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Evaluation Method of R&D Investment Value of Intelligent Manufacturing Enterprise Based on Growth Option

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Abstract

At the transition period of manufacturing industry in China, intelligent manufacturing is compared to the "engine" of economic development. Those intelligent manufacturing enterprises maintain the long-term stability, prosperity and development can promote the "Made in China 2025" plan. R&D is an important approach for enterprises to gain competitive advantages and increase profits. Based on the shortcomings of the traditional discounted cash flow (DCF) method in R&D investment decision, this paper analyses the value of the growth option in R&D. And it points out that making the R&D investment decision should be combined with the value of future growth opportunities of the project. The purpose of this paper provide an evaluation model of R&D Investment value in Intelligent Manufacturing, as a reference on investment decision for intelligent manufacturing enterprises' managers. This paper provides a clearer way of thinking for managers to understand and evaluate the value of R&D projects in an all-round way and gain more profits for enterprises.

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1. Introduction

“Manufacturing is not just the mainstay of the national economy, but also the foundation of development of a country, the access for rejuvenating a country, the basis for being one of the major world powers.” Chinese government proposed the “Made in China 2025” plan for achieving the goal of becoming the manufacturing power

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[1].The other important expression related to “Made in China 2025” is “Intelligent Manufacturing” (I M). Intelligent manufacturing is applying Artificial intelligence technology on production processes, in order to reduce the work intensity of work, improve product quality and production efficiency. As the implementation of “Made in China 2025” plan and strengthening structural reform of the supply, many manufacturing enterprises trend to turn into intelligent manufacturing enterprises and realize the transformation and upgrading. Thus existing intelligent manufacturing enterprises will face more fierce competition in the future, for the reason that more and more enterprises are coming to enter the intelligent manufacturing industry.

As one of high-tech enterprise, the core of intelligent manufacturing enterprise is innovation capability, and R&D investment plays a decisive role in their developments. Enterprise market competitiveness depends largely on the level of corporate R&D capabilities. Compared with the traditional labor-intensive enterprises, intelligent manufacturing companies pay more attention to R&D investment. There are four main features of their R&D investment. 1) High risk. Intelligent manufacturing enterprises are often at the forefront of technology research and development of products or technologies. Meanwhile there is a great deal of uncertainty in research and development process of projects. 2) High input. Compared with the labor-intensive enterprises, intelligent manufacturing companies pay more attention to R&D investment. What these projects need is not only lots of money, but much expensive special equipment as well as superior technicians, to make sure all the process run well. 3) High cost. Nearly most returns of investment for these companies come from revenues of the new product launch. It would lead to a result that financial returns cannot recover rapidly and enterprises would lose a large number of investment opportunities and have higher opportunity cost, for a long development cycle. 4) High yield. Although investments of high-tech enterprises are high-cost and high-risk, they also enjoy higher returns. Intelligent manufacturing enterprises have a good market prospects for investment and the higher product added value, the bigger latent profit space for new products. High-tech products are easily accessible to consumers. They also would meet market demand better and make companies gain more competitive advantage and rapidly grow in the market segments.

There is a long period from original study to final products, with technical uncertainties, uncertainties and competition uncertainties. How to be invincible in this changing environment is a severe challenge for enterprises. Most successful companies show that flexibility is an important and unavoidable way for enterprises to survive and develop in a rapidly changing environment. As DeGroot [2] pointed out, flexibility is "a barrier to change". Hayes and Upton [3] also argued that flexibility, like cost and quality, is a critical factor affecting firm competitiveness. Due to the influence of uncertainty, decision making in flexible planning relies on the result of uncertainty, and the traditional analysis method has significant flaws. The existing traditional quantitative evaluation methods (internal rate of return method, net present value method and payback period method) cannot properly grasp this kind of management flexibility value, and this value increases with the increase of uncertainty. Until the end of the 20th century, the option thought was introduced into the R&D investment decision by some scholars, which provided a new theoretical way for R&D investment decision. Myers [4] pointed out that the NPV method is not suitable for the R&D project evaluation because it neglects the option value of the R&D investment project, and for the first time put forward the idea of the future growth opportunity of the enterprise as the "growth option". On the basis of Myers, Kester [5] compared the growth option as the call option, and considered that the total value of the investment project should include the expected value of the cash flow and the value of the expected value of growth option. He pointed out, as to the projects that their NPV are negative, if the value of the option can offset deficit of the original expected cash flow, it would be feasible for investment. Benninga and Tolkowsky [6] summarized the real options approach and illustrate how flexible value can be introduced into the capital budgeting process and further apply the real option approach to the R&D project evaluation of pharmaceutical companies. Schwartz and Gorostiz [7] discussed the costs and future benefits. Herath and Park [8] considered multi-period capital investment opportunity model as compound real option. In the competitive environment, the investment evaluation and decision-making must take into account the competitor's competitive advantage in real-Investment strategy and the change of option value after competitors enter. Foreign scholars have long been studying R&D in the growth of options. There are a lot of corresponding literatures. But the domestic research in this area is less. Especially for the intelligent manufacturing enterprises an emerging field, growth option analysis is fewer for the R&D project. The purpose of this paper provide an evaluation model of R&D Investment value in Intelligent Manufacturing, as a reference on investment

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