System Dynamic Modeling on the Capital Accumulation and Distribution in Enterprises

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Abstract

The paper establishes the models of System Dynamics of capital accumulation and distribution in enterprises, which underlies the complexity and dynamic properties of them. With the simulation of the SD model, we analyze the relation between capital accumulation and core competences of enterprises, as well as capital distribution (employee income expense, R&D expense and education expense, etc.) and the growth of core competence. Quantitative conclusions are also drawn.

I. The Model Structure

For the capital accumulation and distribution are concerned with a series of complex process such as financing, investment in tangible and intangible asserts, the growth of technology and manufacture competence of enterprises, it's difficult to master the regularity of capital accumulation and distribution. We need to create the capital accumulation and distribution models with the approach of System Dynamic and analyze them qualitatively and quantitatively.

The SD model should be separated into three subsystems: finance subsystem, product-business subsystem and the competence subsystem to reflect the interaction between capital operation, business and competences perfectly. It is shown in figure 1.The product flow of the business subsystem can be represented by the value flow of products, so that the product-business subsystem could be included in the finance subsystem. Therefore, we only picture the major loops of finance subsystem and competence subsystem and analyze them. (As shown in figure 2 and figure 3)

Figure 1 The Whole Structure of SD Model

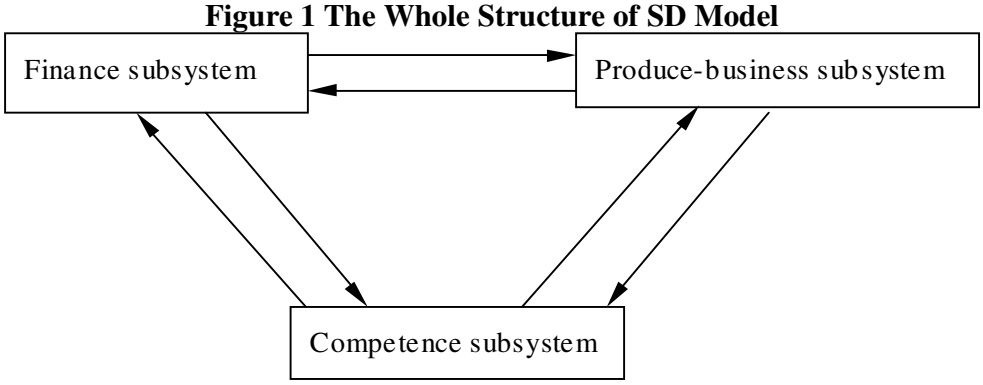


Figure 2 describes the major loops of finance subsystem. The L1 is the value-added positive feedback mechanism, and L2 is the negative feedback one of it. The market capacity and product advantage are defined as extensive variables of finance subsystem.

Figure 2: The Major Loops of Finance Subsystem

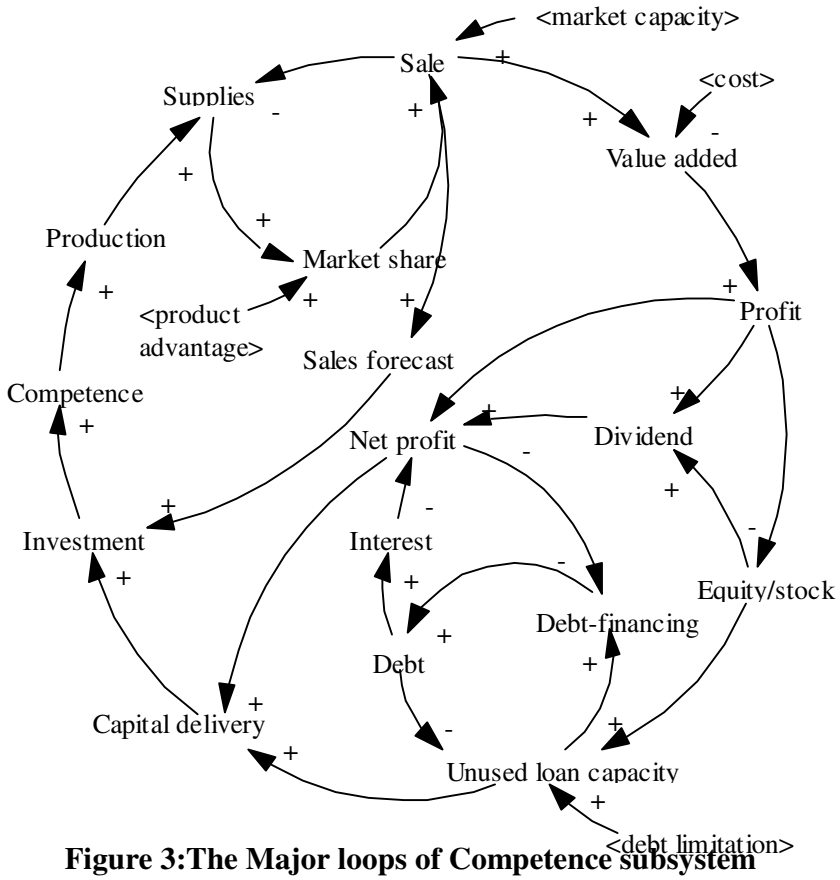
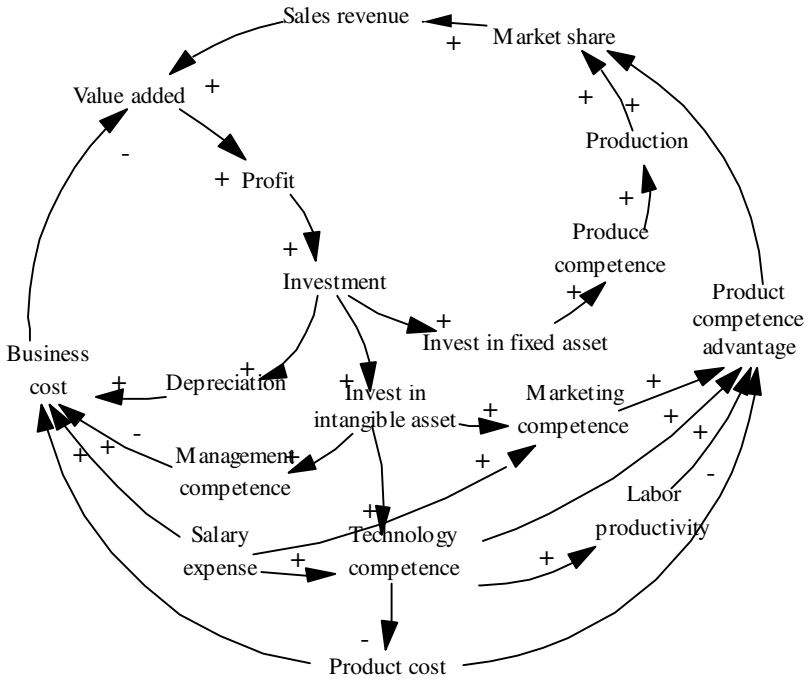
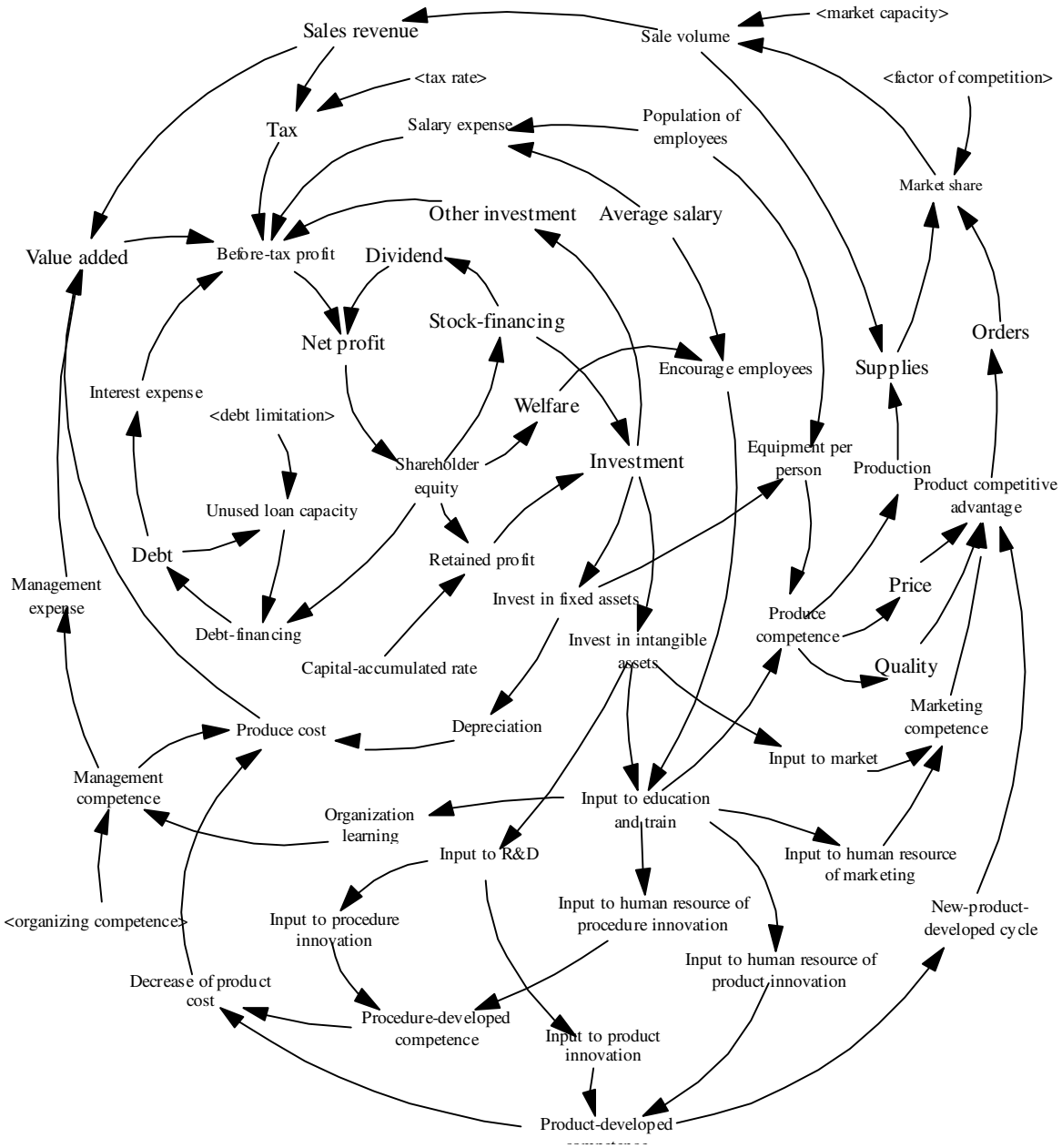


Figure 3:The Major loops of Competence subsystem



But they are internal indexes of competence subsystem. L3 is the value-reduced negative feedback course, and L4 is the positive feedback one of it.

Figure 4:The Major Cause-result Relationship of SD Model



The major loops of competence subsystem are more complex than those of finance subsystem, as shown in figure 3. The finance subsystem can also be regarded as a part of it, and L5 describes the course similar with L1.L7is the positive feedback process of profit-investment-competence-cost, and L6 is the negative feedback one of it.

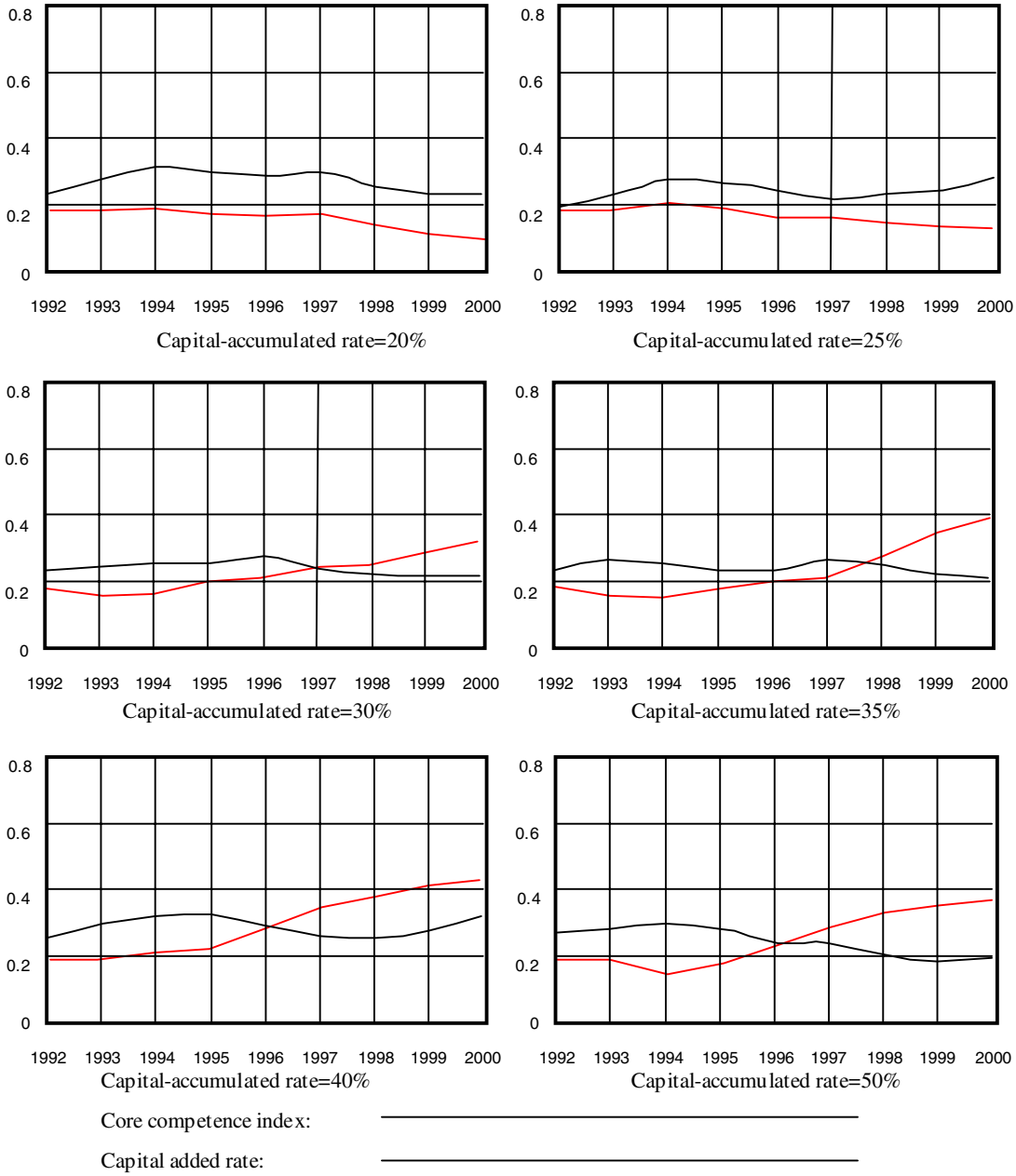
The competence subsystem is composed of R&D, designing, purchasing, manufacturing, testing, financing, marketing, distribution and maintenance, etc. These should be aided by the finance subsystem with adequate capital delivery and right investment strategy. If the enterprise's competence is better than others, it can prompt the product-business subsystem and finance subsystem to get better performance. They can be connected with a big picture of System Dynamic model. Figure 4 presents the major cause-result relationship of SD model of capital accumulation and distribution in enterprises.

II. The Policy Analysis of Capital Accumulation and Employee Income

Today, capital scarcity is the major problem in most Chinese enterprises. It's necessary to speed the capital accumulation. So we first analyze the influence of different capital accumulation rate acting on enterprise development. By this means, we want to make suggestion on the rational extent of capital accumulation rate.

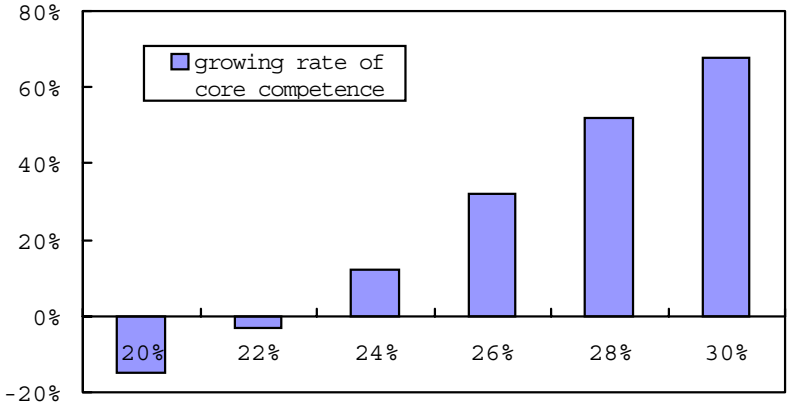
We choose the capital-added rate and core competence index as analytic quotas. The capital-added rate indicates the annual business performance of enterprise. Yet it's short-term quota of enterprise development trend. The core competences index is defined differently. In this SD model, it's defined as the average value of four kinds of capacities, such as productive technology, manufacturing, marketing and management, etc. It indicates the long-term quota of enterprise development trend. If it's assumed that other conditions keep invariable and only capital accumulation rate varies, we could see the variety of capital-added rate and core competence index underlying the simulation of SD model, which is shown in figure 5.

Figure 5 Capital Accumulation Influence on Development of Enterprise



From the simulated results of SD model, the core competence index is in an obvious increasing trend as the capital accumulation rate varies from 30% to 40%. The extent of growth is positively coherent with the capital accumulation rate. The higher the rate is, the faster core competence develops. Furthermore, we study the condition that capital accumulation rate varies from 20% to 30%. The simulated results of SD model (as shown in figure 6) indicates that 22% is the lowest capital accumulation rate which can ensure core competence of enterprise increasing. So it's reasonable for Chinese enterprises to keep the capital accumulation rate from 22% to 40%.

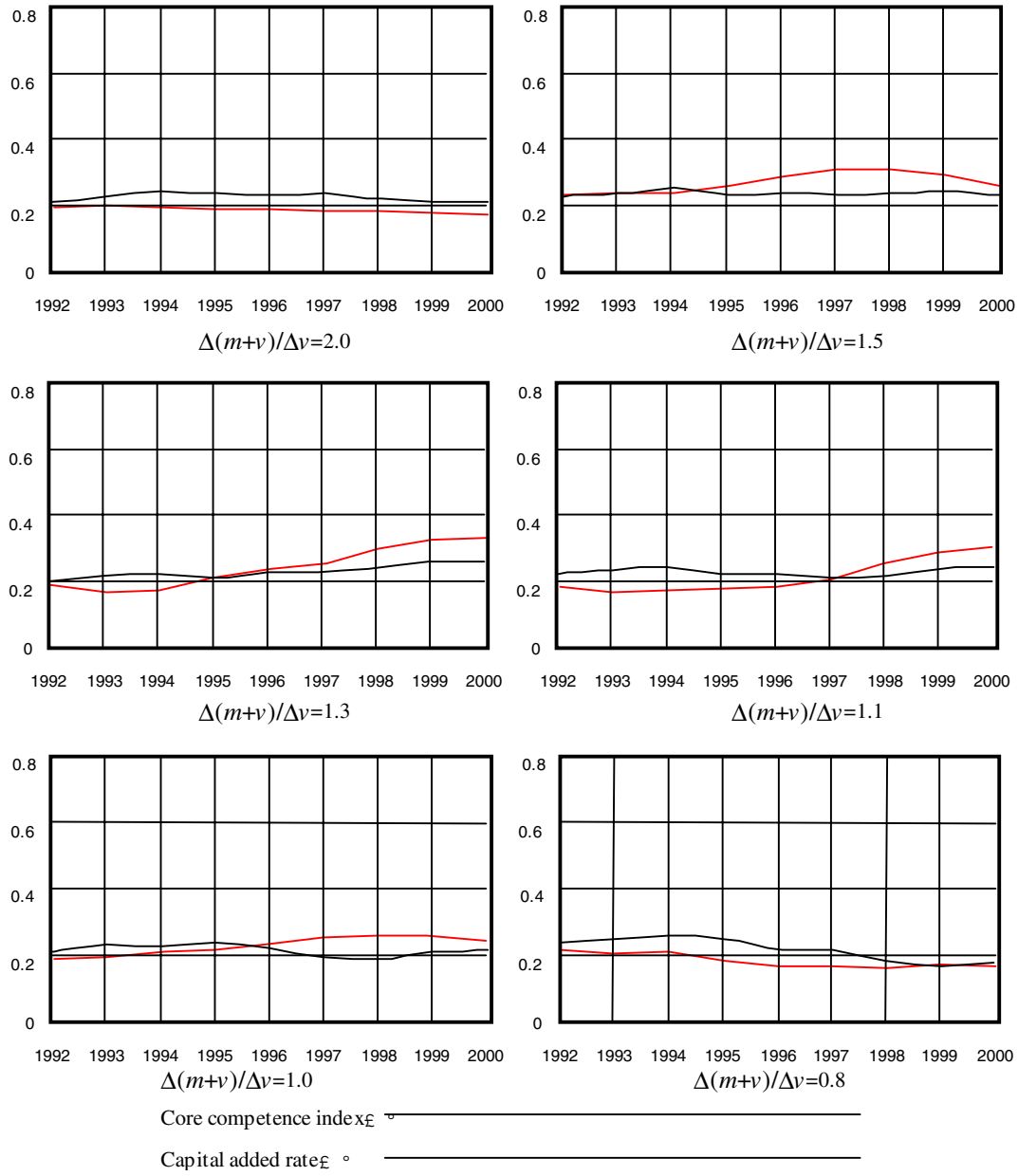
Figure 6: Average Growing Rate of Capital-accumulated Rate and Core Competence Index



Secondly, we consider the influence of the increasment of employee income on enterprise development. With the help of SD model, we study the coherency of the growth of net labor productivity to growth of average employee income. Figure 7 shows that the various curves of core competences index and capital-added rate when the ratio of the growth of net labor productivity to growth of average employee income ($\Delta(m+v)/\Delta v$) is 2.0, 1.5, 1.3, 1.1, 1.0 and 0.8 respectively.

The figures clearly show that the core competence index and the capital-added rate are in decreasing trend if $\Delta(m+v)/\Delta v$ <1.1 or $\Delta(m+v)/\Delta v$ >1.5, and in increasing trend if 1.1<$\Delta(m+v)/\Delta v$ <1.5. It's also proved by the case of Bao-steel.ltd. From 1993 to 1997, its labor productivity increased from 932000 to 2266000 by 2.43 times. The average employee income increased from 920 to1730, by 1.88 times. The ratio of $\Delta(m+v)/\Delta v$ is 1.29.It's consistent with the result of simulation of SD model. So we can draw the conclusion that the rational extent of $\Delta(m+v)/\Delta v$ is 1.1~1.5.

Figure 7: The Ratio of Growth Rate of Labor Productivity to That of Employee Income Impact on Enterprise



III. Conclusions

Underlying the complexity and dynamic feature of capital accumulation and distribution system in enterprises, the paper adopts the approach of System Dynamic to structure the model of capital accumulation and distribution. Through the model, we make qualitative and quantitative analysis of capital accumulation and distribution, focusing on the rational capital-added rate and core competences index. Through the

simulated results of the SD model and analysis of them, we draw these following conclusions:

1.It's rational to keep the capital-accumulated rate on the level of 22%~40% for Chinese enterprises. By doing that, the enterprises can ensure that they have adequate capital to nurture core competences and to delivery appropriate income to employees.

2.The rational ratio of the growth of labor productivity to that of average employee income is 1.1~1.3.

3.The R&D input intensity rate of enterprise must be kept more than 2% so that the core competences index could be kept increasing in long term.

4.Too low education input intensity rate is disadvantageous for nurturing core compenteces of enterprises. So we suggest that the enterprises keep rational input intensity rate of education and training, as analyzed in the above.

These conclusions are proposed as good advice to Chinese enterprise.

Main References

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