The Calculation and Application of Productivity

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Abstract: The article states that productivity has showed the ability of study and production for human being. Laborer's productivity is the basic unit of productivity. The level value of the basic unit is defined by the technical value, functional value and efficiency. According to these values we can calculate the level and speed for the development of the productivity and determine the reason. In production, the basic unit of management values and the performers of the basic unit have a positive relationship. The application of scientific and technological knowledge has a positive effect on the growth of the productivity and determine the quality of the production, number of the basic unit and the work time changing follow some certain regulation.
Key words: Productivity; Basic Unit; Level Value; Technical Value; Functional Value; Efficiency; Management Value; Potential Value

Productivity has showed the ability of study and production for human being. Studying will be critical to developing the theories of productivity and rationally promote the practice.

1. THE BASIC UNIT OF PRODUCTIVITY

Firstly we should clarify the basic unit of the productivity in order to quantization productivity in depth and the calculation of the productivity level. The basic unit means the minimum productivity which can generate products effectively; it is the element to establish the enterprise productivity system of different scale; it is the minimum unit of the productivity. The basic unit has 3 features: 1) it has the fundamental characteristics of the productivity and can't be decomposed; it will become element if decomposed. In addition, there are differences between the element and the whole in essence.2) the level of the productivity can be reflected by the specific value. 3) It is able to operate survival and develop independently and also can construct the productivity system by different number. It can be show from the three features: the basic unit of productivity is not a factor or factors of a simple form of existence, but by different factors get together to construct organic whole.

From the process of productivity development, the labor's productivity has these 3 conditions. 1. Whatever the ancient hand-held stone or wood working tools for production or the modern labor, the productivity made up by worker, working tools and technologies is the minimum scale productivity. It can't be decomposed; when it is decomposed it will change to element not productivity. 2. The level of the labor's productivity can be defined by the number and the quality of the production during certain time. 3. The labor's productivity can carry out the work independently and products (machines, electronic product etc.) complicated production via co-operation. In the development of the enterprises in the world, they choose to add more workers to enlarge the productivity not by adding devices or untrained workers. Therefore, the labor's productivity is the basic unit of the productivity.

Use s to standing for the basic unit of the productivity.

2. THE CALCULATION OF THE PRODUCTIVITY LEVEL

The level of productivity can be defined as the value which can reflect the level of the productivity. It can be determined by the relationship and the performance of the factors. The level of value is the basic unit of productivity factors in the production of value through the play, and the result of the interaction of various factors and is reflected in the performance. Such as different technologies will determine the degree of proficiency, awareness of the labor, quality and speed on the subjects. High value technology can play a most important function of the tool, with the fastest speed to produce a certain number of products that meet quality standards. Technology with low value will not. Therefore, the value of each factor will define the level of basic unit. We are known that the basic unit of productivity consisted by workers, working tools, skills and transformed objects. Workers are someone who masters a certain level of technical knowledge and personnel capable of operating certain tools. Working tools is the use of functional objects. Work technology is labor-related knowledge (including empirical knowledge and theoretical knowledge) of the collection. The more knowledge workers have, the greater the knowledge content of scientific theory, the higher the value of technical grade. The object of labor is being transformed by the workers. For instance, the cotton has long-staple cotton and short-staple cotton, the long-staple cotton has higher efficiency than the short ones. So the long-staple cotton has higher quality and production. We can propose in every production, the highest level the labor can master is n; the actual technological value is e; the maximum functional value of tools is f; the efficiency value of subject of labor is u; working time is t; the level value of the basic unit is h. h can be calculated by the following formulation.

$$h = \frac{e}{n} \times f \times u \times t \ (2\text{-}1)$$

E.g. A lathe worker use normal tool to process certain spares, the highest efficiency value of the lathe is 10 pieces per hour, the highest level the labor can master is 25, actual value is 18 and efficiency value of subject of labor is 1. How is the h value when under the common condition?

$$h = \frac{18}{25} \times 10 \times 1 \times 1 = 7.2 \,\#/\text{hour} \qquad (2\text{-}2)$$

A certain level of productivity produces the appropriate quality and quantity of the product in the specified time. A certain quality and quantity products must reflect the value of a specific level of productivity. However, value often changes with market demanding and cannot accurately reflect the level of productivity. As for some high price gems, the price does not equal to the ability to produce this material. Another example is the electronic products; the price is always sustainable with the marketing regulation. But the ability to produce such products do need a high level. Therefore, under the premise of a certain quality standard, only the output per unit time can always accurately reflect the level of productivity.

In the same or different basic unit, the technological value, efficiency value and the functional value always keep changing. The difference of each factor will lead the level value generate 6 conditions.

1) Different worker have different technological value. When they use the tools which have the same functional value, work on same subject and produce same product the one who has advanced technological value will lead to higher level value.

E.g. A and B are two lathe workers use normal tool to process certain spares. The actual value of A is 21 and B is 11. The highest efficiency value of the lathe is 10 pieces per hour, and efficiency value of subject of labor is 1. How is the h value for A an B?

$$h_A = \frac{21}{25} \times 10 \times 1 \times 1 = 8.4 \, \#/\text{hour} \qquad (2\text{-}3)$$

$$h_B = \frac{11}{25} \times 10 \times 1 \times 1 = 4.4 \, \#/\text{hour} \qquad (2\text{-}4)$$

The h value of A is 90.9% higher than that of B.

2) Master the same technological value but use different tools. The tools with higher functional level will have higher h value.

E.g. A and B have the same actual value but the tool A using has the 5 times functional value than that of B. How is the h value for A an B?

$$h_A = \frac{21}{25} \times 50 \times 1 \times 1 = 42 \, \#/\text{hour} \qquad (2\text{-}5)$$

$$h_B = \frac{11}{25} \times 10 \times 1 \times 1 = 8.4 \, \#/\text{hour} \qquad (2\text{-}6)$$

The h value of A 5 times larger than that of B.

3) Having the same functional value and technological value, the h value changes with the efficiency.

E.g. the subject for A is better than B and the efficiency value is 1.2. It is difficult for B to process the object and the efficiency value is 0.9. How is the h value for A an B?

$$h_A = \frac{21}{25} \times 10 \times 1.2 \times 1 = 10.08 \, \#/\text{hour} \qquad (2\text{-}7)$$

$$h_B = \frac{21}{25} \times 10 \times 0.9 \times 1 = 7.56 \, \#/\text{hour} \qquad (2\text{-}8)$$

4) When the technological or functional value equals to 0, there is no productivity and the h value is 0 too. Workers without tool, nevertheless they have perfect technology, he/she cannot product.

$$h = \frac{25}{25} \times 0 \times 1 \times 1 = 0 \, \#/\text{hour} \qquad (2\text{-}9)$$

$$h = \frac{0}{25} \times 50 \times 1 \times 1 = 0 \, \#/\text{hour} \qquad (2\text{-}10)$$

5) When the value of tools is stainable, e=n, h can reach its maximum value

$$h_{max} = \frac{25}{25} \times 10 \times 1 \times 1 = 10 \, \#/\text{hour} \qquad (2\text{-}11)$$

h_{max} ——the maximum value or the limited value

6) When the objects cannot be changed, the efficiency value is zero and the productive is 0. Each tool has limited function and the labor has limitation in his ability. When the worker operating the tools and skills are unable to transform the object of labor or reach a certain level of transformation, the time of the real value of the relative productivity level is zero.

$$h = \frac{25}{25} \times 50 \times 0 \times 1 = 0 \,\#/\text{hour} \qquad (2\text{-}12)$$

The above research shows: 1. any specific and concrete productivity consist of workers, tools and techniques.2. Whether the transformation of an object of labor productivity and the level value are being transformed by the object of labor reflected in the quality and quantity.3 in every space, the level value the development and the growth speed vertically and between different products.4. According to the change, we can determine the internal factors of development the productivity.

3. THE INFLUENCE AND THE RELATIONSHIP BETWEEN THE MANAGEMENT AND THE LEVEL VALUE

Management is very important to the productivity system. Productivity of the various constituent elements of the system and productivity of running space have a certain amount of features and changes in the law and orderly organization of the various factors to effectively run the development work and productivity, so we need to manage. Management factors and workers is in difference because it does not directly participate in the transformation of the object of labor, but only on the productivity of the various factors that constitute the organization and coordination, and promote overall productivity and productivity of each factor in a certain space and time for orderly operation of the development. As a result the level of the management has directly effect on the level value in the productivity system.

Management of the basic unit of play value and the actual level of value is positive proportional. By a number of basic units together, and on the basis of division of labor and cooperation constitute the productivity of businesses of all sizes the system, the production process are managed by professional management of workers engaged in the use of management techniques and management tools, using certain methods, factors of production within the enterprise and the various combinations of basic units, adjust and give full performance to the comprehensive nature of the labor process. When the level of management is low, under its influences, in consequence, we will get a lower actual level value. When the value is large the basic unit of value in the management level can be 100% to be reflected , the actual level of value can be achieved with the level of its value. Therefore, the basic unit of operation of productiveenterprises plays the actual level of value and managing the value of Formula 2 can be expressed and calculated.

$$h_s = r\left(\frac{e}{n} \times f \times u \times t\right) \qquad (3\text{-}1)$$

$$r = \frac{h_s}{h} \qquad (3\text{-}2)$$

h_s : The actual level value of the basic unit

r: management value

From 3-2 we can know: 1) when the management value is high, the basic unit of value can give full function to the level that can produce relatively high yields and quality products (vice verse). 2) The range of the management value is ≤ 1. 3) When the value is less than 1, there is considerable potential for the level value. When the management value equals to 1, Values in the low technology level and productivity resulting from high-tech value generated between the levels of productivity,

there can continue to improve the potential value of technology. The potential value can be calculated by the flowing formulation.

$$h_r = h\text{-}h_s = (1\text{-}r) \times h \qquad\qquad 3\text{-}3$$

$$h_e = h_{max} - h$$
$$= \frac{(n-e)}{n} \times f \times u \times t \qquad\qquad 3\text{-}4$$

$$= \left(\frac{n}{e} - 1\right) \times h$$

hr : management potential value

he: technological potential value

E.g. there are 120 workers in the machine factory, the maximum technological value is 22, the average value is 15 and the average value of function is 8#/ hour. The efficiency is 1.6 so the production will be 800#/hour. What is the value of h 、 h_s 、 r 、 h_r 、 h_e and the maximum production?

Solution: we know M=800 C=120 $f = 8$ $u = 1.6$

From 2-1 $h = \dfrac{15}{22} \times 8 \times 1.6 \times 1 = 8.73 \# / hour$

From 3-1 $h_s = \dfrac{800}{120} = 6.67 \# / hour$

From 3-2 $r = \dfrac{6.67}{8.73} = 0.764$

From 3-3 $h_r = 8.73\text{-}6.67 = 2.06 \# / hour$

From 3-4 $h_e = \left(\dfrac{22}{15} - 1\right) \times 8.73 = 4.07 \# / hour$

The potential value production:

$M_1 = h_r \times C = 2.06 \times 120 = 247.2\#/hour$

The technological potential value

$M_2 = h_e \times C = 4.07 \times 120 = 488.4\#/hour$

The maximum production of the factory is

$M + M_1 + M_2 = 800 + 247.2 + 488.4 = 1535.6 \ \#/hour$

From the above research we can see that the level of management will determine the actual level value, potential value and level value of the basic unit. Productivity efficiency is certain to play out time, the average productivity level of the actual value. Productivity does not reflect the level of each basic unit of value with the size, whether the potential value in business productivity and the size of the potential value, the value of the level of management and so on. Therefore, the research productivity is

more comprehensive, specific and in-depth. No productivity, no efficiency. Only the development of productive forces, it may increase productivity efficiency.

4. THE RELATIONSHIP BETWEEN TECHNOLOGY AND THE PRODUCTIVITY

The technologies are the important element which consists of productivity and it is also the key to improve the productivity. Technology is running at all times and productivity, workers must master a certain number of knowledge sets. Different times of the technical knowledge contained in scientific theories and empirical knowledge of the different ratio. The closer to the ancient backward productive forces, it will contain more technical experience in the more knowledge, less knowledge of scientific theory. The more close to the modern advanced productive forces, the transformation of human nature, increasing the depth and breadth of the system of continuous development and improvement of scientific knowledge and theories continue to be applied to production practice, science and technology included in the more theoretical knowledge and less experience. At present the technologies has changed from the experience to modern scientific knowledge. According to the functional value of each tool, the technology level of each worker to master the and increase the value of the object of labor efficiency, the amount of scientific and technological knowledge and physical and chemical transformation will keep changing from time to time. Therefore, technologies are the key to improve the technical value, performance value, management value, as well as the overall level of productivity. The application of the science has the positive relationship with the level of productivity. From the development of human society to see various historical stages, each level productivity value increased from the original stage of development to a new level of social values, must apply the appropriate level of scientific and technological knowledge in order to enhance the level of the corresponding period of productivity. Use E to standing the amount of knowledge in order to improving the productivity.

$$\frac{e'}{n} = \frac{e}{n} + E$$

$$F = f + E$$

$$U = u + E$$

$$R = r + E$$

$$H = R\left(\frac{e'}{n} \times F \times U \times t\right) \qquad (4-1)$$

H : The new level value according the development of the society

From above we the infer the following formation

$$D = \frac{H-h}{h} \times 100\% \qquad (4-2)$$

D ——the growth rate of technology

Application of technology will increase the level value and impact productivity, mainly in two aspects.

1) Increasing the number of basic unit for level value

$$Z = \frac{(C-C_D) \times h + C_D \times H}{H} - C$$

$$= \frac{(1+D) \times H \times C_D}{H} - C_D \qquad (4-3)$$

Z——the former number of the level value；

C_D——added amount

2) The production, the number of basic unit and the working time can change with some regulation (table 1). According to the charges of values in the table we conclude that

According to the change of values in the table can be seen: no changes in production circumstances, double the level of value, the effective working time can be reduced by 1 / 2; changes in the effective working time is not the case, the level of value to improve a times, the number of basic units can be reduced by 1 / 2; not at the level of production value and changes in circumstances, the management of the value of every increase of 1 / 4, the effective working time can be reduced by 1 / 5, or the number of basic units can be reduced by 1 / 5 . Both proportional to the level of value and production, and labor time and are inversely proportional to the number of basic units. The regulation can be calculated with the equation

$$M = C \times H_p \times R \times t = C \times H_{pS} \times t \qquad (4-4)$$

$$C = \frac{M}{H_{pS} \times t} \qquad (4-5)$$

$$t = \frac{M}{C \times H_{pS}} \qquad (4-6)$$

M : New production

H_p : Average level value of the basic unit

H_{pS} : Actual average level value of the basic unit

Table1

The Change of Parameter

	M	R	C	H_{pS}	t	changes
H_{pS}=4X/t	256	0.8	10	4x/t	8	
H_{pS}=8X/t	256	0.8	10	8x/t	4	t reduce 1/2
H_{pS}=8X/t	256	0.8	5	8x/t	8	C reduce 1/2
H_{pS}=8X/t	512	0.8	10	8x/t	8	M enlarge 1time
R=1	320	1	10	4x/t	8	M enlarge 1/4
R=1	256	1	10	4x/t	6.4	t shrink 1/5
R=1	256	1	8	4x/t	8	C reduce 1/5

E.g. there is 8500 unit in an industry the actual average level value is 5#/day, management value is 0.78. The new level value is 40#/day since the new machine from 1985. In 1992 a large number of applications new tools and corresponding new technologies in the industry, the basic unit of the new level of value to 500. Asked how much science and technology for growth? Relative value of the original level of the basic unit increased? Industry from 2085 to 1892 the total productivity of the scale and level of the value of the average annual increased? What is the new production in 1992? When the market demand for a daily average of 54 000 when the product can reduce the level of the value of the basic unit of the original number? Or shortened the effective labor time?

From H_{pS} =5#/day; H_{pS}' =40#/day, CD=500 C=8500

From 4-2 $D=\dfrac{40\text{-}5}{5}\times100\%=700\%$

From 4-3 $Z_s=\dfrac{(1+700\%)\times5\times500}{5}-500=3500$

The enlargement(85-92)：$\dfrac{8500+3500}{8500}=1.41$ time

Actual growth of level value: $\dfrac{H_{pS}'\big/H_{pS}}{7}=\dfrac{40/5}{7}=1.143$

From (4-4) we can get the new production of 1992

$M=12000\times5\times1=60000\#/\text{day}$

From 4-5 when the market demanding is 5300 per day

$C=\dfrac{60000\text{-}54000}{5\times1}=1200\#$

From 4-6 we can calculate the shrinking working time

$t=\dfrac{54000}{12000\times5}=0.9\text{day}$

Use 8 hours as a workday: $0.9\times8=7.2h$

Applications in science and technology, productivity levels by the basic unit of value to business productivity and social value of a general increase in productivity levels, productivity and social productivity, and corporate development of productive forces in accordance with the law of continuous development process, the history and reality in foreign production always continue to reflect.

5. THE IMPROVEMENT OF THE LEVEL VALUE AND THE DEVELOPMENT OF THE MARKET ECONOMY

In the marketing economy, the productivity will restrict and affect the development of the economy.

1) In the market economy, the demanding and the number of the basic unit is nearly in balance. Market economy any time for any kind of product demand is a certain limit. When the basic unit of production is equal to the average value of the market demanding, then the market performance of the supply-demand is in balance situation. When the product is in short supply, companies continue competition and constant application of new technologies will inevitably lead to run the basic unit of relative increase (raise the level of value) and the absolute increase (the value of the original level of the basic number of units). When the over demanding begin, the working time or the number of the basic units will reduce. So every product will affect the working time in the market, we can use 4-4 to calculate the relative number.

2) In the community under the conditions of mass production, productivity and development of market economy development needs of the scientific productivity of macro-management.

First, when the application of new technologies and the basic unit of increase in the number of products to meet market demand, if the country is not on the macro-economic development of the market management or lack of scientific productivity, macro-productivity management, productivity blind

laissez-faire development of competition, the inevitable With the emergence of competition to the product backlog, resulting in a large number of basic units of productivity to stop production run, resulting in shutdown or bankruptcy of enterprises, staff of unemployment, reduced purchasing power, economic depression and other "economic crisis" situation occurs. Thus, in conditions of social production, the "economic crisis" is the development of productive forces of human society; there is no macro-productivity, scientific management or the management of macro-productivity, the inevitable phenomenon. From Britain, Germany, the United States, Japan and other capitalist countries in modern times in the process of economic development has been repeatedly shown no macro-productivity scientific management, not the healthy development of the market economy. Second, the value of technology to productivity levels have long been the role and influence from the practice reflected in the development of social productive forces under normal circumstances, when the market demand reaches saturation, the number of laid-off workers are always separated and technology to promote the growth rate is proportional to the . Therefore, how the law in accordance with the development of productivity due to technological applications to the separation of laid-off workers and graduate education into the labor market, and expansion of the field research, the establishment of new production and development of tertiary industry, the workers continuing demand balance, is the macro-economic development of the productive forces of modern scientific management is an important issue, but also to adapt to modern and future society and promote the healthy development of productive forces is a critical.

To calculate the level value or other parameter rationally will let us know the development of productivity clearly. In addition it will help us to get the internal relationship within the productivity, characteristics and easy for us to execute the micro-management. With the development of modern society, enhancing the productivity and the level of management is requirement of the enterprise, countries even the world.

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