so that product cost will be reduced and market competitiveness of products can be increased and then profit rate of enterprises can be increased through enterprise technology innovation. So, it is a task needing researches urgently to construct core competitiveness through technological advancement in global competition for long-term development. It is a universal phenomenon that enterprise profit is low due to the fact that effective core competitiveness cannot be formed for low-level competition resulting from lack of technology innovation. [2]

People have reached consensus on importance of technological innovation so far. Many scholars have discussed influence factors of technological innovation in different perspectives, including: entrepreneur, market structure, organizational structure, R&D group, subject of capital investment, enterprise culture, etc in summary. But subject of enterprise technology innovation shall be found and effective motivation shall be conducted in essence to solve the problem of insufficient impetus of enterprise technology innovation. So, analysis was conducted in perspective of innovative subject in this thesis to find subject of technology innovation and construct reasonable motivation system and conduct effective motivation on enterprise technology innovation.

Dominant Role Analysis of Technology Innovation of Entrepreneurs

Theoretic opinion of technology innovation was proposed by American Austrian economist J . A . Schumpeter in the book named *Economic Development Theory*. Schumpeter defined innovation as “constructing a kind of new production function” and introduced “new combination of a kind production element” into production system of enterprise to obtain potential extra profit. Schumpeter thought that innovation was the main function of entrepreneurs and they were subjects

of innovation. Entrepreneurs continuously “creatively destroyed” original balance through recombination with production elements and promotion of economic development. However, many scholars at home and abroad have proposed different opinions on subject of technology innovation as time goes by. Dominant role of enterprise technology innovation has been transformed from monism of innovative subject that “entrepreneur is the only innovative subject” in the age of Schumpeter to multi-pluralism of innovative subject. It is thought in multi-pluralism of innovative subject that technology innovation activity is coordination of different subjects and it is emphasized to cultivate coordinative spirit among subjects, and it is also emphasized that entrepreneurs have important functions in decision-making of technology innovation at the same time. Some scholars holding multi-pluralism thought that it is likely to make entrepreneurs overestimate their functions in technology innovation in one aspect and it is adverse for entrepreneurs to find technology innovation talents, cultivate technology innovation team of enterprises and fully motivate subjective initiative and enthusiasm of scientific and technological personnel in the other aspect to only pay attention to function of entrepreneurs rather than the functions of other innovative subjects in perspective of practice of enterprise technology innovation activity[3]. Even some scholars thought that dominant power of technology innovation should be shareholders and entrepreneurs exert management behavior under decision-making of shareholders in real productive activities.

In fact, we find that the reason why this disagreement appears is that it lacks accurate definition of entrepreneurs before arguments and that distinction of entrepreneur and managers is confused. Schumpeter thought that innovation was a new combination of production elements and it was the entrepreneur that found and realized these new combinations. It can be said that entrepreneur is defined according to technology innovation, so entrepreneurship is innovative spirit. Entrepreneurs are essentially different from managers we see in real life and main work of enterprise managers is to execute creativity of entrepreneurs. As explained by Chinese famous scholar Yang Qijing, entrepreneurs are people who can find profit opportunities and construct new or change production function $f(x)$ (including combination ways of x); while managers are people to adjust x combinations according to market situations on condition of fixed production function $f(*)$ [4]. So, it can be found that entrepreneurs do not conduct management activity under decision-making of shareholders and it is the manager that exerts management activity.

Technological innovative subject is undertaker of technological innovative activities and there are different opinions on who is the subject of enterprise technology innovation. Is it the enterprise, entrepreneur or R&D group? Firstly, enterprise is not the innovative subject. Though enterprise is abstracted as “economic man” of total rationality, it is only a “black box” the outsider cannot understand in fact and all enterprise decisions are derived from selection for entrepreneurs to pursue profit maximization. So, enterprise is not technological innovative subject and all innovative activities are finally composed of practical activities of humans. Secondly, not all participants in technological innovative process are subjects. For example, R&D personnel are direct undertakers of a specific research on development of technological innovation and they research and develop products or crafts or digest and absorb introduced technologies, and they lack innovative decision-making power and innovative desire and ability required by innovative subjects. Finally, only entrepreneurs can become technological innovative subjects. Technological innovative subject is behavior subject to implement decision-making power on specific innovative schemes and innovative behavior and produce final decisions, which just conforms to conception of entrepreneurs that “function is to realize new combination of production means” defined by Schumpeter, so it can be found that only entrepreneurs are active executors of innovative activities.

Problem Research on Insufficient Technological Innovative Ability of Entrepreneurs

Fundamental Factor Affecting Technological Innovative Power—Innovative Spirit of Entrepreneurs. Entrepreneurs are subjects of enterprise technology innovation and leading power of technology innovation to act as decision makers and executors in the process of technological innovation. Innovative spirit of entrepreneurs is key driving force for enterprise to conduct

technological innovation. Innovative spirit refers to that fact that entrepreneurs have strong innovative will, motivation and consciousness. Enterprises will grasp innovative opportunities more actively and conduct active innovative activities if innovative spirit of entrepreneurs is stronger. Innovative impetus of entrepreneurs as innovative subjects is derived from attraction of technological innovative activity on innovative subjects. Technological innovative ability of entrepreneurs is formed by integration of innovative ability activated by innovative impetus and innovative impetus. So, technological innovative power of entrepreneurs is affected by two factors, namely innovative impetus and innovative ability. Innovative ability of entrepreneurs is mainly decided by quality of entrepreneurs, which is regarded as an exogenous variable and set as A ; innovative impetus of entrepreneurs is an endogenous variable of enterprises and set as M ; F is technological innovative power of entrepreneurs. Model is:

$$F = A \times M$$

M is an endogenous variable of enterprises and innovative impetus of entrepreneurs is mainly derived from pursuit of maximization of personal interest and utility[5]. Entrepreneurs should fully weigh all aspects of interest obtained by themselves when they conduct technological innovative decisions and their sources of innovative ability include salary, control benefit, career success, value increase of human capital, so innovative impetus of entrepreneurs can be indicated as:

$$M = f(S, D, R, H)$$

So the equation is $F = A \times f(S, D, R, H)$. Innovative impetus of entrepreneurs shall be increased to improve innovative power of enterprise innovation subjects-entrepreneurs on condition that their innovative ability is known. Innovative impetus is in positive relation to salary, control benefit, career success, value increase of human capital, so factors in this aspect shall be fully considered when enterprises are formulating motivation system to increase innovative spirit of entrepreneurs and increase their impetus to conduct technological innovation.

It can be found that maximization of personal profit is the fundamental reason why entrepreneurs have different innovative behaviors and it is also an important feature of technological innovative behavior for entrepreneurs. It is for owners of enterprises to conduct effective motivation and control in perspective of entrepreneur interest so that they can make innovative decisions good for long development of enterprises to know this point. Reason of insufficient enterprise innovation impetus is researched in perspective of innovative impetus as follows.

Reason Analysis of Insufficient Innovative Impetus for Entrepreneurs. We assume that entrepreneurs face two choices: one is to conduct technological innovation and the other is not to conduct technological innovation. Success probability of technological innovation is p and the failure probability is $1-p$, and $0 \leq p \leq 1$. Output level of enterprises is x_i ($i = a, v, f$, and a represents not to conduct technological innovation and v represents success of technological innovative behavior and f represents failure of technological innovation) [6]. Entrepreneurs obtain motivation profit in positive relation to output level, $s_i = s(x_i)$. Entrepreneurs also will obtain corresponding control benefit (D) through their control power on enterprises besides obtaining motivation reward, namely $D = \alpha(x_i - s_i)$. α is ratio of actual control power of entrepreneurs on enterprises. Entrepreneurs not only can bring actual monetary profit, but also they will obtain spiritual reward resulted from career success at the same time through efforts of technological innovation and spiritual function is also a function based on enterprise assets accretion, namely $R = \beta(x_i - x_a)$, and β represents standards of spiritual motivation taken by enterprises pertinent to different technological innovative result of entrepreneurs. Human capital increment of entrepreneurs is also based on function of enterprise assets accretion, namely human capital value will be higher if the result of innovative behavior of entrepreneurs is higher. Then the value in human resource market will be higher, so $H = \gamma(x_i - x_a)$, and γ is evaluation standard of innovative result on positive value of human resources of entrepreneurs for manpower capital market. C_a is normal operation cost of enterprises and C_d is decision-making cost for enterprises to conduct technological innovation. Though enterprise technology innovation is possibly to fail,

but enterprises select technological innovative behavior after feasibility analysis in innovative process. So, enterprise cost is $C_a + C_d$ if technological innovation is conducted whether it is successful or fails and cost of not conducting technological innovation is C_a . Utility function of success and failure of technological innovation and not adopting technological innovation for entrepreneurs can be indicated as:

$$\begin{aligned} u_a &= s_a + \alpha(x_a - s_a) + \beta(x_a - x_a) + \gamma(x_a - x_a) - C_a \\ &= s_a + \alpha(x_a - s_a) - C_a \end{aligned} \quad (1)$$

$$u_v = s_v + \alpha(x_v - s_v) + \beta(x_v - x_a) + \gamma(x_v - x_a) - (C_a + C_d) \quad (2)$$

$$u_f = s_f + \alpha(x_f - s_f) + \gamma(x_f - x_a) - (C_a + C_d) \quad (3)$$

It can be found in Equation (1) that there will be no spiritual motivation from enterprises and manpower capital of entrepreneurs will be impossible to appreciate in labor market if technological innovation is not selected. (2) is utility function of successful innovation for enterprises and (3) is failure function of enterprise innovation. It can be found in Equation (3) that enterprises will conduct spiritual motivation on the basis of performance pay in case of success to encourage technological innovative behavior of entrepreneurs, but enterprises will not conduct negative spiritual motivation according to loss even though it fails. It can be found that utility expectation of technological innovation is from Equation (2) and (3):

$$\begin{aligned} \bar{u} &= p[s_v + \alpha(x_v - s_v) + \beta(x_v - x_a) + \gamma(x_v - x_a) - (C_a + C_d)] \\ &\quad - (1-p)[s_f + \alpha(x_f - s_f) + \gamma(x_f - x_a) - (C_a + C_d)] \end{aligned} \quad (4)$$

Entrepreneurs choose not to innovate when $(1) \geq (4)$ and choose to innovate when $(1) < (4)$. It can be found from equation that relation affecting size of (1) and (4) is decided by size of p , α , β , γ and innovative impetus of entrepreneurs will be stronger if success probability (p) of enterprise technology innovation is greater; innovative impetus of entrepreneurs will be stronger if equity ties of enterprises is clearer and shareholding ratio of entrepreneurs is higher and α value is greater; innovative impetus of entrepreneurs will be stronger if enterprises adopt reasonable spiritual motivation ways on entrepreneurs and offer more spiritual motivation pertinent to innovative result of entrepreneurs and β value is higher; innovative impetus of entrepreneurs will be stronger if manpower capital market is more perfect and selection system of entrepreneurs is more scientific and γ value is higher.

There are problems of low technological level and unreasonable selection process of entrepreneurs to cause low success probability of innovation in Chinese imperfect market economy conditions; enterprise equity is not clear, especially original state-owned enterprises dominant in market cannot still get rid of footprint of planned economy and entrepreneurs lack effective control power; monetary motivation is adopted all the time in motivation process of entrepreneurs and motivation structure is unreasonable, so it lacks effective spiritual motivation; external manpower capital market is absent and reasonable evaluation of manpower capital of entrepreneurs cannot be conducted according to innovative result of entrepreneurs to cause low innovative impetus of entrepreneurs. Internal and external governing structure of enterprises shall be reasonably constructed to facilitate enterprise technology innovation according to fundamental factors causing these current statuses in face of current status of low enterprise technology innovation impetus.

Strategic Research on Increasing Enterprise Technology Innovation Impetus

Improvement of Entrepreneur Mechanism Selection and Increase of Probability of Successful innovation. Technological innovative impetus and success probability of enterprises are decided by different selection ways of entrepreneurs. Currently, superior administrative appointment way is still dominant way of selecting Chinese entrepreneurs and this choose-and-appoint mechanism of administrative appointment leads to the fact that enterprise innovation quality information cannot be obtained. And appointment is easily disturbed by subjective factors of superior leaders for there is no stable system guarantee or effective contract protection, so employment duration and stability degree are greatly uncertain to cause that entrepreneurs lack innovative impetus and ability. Then how should entrepreneurs of high innovative quality be selected in manpower capital market? Economic scholars have not reached consensus on feature of entrepreneurs with good innovative quality. Opinion of Fu Jiaji is selected in this thesis and Fu Jiaji, etc thought that they shall be equipped with consciousness of continuous innovation, achievement and opportunity and be good at use talented people. So, one of features entrepreneurs shall be equipped with is indispensable basic condition, namely never being satisfied with current status and owning strong innovative impetus. Dissatisfaction with current status is premise to produce innovative consciousness and a person who is satisfied with current status will not produce innovative consciousness. Strong innovative consciousness is gradually formed based on certain innovative ability of entrepreneurs. Innovative consciousness will be stronger if innovative ability is stronger and assurance of entrepreneurs on successful innovation is greater[7]. So, enterprises shall know about their innovative ability through related tests in one aspect at the time of selecting entrepreneurs, and enterprises shall also inspect their exclusive skills according to features of enterprises at the same time. In terms of organizational structure, system dominant in Board of Directors with operators publicly selected and recruited through internal and external manager market shall be established and normalized employment contract shall be signed to clearly define right, obligation and responsibility of operators, constrain opportunistic behavior of operators and promote forming of stable tenure and reward expectation of operators so as to conduct innovative activity in perspective of maximizing personal utility.

Selection of Compound Motivation Means and Increase of Motivation Effect. Motivation on entrepreneurs of Chinese enterprises mostly relies on simple income motivation. The greatest advantage of this motivation is that results can be achieved instantly. But effect of this motivation way will surely be reduced as time goes by according to diminishing marginal utility law. And then fund amount of reward has to be increased to strengthen motivation effect, which is contradictory to cost control of enterprises. This is an uncontrollable contradiction, so enterprises have to alter original single motivation way and select compound motivation means. (1) Salary structure of operators shall be improved to realize combinational way with basic salary, performance pay and subsidy, take account of both short-term benefit and long-term benefit, improve annual salary system, stock option plan and management shareholding and design planning income of pension reasonably. (2) Material motivation shall be combined with spiritual motivation and enterprises shall continuously increase intensity of spiritual motivation to increase stimulation effect at the same time of material motivation pertinent to psychological satisfaction of entrepreneurs with success of technological innovation at the same time of increasing material motivation. (3) Motivation means of control power shall be adopted to increase motivation effect. Though salary is undoubtedly the most direct influence factor, control power in technological innovation has more fundamental decisive meaning on motivation of owners of manpower capital essentially because owners of manpower capital to obtain control power of technological innovation is premise of the motivation problem and monetary reward and non-monetary reward can be regarded as reward for owners of manpower capital to use control power. (4) Responsibility insurance system of operators shall be introduced and loss due to non-subjective reasons in innovative activities shall be properly compensated to increase their ability and consciousness of risk undertaking.

Improvement External Manpower Capital Market to Facilitate Manpower Capital Accretion of Entrepreneurs. Entrepreneurs not only should obtain corresponding reward in enterprises due to technological innovative success, but also should increase their manpower capital.

Entrepreneurs obtain corresponding reward through their innovative spirit and innovative ability essentially because most income of entrepreneurs has been confirmed before exercising the power when they take office in a certain enterprise. This can fully explain that their rewards are manpower capital rewards enterprises offer according to former experience and achievement. Entrepreneurs will also be in flow state, so they expect that their innovative success not only brings about realistic income, but also it can contribute to their manpower capital accretion. But information of innovative success for entrepreneurs cannot be effectively spread, so their manpower capital accretion cannot be achieved to a great extent. So, the nation and enterprises should make efforts jointly to continuously improve manpower capital market, make information transparent so that motivation function on technological innovation can be formed due to manpower capital accretion of entrepreneurs.

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