Journal of Business and Economics, ISSN 2155-7950, USA
January 2021, Volume 12, No. 1, pp. 23-35
DOI: 10.15341/jbe(2155-7950)/01.12.2021/003

http://www.academicstar.us

Economic Basis of the Applied Fourth Industrial Revolution on Agricultural Land Allocation and Social Welfare

Nguyen Van Song[1], Nguyen Cong Tiep[1], Dinh van Tien[2], Thai Van Ha[2], Nguyen Tat Thang[1], Nguyen Xuan Diep[3], Vu Ngoc Huyen[1], Nguyen Xuan Huu[4], Vuong Thi Khanh Huyen[1], Nguyen Van Hanh[4]

(1. Vietnam National University of Agriculture (VNUA), Vietnam;

2. Ha Noi University of Business and Technology, Vietnam;

3. Thai Nguyen University of Economics & Business Administration, Thai Nguyen, Vietnam;

4. Vietnamese Academy of Forest Sciences (VAFS), Ha Noi, Vietnam)

Abstract: The Fourth Industrial Revolution will change the production, consumption, as well as all aspects of the lives of producers, consumers, and other organizations in the society. Based on theoretical economical and mathematical models, the article demonstrates the impacts of the application of the Fourth Industrial Revolution on farm production, agricultural sector, distribution land resource, and social welfare. The results show that the value of marginal products (VMP) will be increased. The Fourth Industrial Revolution, will help to attract more lands for production, thereby the land price will go up at a slower rate than that of the farm's marginal product value; as a result, social welfare will also be improved. The land market of Vietnam needs to be ensured by policies and laws to operate in accordance with the rules of the market and sustainability in the coming years.

Key words: application; the Fourth Industrial Revolution; value of marginal product; land; social welfare

JEL code: Q

1. Introduction

The increase in the manufacturing sector not only increases the resource of investment input, but in fact, there are three ways to increase the production capacity line of a business (For example: an agricultural farm), one sector, an economy is: first, borrowing to invest more resource for production; second, improving science and

Nguyen Van Song, Dr., Professor, Vietnam National University of Agriculture; research areas: agriculture economics, natural resource and environmental economics. E-mail: nguyensonghua@gmail.com.

Nguyen Cong Tiep, Dr., Vietnam National University of Agriculture; research areas: economics and management. E-mail: nctiep@vnua.edu.vn.

Dinh van Tien, Dr., Professor, Ha Noi University of Business and Technology; research area: economics. E-mail: dvtien.napa@yahoo.com.

Thai Van Ha, Dr., Ha Noi University of Business and Technology; research area: economics. E-mail: vanha280182@gmail.com.

Nguyen Tat Thang, Dr., Vietnam National University of Agriculture; research area: economics. E-mail: nguyenduongthang@yahoo.com.

Nguyen Xuan Diep, Mr., Thai Nguyen University of Economics & Business Administration; research area: economics. E-mail: nguyenxuandiep@gmail.com.

Vuong Thi Khanh Huyen, Mrs., Vietnam National University of Agriculture; research area: economics. E-mail: vuongthikhanhhuyen@gmail.com.

Nguyen Van Hanh, Dr., Committee on Ethnic Minority Affairs of Vietnam; research area: economics. E-mail: nguyenhoanghanh73@yahoo.com.vn.

technology, applying new science and technology; third, strengthening cooperation in production, in consumption of products between production units, between business organizations, between sectors; In three ways to increase the above production capacity for a business, an sector, a nation, only the second way that is to improve science and technology to be effective and sustainable.

In the future, technological innovation will lead to a leap in the supply of product, ensuring long-term benefits of efficiency and productivity. Transport and communication costs will decrease, global supply chains will become more efficient, trade cost will be reduced, all will open new market and boost economic growth (Klaus Schwab, 2016). In this fourth revolution, we are benefiting, with a host of new technologies that connect everything, digital and biology. These new technologies will impact all sectors, economies and industries, linking billions of people to the website, significantly improving the efficiency of businesses (Marr, Bernard, 2016).

The objective of the article is to demonstrate and analyze the economic model perspective in order to specify the basis from an economic perspective that impacts the application of Industrial Revolution 4.0 on the output of a farm, a sector, a nation, the impact of application of Industrial Revolution 4.0 to redistribute land resource in agriculture, and the impact of application of Industrial Revolution 4.0 on social welfare.

The article is divided into 4 main parts, Part I: The theoretical basis of input substitution, this part clearly demonstrates the effect of pare to in production and the distribution principle of input to achieve efficiency in resource allocation of production area, this is the basis for solving Part III; Part I, outlines the approach and analysis method of the article; Part III: Results of research and discussion, analysis part of input substitution that ensures effective distribution of resource in the manufacturing sector, analysis of distribution and movement of land resource when applying Industrial Revolution 4.0, Analysis of social welfare changes when applying Industrial Revolution 4.0; Part IV, conclusion and policy implication for Vietnam.

2. Theoretical Basis of Input Substitution

2.1 The Theoretical Basis of Scientific and Technological Progress and Input Substitution

According to Mas-Colell, Andreu (1995), "Marginal Rate of Technical Substitution (MRTS) is that the amount of one input (For example: labor input $-\Delta L$) is replaced by another input (For example: capital input ΔK) meanwhile the achieved output level has not changed". This rate will provide the most effective alternative between the input for the production process.

Research on input substitution, productivity performance and farm size/scale, Yu Sheng, Alistair Davidson, Keith Fuglie and Dandan Zhang (2016) find the relationship between intimacy input substitution, scale efficiency of those farms: when there is the high technology application process (Industrial Revolution 4.0) in production, the farms will increase production efficiency through saving input cost and expanding the production scale.

Group of authors Stefanie Haller, Marie Hyland (2014)used the translog cost function to build an analytical model for manufacturing sector for Ireland, from 1991 to 2009; The result of estimating price elasticity, cross-price and substitution elasticity between input are capital, labor, materials and energy for the conclusion that capital and energy are alternative inputs in the strongest production process; when energy price increases by 1% will increase by 0.1% in capital demand. In these factors, price elasticity reflects the potential for technology substitution, an increase of 1% in energy price, resulting in a 1.58% increase in capital/energy input. But large or foreign-invested companies accounting for the majority and with less reaction than domestic companies or small companies.

The Author Ruth M., Hannon B. (1997) used dynamic model to analyze the substitution of input types and for skill, high skill conclusions when manipulating works that is an important alternative factor for time input.

Research on cost, demand factor and productivity growth are considered in the handicraft sector in 1958-1987. The authors conclude that: elements that are labor, capital and materials can all be interchanged during the production process; Labor will continue to play the most important role of the input. However, the regional comparative advantage is not only related to labor, but also policies to attract technological advances or to between sectors, these factors must also be considered and counted (Barry J. Seldon & Steven H. Bullard, 1992).

Studies on input substitution in the fishery sector tend to focus on the substitution between physical input or fishing time. The result showed that the input substitution is clearly consistent with the behavior towards maximizing profitof the producer (Sean Pascoe & Catherine Robinson, 2008).

Yu Sheng et al. (2016), developed a theoretical model to test the relationship between substitution (engineering) and productivity, scale; The authors conclude that, for larger scale farms, the input substitution efficiency affects higher labor productivity; J. M. Gates (2000) concluded that "Digital analysis is consistent with the theory that shows operation cost and that can be reduced without substitution between fishing by using more traps method and longer immersion time".

The authors Kang Shi, Juanyi Xu, and Xiaopeng Yin (2015) have developed an open economic model that studies why a floating exchange rate policy is ineffective in emerging market economies in East Asia; The authors argue that there is no significant input substitution between local labor and import intermediary in good business production and widespread use of foreign currency in export price in East Asian economies; Fixed exchange rates in most cases bring higher welfare.

In a research study, the authors estimated the cost of production and the elasticity of the substitution of input for smallholders in Zimbabwe, using a double method (cost function) with detailed data on price, survey results of 65 farms on six survey sites within two years in Zimbabwe; group of authors of Timothy J. Dalton, William A. Masters, and Kenneth A. Foster (1997) conclude that 95% of the choice of farm behaves in accordance with the principle of optimal input use, with moderate between labor, biochemical input and capital. These results indicate that farmers can substitute between input when the price of input types changes, especially to increase labor use when rural population increases.

Ximing Cai, Claudia Ringler, Jiing-Yun (2008), studied the substitution of input in agriculture to conserve watersourse, the authors concluded: the substitution of irrigation water with other agricultural input is an important method to conserve water when producer faces increasing pressure on water resource from both non-agricultural water demand and water environment requirements. The potential of water use substitution was adopted by the authors through an empirical analysis based on the function of multi-input crop production on farm and field scales. Results from crop production analysis showed both crop yields and net profit maximization.

2.2 Theoretical Basis of Input Price Elasticity to Input Substitution

G. Boyle (1981) studied, the changing resource structure of agriculture for 25 years, by using the neoclassical production theory framework. The translog function is used to estimate the elasticity of the substitution coefficient. Analysis of the author compares two periods, 1953-1970 and 1953-1977; The results show that: labor and machinery are replaced by low elasticity (less relaxation) in the period 1953-1970. In contrast, labor and materials are replaced with higher elasticity (elasticity). The application of technical advances such as machinery and materials used will lead to labor savings.

The author Olivier de La Grandville (1997) demonstrated that the input substitution in the production process depends on the curvature of the contour (isoquant), the authors also studied and concluded that the elasticity of Input substitution is a parameter that reflects the efficiency of the input substitution in the direction that will use the optimal input.

The use of data in the 75 years of the US economy, Robert S. Chirinko (2007) the elasticity of substitution between capital and labor and the conclusion that the level of elasticity ranges from 0.4-0.6 (less elasticity). Data from British Columbia's salmon fishery sector provides evidence of the ability to substitute input for two types of vessels. This result raises questions about the usefulness of choosing input alternatives (Diane P. Dupont, 1991).

The research of the authors group, led by Darold Barnum (2016), points out that when using overall data, analyzing management decision should be concerned with replacing input. Rao V Nagubadi, and Daowei Zhang (2006) used a cost model to analyze the input substitution in the wood preservation sector in Canada from 1958 to 2003; The results of the study of team showed that the ability to significantly replace existed between different types of input. Inside, replacing labor with other input is easier than replacing other input with labor, and replacing other input with materials easier than replacing materials with other input.

Research by Regier Gregory K. and Dalton, Timothy J. (2013) on the impact of genetically modified corn on labor, costs and the ability to substitute input for smallholder producers in South Africa; The research results show that the elasticity of the substitution factor represents a strong substitution between the input factors.

In most energy models, the effectiveness of energy policy instruments depends primarily on both price and substitution elasticity between different input and is directly proportional to technological progress (Gerard H. Kuper & Daan P.van Soest, 2003).

The use of the cost conversion function of American authors studying the input structure for water utilities of USA; The results show that: capital is an alternative input to both energy and labor, but there is no strong alternative that exists between energy and labor. Energy is an input that requires intensive use in water production, so, it is less elastic (Kim H. Youn, Clark Robert M., 1987).

3. Research Methods

Methods of modeling, mathematics, analytical method, institutional comparison are also used in this article, these methods are likely to show that how different forms of economic and social organizations have been to set up, establish, and to change in different economies. This method focuses on macro-social institutions, especially those that govern’s access to important resource, especially two important: labor and capital input (Whitley, 1999).

The systematic analysis of institutions, the interaction between institutions and the behavior of business organizations has been carried out according to economic relations and economic behavior (Maurice et al., 1986; Hollingsworth & Boyer, 1997; Herrigel, 1996; Lane, 1992).

4. Results and Discussion

4.1 Substitutionbetween the Two Input Ensures Efficiency in Resource Usage

In every production process, land, labor and capital are the three main input. In agricultural production, two important input are labor and land. The two short-term inputcan be seen as a limit on resource in the production process of a farm, of a locality, of a sector, as well as of a nation. Efficient use of these two basic resources in production that requires satisfying certain economic conditions. In order to clarify this issue, we assume that in the economy produce two (2) types of goods X (flower) and Y (rice); If we fix the amount of X goods (flower) in the production volume X0and find a way to maximize production of goods Y, in terms of the two basic resource of labor and land, we have:

Purpose function: Max Y = F(Ly, Ldy)

Subject to:

X0 = G(Lx,Ldx)

L constrain = Lx + Ly

Ld constrain = Ldx + Ldy

Where: Ly, Lx are labor (consist of the quality and quantity of labor of a farm or economy) to produce X goods and Y goods; and Ldy, Ldx is the land, to produce X goods and Y goods. L constrain (Lrb) và Ld constrain (Ldrb) are constraints on labor resource and constraints on the land area of a farm or an economy. G(Lx, Ldx) and F(Ly, Ldy) are two goods production functions X and goods Y that use two input of labor and land.

Use the algorithm of Lagrangian (Λ) we have:

$$\Lambda = F(Ly, Ldy) + \lambda\{X0 - G(Lx, Ldx) + \lambda L[Lrb - Lx - Ly] + \lambda Ld[Ldrb - Ldx - Ldy]$$

Find the necessary conditions (FOC)

$$\partial\Lambda/\partial Ldy = MPLdY - \lambda Ld = 0 \quad (1)$$

$$\partial\Lambda/\partial Ly = MPLY - \lambda L = 0 \quad (2)$$

$$\partial\Lambda/\partial Lx = -\lambda MPLX - \lambda L = 0 \quad (3)$$

$$\partial\Lambda/\partial Ldx = -\lambda MPLdX - \lambda Ld = 0 \quad (4)$$

From (1), (2), (3) and (4) we have:

$$MRTS_{LdL}{}^{Y} = \frac{MP_{Ld}{}^{Y}}{MP_{L}{}^{Y}} = \frac{\lambda_{Ld}}{\lambda_{L}} \quad \text{for Y products goods} \quad (5)$$

$$MRTS_{LdL}{}^{X} = \frac{MP_{Ld}{}^{X}}{MP_{L}{}^{X}} = \frac{\lambda_{Ld}}{\lambda_{L}} \quad \text{for X products goods} \quad (6)$$

From (5) and (6) we have:

$$MRTS_{LdL}{}^{Y} = MRTS_{LdL}{}^{X} = \frac{\lambda_{Ld}}{\lambda_{L}} = \frac{land\ price}{labor\ price} \quad (7)$$

Inside: MP is the marginal product; MRTSLdL is the Marginal Rate of Technical Substitution between land and labor; λ_L &λ_{Ld} is the cost of an input unit of labor and land, if calculated in 1 unit of labor or land, this is the wage, salary and price of a unit of land put into production.

Thus, Eq. (7) gives conclusion that: in order to achieve efficiency in the production process that requires a marginal rate technologycal substitution between land for labor to produce goods X is equal to the Marginal Rate substitution of land for labor for production of goods Y, at the same time, equal to the rate between the price of one unit of land and and the price of a unit of laborquantity.

4.2 Distribution and Movement of Land Resource When Applying Industrial Revolution 4.0

4.2.1 Distribution of Land Resource Before the Application of Industrial Revolution 4.0

In a nation, the total supply of land quantity is completely inelastic (vertical supply curve), in the short term, the supply of land quantity for sectors is fixed, but in the long term, the supply of land for sectors can change depending on the level of profit that the land area brings. This shift not only takes place between sectors (industry, agriculture, fisheries, forestry, tourism services, etc…) in an economy, but it also takes place within an internal farm, internal agricultural sector that depends on the profitability of the products types being produced in one farm, within the agricultural sector. We know that the supply of land in the fixed agricultural sector is (L_d), inside: land for rice production (L_{d-rice}) and farmland for flower production ($L_{d-flower}$). In the case of simplicity, we assume the farm or sector produces only two products.

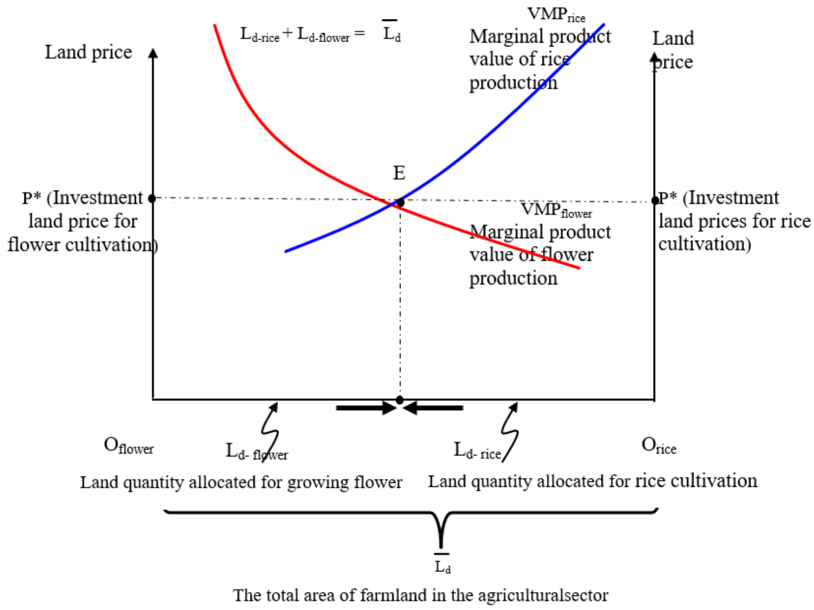

Figure 1 Allocation of Land for Production Between Two Types of Flower and Rice Products in the Agricultural Sector, Prior to the Application of Industrial Revolution 4.0

Source: Nguyen Van Song, 2006

Where:

$VMPf_{lower}$ is the marginal product value of flower land area (VPM = flower price * marginal product of the investment of a unit of flower cultivation land);

VMP_{rice} is the marginal product value of paddy land area (VPM = rice price * marginal product of the investment of an additional unit of rice cultivation land);

L_d is the total area of farm land or sector used for production or cultivation;

$L_{d-flower}$is the total amount of land invested to grow flower of the farm, or of the sectorwith application of Industrial Revolution 4.0;

L_{d-rice} is the total amount of land invested to grow rice in a farm or without application of Industrial Revolution 4.0;

P* is the price of a unit of land invested for planting flower or growing rice before application of Industrial Revolution 4.0;

Before the farm, or agricultural sector applies, developes Industrial Revolution 4.0; farm, or agricultural sector will invest the land area quantity to grow flower is$L_{d-flower}$ and the land area quantity to plant rice is L_{d-rice}in there: the marginal product value of flower growing land VMP_{flower} equals (=) the marginal product value of rice cultivation landVMP_{rice} and equals (=) rent price of a unit of land for investment. Thus, the price of a unit of land, flower price, rice price, flower marginal productivity and rice marginal productivity will be 5 factors for the farm owner to base, decision maker will invest how much land area that will be used for planting flower and how much land will be invested in rice cultivation or conversion to other crops and products. Intersection between two marginal product value lines (in the case of farms make business in two product), or intersection between multiple marginal product value lines (in the case of farms make business in multiple product), and the price of a land unit will be the basis for deciding land investment, or converting land between products within the internal farm, within the internal agricultural sector.

4.2.2 Land Conversion Within the Internal Farms, or Within the Internal Agricultural Sector, When Applying or Developing Industrial Revolution 4.0

Industrial Revolution 4.0 when applied and developed on a farm, or in the agricultural sector will create a big shift, increasing crop productivity and livestock productivity. In this case, for simplicity, we assume that the flower production of the farm or agricultural sector applied Industrial Revolution 4.0 in rice production has not yet been applied to production. Thus, the marginal product (MPLd) of a unit of land for growing flower will drag the marginal product value of the flower product (VMPflowerafter4.0) moving upwards (see Figure 2). The shift of the marginal product value line of floriculture land is the shift of the "demand curve" to flower growing land. This shift creates a new equilibrium point on the allocation of land in the farm or the new equilibrium of the E4.0land use market, instead of the point E. The new equilibrium point that is established will lead to change on the decision making to allocate land to production for products farm or agricultural sector. Flower farms now have a higher demand for flower land and are willing to pay the land price (Pland after application 4.0) higher than the land price before applying Industrial Revolution 4.0 to flower production (P Land before Application 4.0). The new equilibrium point established E4.0 instead of point E that will change the land area (L*d-after 4.0 – (trừ) L*d-before 4.0) from rice production to flower production. Due to this effect, the rice producers with marginal product value EE4.0will not be able to survive if they continue to grow rice but must switch to growing flower or producing other products with higher marginal product value than land use price after application of Industrial Revolution 4.0 (VPM > P land after application 4.0). This result implies, although only flower production using Industrial Revolution 4.0 in production leads to rice producers or other sectors to find new jobs, or have to improve themselves to switch to flower production, application of Industrial Revolution 4.0 in production.

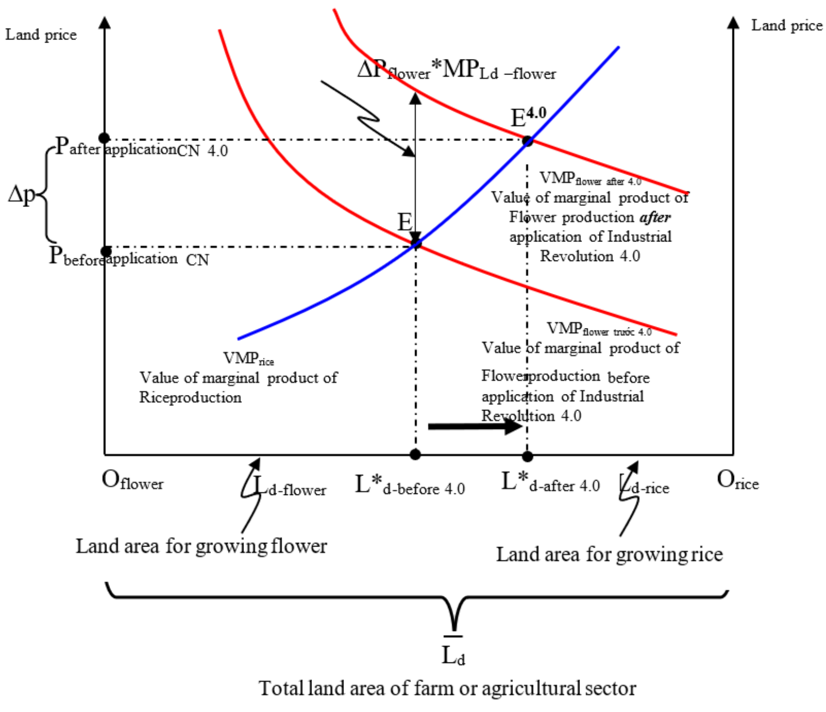

Figure 2 Effect of industrial application 4.0 to redistribute land resources infarms or in the Agriculture sector

Where:

$MP_{Ld-flower}$ is the marginal product of flower production after application, development of *Industrial Revolution* 4.0;

ΔP_{flower} is the change in the price of flower in the market after application, development of *Industrial Revolution* 4.0;

ΔP_{land} is the change in land priceafter application, development of *Industrial Revolution*4.0;

$VMP_{flowerbefore4.0}$ is the marginal product value of flowerbefore application, development of *Industrial Revolution* 4.0;

$VMP_{flowerafter4.0}$ is the marginal product value of flowerafter application, development of *Industrial Revolution* 4.0;

$L^*_{d\text{-}before\ 4.0}$ is the equilibrium land allocation pointbefore application, development of *Industrial Revolution* 4.0;

$L^*_{d\text{-}after\ 4.0}$ is the equilibrium land allocation point after application, development of *Industrial Revolution*4.0;

$L_d$is the total area of arable land of the enterprise or the agricultural sector.

To consider the increase in land priceprior to before application of *Industrial Revolution* 4.0 ($P_{landbefore}$application$_{4.0}$)on the land priceafter applicationof *IndustrialRevolution* 4.0 ($P_{landafter}$ application $_{4.0}$) how will affect the output price and profit of the farm, we can prove it as follows: Based on the result of Figure 2 we see an increase of Value of marginal product applied by *Industrial Revolution* 4.0 (ΔP_{flower} $*MP_{Ld-flower}$) bigger than the change in input price is land Δ_{Pland} according to the following equation:

$$\Delta_{Pland} < \Delta P_{flower} * MP_{Ld-flower} \quad (8)$$

If we divide both sides of the disequation above (8) for land price before application of *Industrial Revolution* 4.0 (P_{land} before application $_{4.0}$), then replace the land price before application of *Industrial Revolution* 4.0 by Value of marginal productof the flower before application of *Industrial Revolution* 4.0 we have:

$$\frac{\Delta_{land\ price}}{P_{land\,before\ 4.0}} < \frac{\Delta P_{flower} * MP_{Ld\ ?\ flower}}{P_{land\,before\ 4.0}} = \frac{\Delta P_{flower} * MP_{Ld\ ?\ flower}}{P_{flower} * MP_{Ld\ ?\ flower}} = \frac{\Delta P_{flower}}{P_{flower}}$$

The final result of Eq. (2) shows us that the speed of land price increase (Δland price/Plandbefore 4.0) is lower than the speed of flower price increase (ΔPflower/Pflower). This result leads us to conclude that: when applying Industrial Revolution 4.0, the speed of input price increase (land) is smaller than the speed of output price (flower). The implication of this issue is that when applying science IndustrialRevolution 4.0, not only the marginal productivity (MPland) of land increases but the speed of output price increase is higher than the speed of input price increase, so producers will have more interest.

In this research model we assume only one product (flower) in the farm, or in a sector applies IndustrialRevolution 4.0, so, only marginal product MPflower of land will increase. But it is easy to see that if both flower and rice products, or both two sectors all applying Industrial Revolutionprogress 4.0, both VMPflower and of VMPrice will move upwards to increase demand for input, but because the supply of land is less or completely inelastic, leading to an increase in land price. The allocation of land in this case will depend on which product, which sector that apply IndustrialRevolution4.0 more and more effectively will attract more land for production.

4.3 Social Welfare Change When Applying Industrial Revolution 4.0

4.3.1 In Case of Only One Product of The Farm, or A Sector Applying Industrial Revolution 4.0

In the case of only one product (For example: flower) of the farm or a sector applying Industrial Revolution 4.0, other products not yet or application of Industrial Revolution 4.0. In this case, the PPF production capacity line is only moved from the product manufacturing side applied Industrial Revolution 4.0, another product (For example: rice) will not change (see Figure 3).

Production capacity line (PPFbefore 4.0) of farms, or sector before applying Industrial Revolution 4.0 into flower production; The yield of rice produced is R0 and the flower yield is F0, with this yield level, the balance will be at point A and the level of social welfare achieved is U1. When producing flower of the farm, or of a sector applying Industrial Revolution4.0, the flower production capacity line will move up (PPFafter 4.0). Flower yield will increase from F0 up F4.0, the yield of rice will decrease from R0 to R1, the balance will be at point B and the level of social welfare achieved is U2. The increase in social welfare from U1 to U2 due to the application of Industrial Revolution 4.0 into flower production.

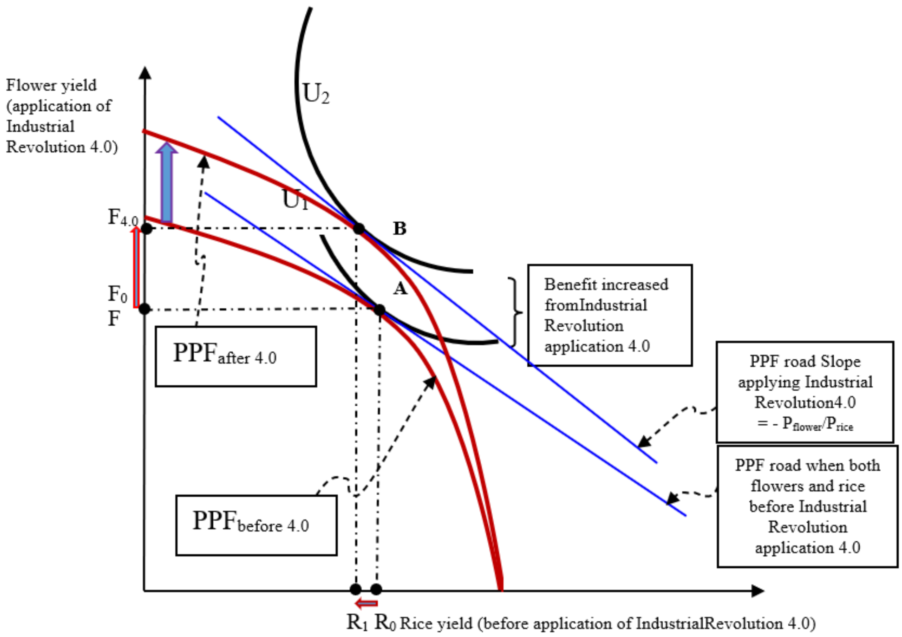

Figure 3 The Increase in Social Welfare, the Case of Only One Product of the Farm, or a Sector Applying Industrial Revolution 4.0

Where:

PPF is the production capacity line of a farm, agricultural sector, or nation;

U is a utility line that reflects the level of social welfare that can be achieved;

P_{flower}/P_{rice}related price measure the corner coefficient of the PPF line.

4.3.2 In the Case of Both Products, or Many Products of Farm, or Many Sectorsapply Together Industrial Revolution 4.0

In the case of both products, or many products of farm, or many sectors apply together Industrial Revolution 4.0; Thus, the marginal product of all these products has increased, although the land resource and other resource on the farm, on the sector have not changed. Although resource do not increase, but due to the application of

Science Industrial Revolution 4.0 will make the production capacity line (PPF) of enterprises move up to both products through the application of new science and technology in both products. products (Figure 4). In this case, it is different from the case of only one product (flower), or one sector of application of Industrial Revolution 4.0, the PPF only moves upwards in the product (flower) with application of Industrial Revolution 4.0, other sectors will not move (Figure 3).

In contrast to the case of only one product or one sector applying Industrial Revolution 4.0, it is possible to make other sector products decrease (For example: the yield of rice decreases from R0 to R1) in the case (Figure 3), when only the yield of sector with application of Industrial Revolution 4.0 will increase. Land resource on farm or sector will flow into the area with application of Industrial Revolution 4.0. In the case of both or many products, many sectors apply together Industrial Revolution 4.0, yield of both or yield sectorsalso increase, flower yield increases from F0 to F4.0; rice yield (not reduced as in case 1) but also increased from R0 to F4.0. In this case, we cannot confirm that land resource in the farm will be more attracted to which productsprodución, which sector. We can only affirm that which sector, which product or sectorwith better application of Industrial Revolution 4.0 is, better efficient, have higher marginal product value (VMP) that will attract more land resource.

Considering the corner coefficient of the PPF line to see how the impact of Industrial Revolution 4.0 affects the relative price (the exchange rate of the two types of products), in the case of both products, or many products of farm, or many sectors apply together Industrial Revolution 4.0 will certainly change, but they are parallel (as shown in Figure 4) only in the case of both products, or many products of farm, or many sectors affecting the relevant price (price rate) of the products is the same (case of Figure 4).

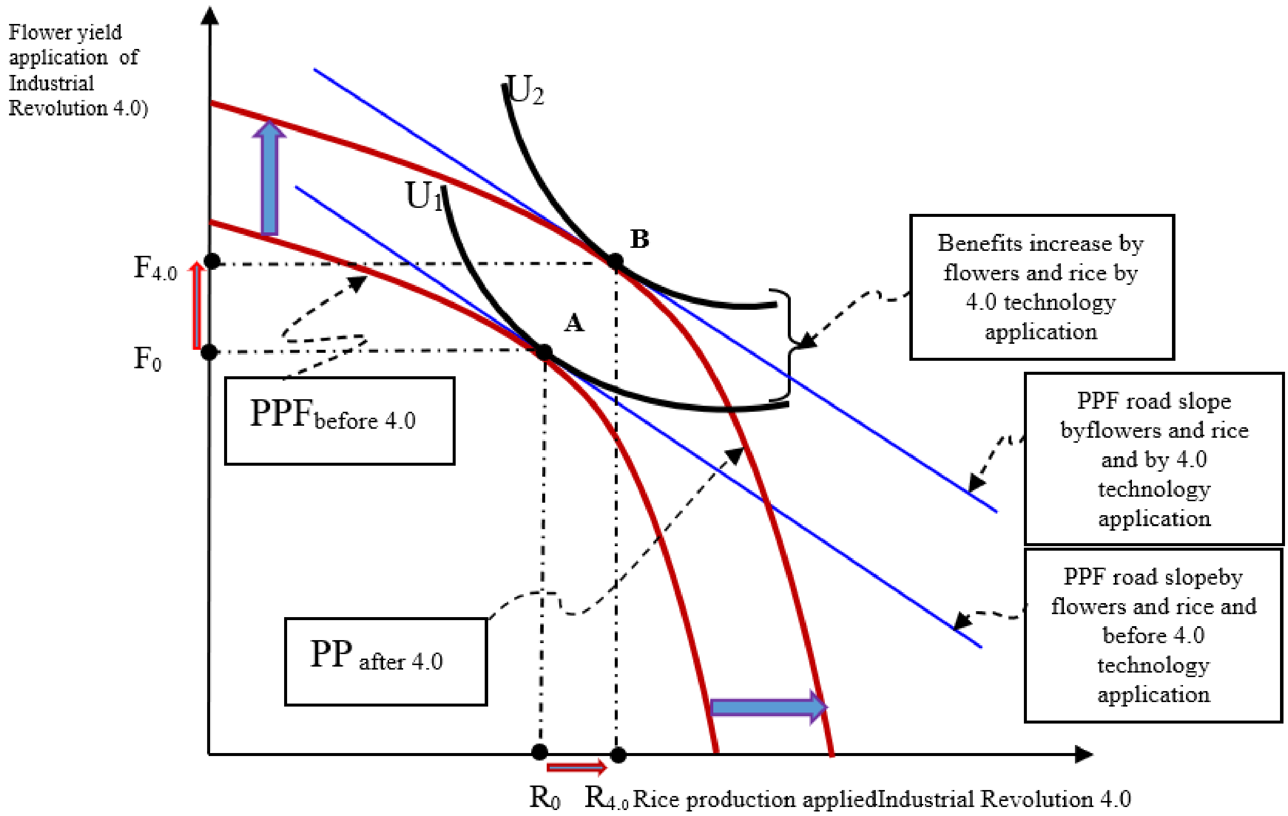

Figure 4 The Increase in Social Welfare, the Case of Both Products, or Many Products of Farm, or Many Sectors Apply Together Industrial Revolution 4.0

5. Conclusions and Implications

*The Industrial Revolution*4.0 will affect the production process, transform land resource in particular and input in general within the internal farm, within the internal sector, and in an economy.

To replace the two efficient production inputs of a farm, one sector, one nation and that replaces the marginal rate technological substitution (MRTS-marginal rate technological substitution) between land for labor to produce goods X equals the marginal rate of substitution of land for labor for production of goods Y is also equal to the rate between the price of a unit of land and the price of a unit of labor.

Product, sector with application of *Industrial Revolution* 4.0 will create the marginal product value (VPM_{input}) of increased input, the increase in marginal product value creates redistribution of resource in the manufacturing sector. Land will be attracted to products, sectors with application of *Industrial Revolution* 4.0, it will be more because the value of marginal products (VMP land) will be bigger to make more input demand. Because land resource will be attracted to products, sectors with application of *Industrial Revolution* 4.0, it will lead to a decrease in land area for other products and other sectors. Product yield of sectors without application of *Industrial Revolution* 4.0 or go after the investment of *Industrial Revolution* 4.0 will decrease and the unemployment rate in this sector will increase.

The change increases the price of land compared to the old land price, but the speed of increase in marginal product value, and in particular, the increase in output price (flower) is higher than the increase in land price. Because the marginal product value increases mainly due to the marginal product of sector with application of *Industrial Revolution* 4.0 increases, the used resource efficiency will be higher and attract more land.

In the case of both products, or many products of farm, or many sectors apply together Industrial Revolution 4.0 will make the PPF line move upwards on both or many products, although the land and input resources remain unchanged. The yield of both sectors also increases. The increase level is more or less that depends on the level and effectiveness of application of *Industrial Revolution* 4.0.

Application of Industrial Revolution 4.0 in the case of just one product or one sector (Figure 3), or for many products or multiple sectors (Figure 4), increases social welfare to a higher level. Although the resource of the farm and sector do not change, this represents the advantage of the application of science and technology in general and the application of *Industrial Revolution* 4.0in particular for the farm production and agricultural sector, and business, economy of a nation.

Through this article, we identify the important role of the market in efficient resource distribution, ensuring the greatest social welfare, in the market economy with the government regulation; In particular, the result focused on input market (labor, land, capital), especially the land market. Any output, input or mixed market requires transparency, clarity, not bias. The market must be operated in accordance with the rule, law, coordinated by the rules of the market, not bias, not distorted by human intellectual intervention (except market failures: monopoly, externalities, imperfect information, public goods, risks, fluctuations in the economic cycle, the government must intervene by the government). If the market is operated according to its rules, it will distribute its own resource effectively and achieve the greatest social welfare. The current land market in Vietnam is unclear, the transparency and the conditions of a real market are lacking, or weak (For example: the land price frame is built too slowly, backward, not updating with market price changes daily, hourly, land valuation criteria are missing, not specific: land valuation must be specific to each piece of land, because land price depend on many factors such as: ownership, area, quality, shape of the land, direction of the land, distance of the land to the market, the importance of livelihood of the living people on that parcel of land, etc…). Currently, there are too many outstanding issues in local land issues of the localities because the land market lacks many conditions of a real market. In order to the land market to operate and distribute effectively and achieve the highest social welfare, the elements of the competitive market must be gradually created and operated in accordance with market rules and be protected by law to survive sustainably.

References

Barry J. Seldon and Steven H. Bullard (1992). "Input substitution, economies of scale and productivity growth in the US upholstered furniture sector", *Applied Economic*, Vol. 24, No. 9.

Barry J. Seldon and Steven H. Bullard (1992). "Input substitution, economies of scale and productivity growth in the US upholstered furniture sector", *Applied Economics*, Vol. 24, No. 9.

Darold Barnum, Jason Coupet, John Gleason, Abagail McWilliams and Annaleena Parhankangas (2016). "Impact of input substitution and output transformation on data envelopment analysis decisions", *Applied Economics*, available online at: https://www.researchgate.net/publication/307566263/download.

Diane P. Dupont (1991). "Testing for input substitution in a regulated fishery", *American Journal of Agricultural Economics*, Vol. 73, No. 1, pp. 155-164.

Boyle G. (1981). "Input substitution and technical change in Irish agriculture — 1953-1977", *The Economic and Social Review*, Vol. 12, No. 3, pp. 149-161.

Gerard H. Kuper Daan and P. van Soest (2003). "Path-dependency and input substitution: Implications for energy policy modeling", *Energy Economics*, Vol. 25, No. 4, pp. 397-407.

Herrigel G. (1996). *Industrial Constructions: The Sources of German Industrial Power*, New York: Cambridge University Press.

Hollingsworth R. J. and Boyer R. (1997). "Coordination of economic actors and social systems of production", in: Hollingsworth, R. J. and Boyer R. (Eds.), *Contemporary Capitalism the Embeddedness of Institutions*, the USA: Cambridge University Press.

Gates J. M. (2000). "Input substitution in a trap fishery", *Journal of Marine Science*, Vol. 57, No. 1, pp. 89-108.

Kang Shi, Juanyi Xu and XiaopengYin (2015). "Input substitution, export pricing, and exchange rate policy", *Journal of International Money and Finance*, Vol. 51, pp. 26-46.

Kim H. Youn and Clark Robert M. (1987). "Input Substitution and demand in the water supply production process", *Water Resource Research*, Vol. 23, No. 2, pp. 239-244.

Klaus Schwab (2016). "The fourth industrial revolution: What it means and how to respond", *World Economic Forum*, accessed 2018-03-20.

Lane C. (1992). "European business systems: Britain and Germany compared", in: Whitley R. (Ed.), *European Business Systems Firms and Markets in Their National Contexts*, SAGE publications.

Marr Bernard (2016). "Why everyone must get ready for the 4th industrial revolution", *Forbes* (blog), accessed 2016-12-12.

Mas-Colell Andreu, Whinston Michael and Green Jerry (1995). *Microeconomic Theory*, Oxford: Oxford University Press.

Maurice M., Sellier F. and Silvestre J. J. (1986). *The Social Foundations of Industrial Power*, Cambridge, Mass.: MIT Press.

Nguyen Van Song (2006). *Economic Resource and Environment*, Agricultural Publishing House.

Olivier de La Grandville (1997). "Curvature and the elasticity of substitution: Straightening it out", *Journal of Economics*, Vol. 66, No. 1, pp. 23-34.

Rao V. Nagubadi and Daowei Zhang (2006). "Production structure and input substitution in Canadian sawmill and wood preservation sector", *Canadian Journal of Forest Research*, Vol. 36, No. 11, pp. 3007-3014.

Regier Gregory K. and Dalton Timothy J. (2013). "Labor-savings of roundup ready maize: Impact on cost and input substitution for South African smallholders", *Research in Agricultural & Applied Economics*, available online at: http://ageconsearch.umn.edu/record/160521.

Robert S. Chirinko (2007). "Sigma: The long and short of it", *Journal of Macroeconomics*, Vol. 30, No. 2, pp. 671-686.

Ruth M. and Hannon B. (1997). "Substitution of input in production", in: *Modeling Dynamic Economic Systems*, Springer, New York, NY.

Sean Pascoe and Catherine Robinson (2008). "Input controls, input substitution and profit maximisation in the English Channel beam trawl fishery", *Journal of Agriculture Economics*, Vol. 49, No. 1, pp. 16-33.

Stefanie Haller and Marie Hyland (2014). "Factor input substitution in Irish manufacturing", The Economic and Social Research Institute, Working Article.

Timothy J. Dalton, William A. Masters, and Kenneth A. Foster (1997). "Production costs and input substitution in Zimbabwe's smallholder agriculture", *Agricultural Economics*, Vol. 17, No. 2-3, pp. 201-209.

Whitley R. (1999). "How and why are international firms different? The consequences of cross-border managerial coordination for firm characteristics and behavior", in: *15th EGOS Colloquium*, University of Warwick, 4th-6th July.

Yu Sheng, Alistair Davidson, Keith Fuglie and Dandan Zhang (2016). "Input substitution, productivity performance and farm size", *Australian Journal of Agricultural and Resource Economics*, Vol. 60, No. 3, pp. 327-347.