1. Introduction

Through the Korean debate on the value of software (“Debate”), many writers have tried to explain the problem of the value and price of software package – the outstanding divergence between the price and production cost of a unit of software package – such as Microsoft Windows XP and Microsoft Office. Many issues like the unit of commodity, the amount of the value of software and the nature of R&D labour have been raised so far, and they have been followed by the related debate over the main categories of Marx’s labour theory of value – extra surplus value, rent and monopoly price. In this sense, the debate on the value of software package is not only about the value and price of software package but also about Marx’s labour theory of value itself.

Among many discussion points of the debate, in this paper, we will focus on the nature of R&D labour. R&D labour is defined as labour expended in the development of the source codes of software package (“Source”), which is not needed in the process of producing installers of software (“Installer”) which are produced based on the source codes and actually traded in the market. Hence a question about whether or not R&D labour that is not expended in the production of Installers produces part of the value of Installers was raised. It also inspired another question of how R&D labour is related with the production of Installers. In the Debate, R&D labour has not been theorised sufficiently, which we will discuss later. Due to this, the problem of the value of software package has not been explained well either. In addition, in that R&D labour is not limited to the development of software package, but is required for the production of commodities in general, this provoked the need to theorise R&D labour in a broader context – commodity production in capitalism.

In this paper, it will be argued that R&D labour should be incorporated into the labour theory of value in a consistent and coherent manner, and will show how this is possible. In order to do this, concepts such as knowledge, knowledge labour and knowledge production process will be introduced, and roles they play in the commodity production in capitalism will be explained. As the new concepts become part of the labour theory of value, the needs to reinterpret Marx’s labour theory of value naturally arise. In this paper, we will address these needs by reviewing extra surplus value, competition within sectors and monopoly price on the basis of the new theoretical approach. As the result of this, the viewpoint of this paper on the original question of the Debate – the value and price of software – will be provided.

The remainder of this thesis is organised as follows. Section 2 critically reviews the literature of the Debate by focusing on the different views on R&D labour. Section 3 argues that the knowledge production process which forms a pair with the labour process should be conceptualised. Section 4 describes how knowledge labour that produces knowledge (Source) in the knowledge production process is related to the production of the value of commodity (Installer). Knowledge labour does not produce the value of commodity either directly or indirectly, but the product of knowledge labour – knowledge – determines the productivity of labour in the labour process, and makes direct labour expended in the labour process act as intensified labour. Hence, extra surplus value emerges as the central category of the analysis. Section 5 deals with monopoly price. Many writers of the Debate have argued that a specific form of competition – monopoly – establishes monopoly price, but it will be argued that this interpretation is different from Marx’s. And it will be shown that the value of software package is not necessarily 0 and can be larger than 0 due to the existence of extra surplus value, and the price of software package is monopoly price only under specific circumstances. Section 6 points out that it is inappropriate to use the category of rent in the analysis of the value of software package. Section 7 summarises the paper, and presents the need for theories of “knowledge production process in capitalism”.

2. Literature Review: Distinction between Source and Installer / The nature of R&D labour

The question of how the value and price of software package is determined has been the main them of the Debate. The reason for this is that whereas the production of Source costs a lot, the production of Installers costs far less and the cost is close to 0 (See Figure 1 Source and Installer).
The following theories have been presented in order to explain this divergence between the price and production cost of a unit of software package based on Marx’s labour theory of value:

- N. Kang (2002, 2004): In case of software package, the distinction between Source and Installer should be drawn, and Source should be considered as commodity – the object of study. The value of Source is realised through the sale of Installers.\(^1\)

- Chae (2004a, 2004b, 2008), S. Kang (2008): Installer should be considered as commodity, and R&D labour that produces Source does not produce the value of Installers. Hence, the value of Installer is close to 0, and the price of Installer is monopoly price.

- C. Lee (2005), Ryu (2005), Kim (2008), Cho (2008): Regardless of the problem of which should be seen as commodity, Source or Installer, R&D labour that produces Source and labour that produces Installers are not qualitatively different from each other and the value of Source is distributed to the value of each Installer.

1) **N. Kang, K. Lee**

N. Kang (2002, 2004) considers the outstanding divergence between the price of software package and its production cost as a defining characteristic of information commodities such as software package\(^2\), and argues that contrary to other commodities, in case of software package, we need to distinguish between Source and Installer, and Source should be considered as commodity. Namely, ‘The value of information commodity is the labour time required to reproduce Source rather than an Installer’ (N. Kang, 2002: 99). And ‘the value of Source is realised by selling many Installers’ (ibid.). Hence, ‘whether or not the value of information commodity is fully realised depends on the selling price of each Installer and total number of Installers sold in the market’ (ibid.). In this view, as Source itself is considered as commodity, R&D labour that produces Source is labour that produces value (productive labour).

First of all, we can point out that the distinction between Source and Installer is correct, which is also important for the theorisation of knowledge labour in that it implies R&D labour is different from direct labour in general. However, considering that commodity production is basically mass production and ‘replica production’ (C.Lee, 2005: 155), we can also say that this distinction also applies to other commodities. As we always consider Installer (or replica) as commodity in case of other commodities, it might be correct to say that we should consider Installer as commodity in case of software package as well. There does exist a particular aspect of the production of software package that the labour time required to produce an Installer is close to 0. However, this does not justify the argument that Installer cannot be considered as commodity. Each Installer has its own material substance, it is

\(^1\) K. Lee (2004) argues that the unit should be ‘Algorithm’ rather than the entire source codes. However, this view is not so different from that of N. Kang in that Installer is not considered as commodity that has value.

\(^2\) ‘Information commodities have characteristics that are quite different from other commodities … view from a production perspective … the marginal cost of software is close to 0’ (N. Kang 2002).
being actually traded.

2) **Chae, S. Kang**

Criticising N. Kang, Chae argues that Installer rather than Source should be considered as commodity, and hence as the object of analysis. In addition, he also argues that as ‘virtually no labour time is needed’ (Chae 2004) to produce Installers, the value of Installer is close to 0. This argument is based on the observation of the general production methods of software package. The production of software package in general requires the source codes (Source) and the first Installer produced by compiling the source codes, computers, electricity and a medium (e.g. CD) to store Installer as means of production and living labour. When an Installer is produced, computer, electricity and medium transfers value, which is added to the new value produced by the living labour (simple copy labour). However, the first Installer and Source do not transfer any value because even if we assume that Source does have value, nothing in it has been changed before and after the production. So even if it is true that Source is indispensable for the production of Installers, Source does not transfer value to Installers. Source contributes to the production of Installers in the same way as land does for the production of agricultural products.

According to this view, we can conclude that the value of software package is close to 0. Further, given that the price of each Installer is much higher than 0, it is also right to say that the value of software package does not determine its price. Hence, Chae and S. Kang argue that the price of software package that is not determined by its value is monopoly price established by intellectual property rights. In other words, if no intellectual property rights had existed, due to the fact that the production of Installers requires little labour and the value of Installer is close to 0, the commodification of software package would not have been possible. According to the argument that the value of Installer is produced by the direct labour expended to produce Installer only, and hence is close to 0, R&D labour expended to produce Source is seen not to add anything to the value of Installer. Hence, S. Kang (2008) argues that R&D labour ‘never produces value’. However, he adds that as the result of R&D labour, the labour time required to produce Installers (from the second Installer onwards) decreases, which corresponds to the key arguments of this paper.

We can point out two things on this view. First, even though value is determined by socially necessary labour time, here a production method which is particular and concrete – namely, the production using the copy function of computer – is considered to be the main determinant of the value of software package. In other words, the observation of the general production methods of software package leads to the conclusion that the value of software package is close to 0 in general.

Second, this view assumes that capitals that produce software package comprise a sector of the economy. For Marx, the value of a commodity is determined by the average or dominant production methods of the sector the commodity belongs to, and a sector is comprised by capitals that produce commodities having the same use value, not by those who use the same production methods or technologies. As we have many different software packages that have different use values, capitals producing software package comprise more than one sector. In addition, as a sector is comprised by capitals producing commodities having the same use value, some capitals in a sector produce software packages whereas the others produce other types of commodities. For example, capitals producing PC dictionary may compete with capitals producing dictionary (book) within a single sector as they produce commodities with the same use value. This signifies that the value of software package is not necessarily close to 0 even if the labour time required to produce software package for individual capitalists is close to 0. It depends on the actual forms of competition within a sector to which the software belongs to and the level of knowledge that the production of the software package requires, which we will discuss later.


Regardless of the question of what should be considered as commodity in case of software package (either

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3 We will discuss this in detail in section 5.

4 In his latest paper (Chae 2008) on this subject, Chae, by saying that ‘of course, workers employed by capital like system engineers and programmers produce value and are exploited’, admits R&D labour produces value. However, it is not clear to which product the value created by R&D labour belongs to, and it is difficult to say that his view has been changed.

5 S. Kang says, ‘it is because as the result of communal labour, the labour time required for the reproduction and the amount of means of production to produce commodities that are no more new decrease’.

6 The use value of PC dictionary and that of book dictionary are not identical. However, use values are never ‘identical’ with each other. ‘The same use value’ itself is an abstraction through which Marx tries to show that the economy is composed of a number of sectors that are distinct with each other, and capitals within a sector compete with each other by increasing productivity of labour.
Source or Installer), C. Lee, Ryu, Kim and Cho argue that both R&D labour that produces Source and labour that produces Installers produce value.7

‘Value of every commodity is determined by embodied labour time, which is the sum of direct labour time and indirect labour time. If we view Installer as commodity, the production cost of Source is indirect labour that decreases as the number of produced Installers increases. The indirect labour portion of the total embodied labour decreases as the number of produced Installers increases’ (C. Lee, 2005: 157-8).

‘There is no reason why we cannot say that the value of Source (V) divided by the number of sold Installers is the value of each Installer’ (Ryu, 2005: 173).

‘Producing 10 million Windows XP Installers requires not only copy labour but also R&D labour. Hence, by summing up all these labours and dividing the total labour time by 10 million, we can easily calculate the ‘value of each Windows XP installer’ (Kim, 2008: 266).

‘Labour value expended in producing knowledge is distributed among many cars, and realised through the price of each car. However, it is not true that only part of the design knowledge is consumed for each car. Likewise, all the algorithms in Windows XP participate in the consumption process.’ (Cho 2008).

In sum, the value of Installer is seen as the sum of the value produced indirectly by the labour expended in the production of Source and the value produced directly by the labour expended in the production of Installer.

We can point out two things on this view. First, the value of Installer is determined *ex post facto*, depending on the number of produced/sold Installers. As the number of produced/sold Installers increases, the value of Installer decreases accordingly even without any changes to the productivity of labour. It is not consistent with Marx’s labour theory of value in that even though the production of Source is indispensable for the production of Installers, no changes to Source are incurred before and after the Installer production process. This has nothing to do with whether or not Source has value. Second, it is considered that R&D labour and direct labour that produces Installers are not qualitatively distinctive. Portion of value that is produced by R&D labour is seen to be added to the value of Installers produced by direct labour *ex post*. It means that R&D labour and the direct labour producing Installers are independent from each other, and only related with each other externally.

As we have seen so far, there are some theoretical problems in all the three views on the nature of R&D labour and the value of software package. As we mentioned in Introduction, to solve these problems, the nature of R&D labour in terms of the production of value needs to be studied, which requires in general the clarification of the roles of knowledge labour in the commodity production in capitalism.

3. Introducing knowledge production process

To begin with, we need to make a few things clear. First of all, the distinction between Source and Installer is right and important. Secondly, we should consider Installer as commodity, the object of study. Of course, we need to keep in mind that the distinction between labour producing Source (knowledge) and that producing Installer (commodity) appears to the extreme extent in case of software package. Hence, an inherent aspect of commodity production in general – the cost of producing the first unit of commodity is higher than the unit cost of production – appears very clearly in this case. This suggests that there are no needs to develop particular theories of the value of software package. Hence, for example, contrary to Chae (2004a) who argues that software package cannot be sold as commodities without the protection by intellectual property rights and its price can only be seen as monopoly price, the production and sale of software package in the form of Installers should be seen as a method of the production and distribution taken under such social conditions as the existence of intellectual rights which prevent illegal copy of software package.8

The distinction between Source and Installer in the production of software package in particular, and in the production of commodities in capitalism in general is an important theoretical starting point. However, the distinction alone looks not sufficient. Hence, we need to approach the question of the value and price of software

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7 Whereas C. Lee, Ryu, Kim argue, either explicitly or implicitly, that Installer is commodity, Cho says that Source should be considered as commodity.

8 If no intellectual property rights existed, production and distribution of software package in the form of Installers would not be possible because it is easy to make a copy of an Installer without buying it. In this case, rather than distributing the Installer, in order to prevent illegal copy, capital may choose let workers install software package on customer’s PC (for example, the software of electronic calculator cannot be separated from the hardware itself). So we should view the production and distribution of software package in the form of Installers as the product of particular social conditions (including intellectual property rights), and the way software package is produced and distributed may be changed as social conditions change.
package from a little different perspective. We need to look into details of Source and Installer, and the relations between them. Especially, we should explain how labours that produce Source and Installer respectively are related with the production of value. In order to do that, we should leave the ‘hidden abode of production’ (Marx, 1867: 279) for a while, and take a different view of commodity production process.

1) Labour presupposes knowledge

In the chapter 7 of *Capital 1*, Marx argues that the labour process in the capitalist mode of production is the valorisation process at the same time. In addition, in the first part of this chapter, Marx analyses the labour process as labour process as such, which provides us with Marx’s views on labour.

According to Marx, what distinguishes labour of human from labour of animals is that the result of human labour already exists before labour. Marx says, ‘the architect builds the cell in his mind before he constructs it in wax’ (Marx, 1867: 284), and ‘at the end of every labour process, a result emerges which had already been conceived by the worker at the beginning, hence already existed ideally’ (ibid.). Hence, the labour process that belongs to the hidden abode of production presupposes the knowledge of the goal of labour (i.e. what to produce) and the techniques to realise the goal (i.e. how to produce). It means that commodity production requires not only concrete labour expended in the labour process, but also labour that produces knowledge of what to produce and production methods and means to be used. When Marx says ‘this activity is determined by its aim, mode of operation, object, means and result’ (Marx, 1867: 132), the aim, mode of production, object, means and result comprise knowledge of a specific labour process.

In other words, labour does not include the production of knowledge, but takes it for granted that knowledge (aim, mode of production, object, means and result) exists already. In that knowledge production is not considered as labour, it is implied that labour that is expended in the production of knowledge does not produce value.

2) Knowledge production process, knowledge labour, knowledge

Hence, we should distinguish between the knowledge production process and the labour process. In addition, in the capitalist production, the production of knowledge related to production methods is being done in systematic ways by capital, thus excluding workers from this process. This inspired the conceptualisation of the separation between conception and execution as being an important tendency in capitalism. Hence, the production of knowledge in capitalism is important in that not only does labour presuppose knowledge, but also knowledge is produced in specifically capitalistic ways.

Hence, we argue that the production process in capitalism is composed of the labour process and the knowledge production process. In the same vein, we should distinguish between labour expended in the knowledge production process and labour expended in the labour process and between the product of the knowledge production process and the product of the labour process. The labour expended in the knowledge production process is important in terms of the production of value in that it does not produce value either directly or indirectly, but it determines the productivity of labour and makes direct labour of the labour process act as intensified labour, which we will discuss in more detail later.

As mentioned in the Introduction, the Debate has been dealing with the issue of knowledge, and has been using the concepts like Source (model) and R&D labour. These concepts, however, are more or less limited in that Source reflects the notion of what to produce, but not how to produce. In addition, the production of Source (model) requires not only R&D labour which presupposes workers with a relatively high level of knowledge but also simple labours and diverse means and instruments of production. So we propose to use new concepts as below:

First, ‘labour process’ is a purposeful process through which commodities are produced by using given means of production (instruments of labour and objects of labour). As Marx argues in the chapter 7 of *Capital 1*, in the capitalist mode of production, the labour process is the valorisation process at the same time. The labour process presupposes knowledge or blueprint that is the result of the knowledge production process.

Second, ‘knowledge production process’ is a process where knowledge or blueprint that is required for the labour process is produced. Not only living labour but also a diverse means and instruments of labour are used in the knowledge production process. The knowledge production process includes, for example, the process through which workers learn how to use new machinery that will be used in the labour process to enhance the existing production methods. The learning itself is considered as labour in the knowledge production process.

Third, ‘knowledge labour’ or ‘design labour’ is living labour that is expended in the knowledge production
As mentioned earlier, learning of knowledge produced in the knowledge production process is considered as knowledge labour as well.9

Fourth, ‘knowledge’ or ‘blueprint’ is the result of knowledge labour, and it specifically refers to the knowledge of the labour process. It includes the specifications of commodities to produce (e.g. colour, size, functions, etc.), production techniques, raw materials to use, how to build specific production lines and so on. Knowledge exists in many different forms. For example, the skill of planing cannot be separated from the workers who know how to plane. This aspect of knowledge is reflected in the distinction between codified knowledge and tacit knowledge. The fundamental difference between knowledge and the commodities produced in the labour process is that knowledge is not affected by wear and tear.10

Fifth, labour or direct labour is labour expended in the labour process.

The distinction between the knowledge production process and the labour process corresponds to the distinction between Source and Installer. In other words, labour that produces Source is knowledge labour and labour that produces Installer is direct labour.

Let us look into details of the knowledge production process of software package (e.g. Windows XP). Diverse labours are needed to produce the source codes of Microsoft Windows XP. We need workers who understand all the technical details of computer and define the functions and specifications of the software. We need workers who actually do programming based on the specifications. We also need workers who test the software to make sure that the software is developed as specified. All these workers are doing knowledge labour and work in the knowledge production process regardless of the types of work they do. It is because the distinction between knowledge labour and direct labour is drawn on the basis of the roles played in the commodity production, not according to the level of knowledge that is required for each labour. Whether or not workers transporting commodities produce value depend on which capital employs these workers. In the same way, a specific labour can be considered as knowledge labour in some cases, and as direct labour in other cases. This way of conceiving knowledge labour is different from that in the knowledge economy theories based on the mainstream economics, where labour is classified as either knowledge labour or direct labour based on the level of required knowledge. Based on this classification, the knowledge economy theories calculate the ratio of knowledge workers to normal workers in an economy, and determine the level of transition to knowledge economy based on that ratio. Contrary to this approach, the concept of knowledge labour in this paper is intended to reveal the structure of the production process in the capitalist mode of production.

Once the knowledge production process is completed, Installers are mass-produced using the source codes (knowledge of the labour process). This mass production process is the labour process where Windows XP

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9 Capital may expect that workers have already learned some skills before the employment.

10 Knowledge – the product of knowledge production process – does not have value. Knowledge as the product of the knowledge production process is distinguished from knowledge as such. Knowledge in a narrower sense – the object of analysis – has use value in that it determines the productivity of direct labour. It is true that knowledge can be codified and sold, but in the same ways as land is priced and sold. Codification is a means of easing the process of learning, and codified knowledge itself is not commodity. In addition, it is known that complete codification of knowledge is not possible.
Installers are produced, and means of production such as computers, electricity and CD are also used during the labour process. Living labour is expended in the labour process, and in this case, it is simply ‘copying’. As the result of the labour, CDs containing Installer are produced.

New Automobile Model (Knowledge)

- Specifications (Model Design)
- Research & Development
- Trial products
- Several rounds of intensive test
- Design (Production Line)
- Lots of efforts required

Automobile (Commodity)

- Traded in the market
- Mass production

Automobile

Figure 3 Automobile production and the distinction between knowledge and commodity

This distinction between the knowledge production process and the labour process is also present in the production of other commodities – for example, automobiles (See Figure 3 Automobile production and the distinction between knowledge and commodity). First and foremost, a new model of automobile should be designed and developed because it is not until the new model becomes available that mass production is possible. So what to produce should be determined. New model (or product) development includes the initial design of the new product concept, production of trial products, and the long-term test and defect fix process. The design of the new product concept requires high-level of knowledge as it not only involves the visual design of automobile but also requires engineering consideration without which the actual implementation of the visual design is not possible. Based on the new design, the first trial product is produced, which requires much more labour time than is needed to produce an automobile in mass production (i.e. the labour process) as no automated production process is not available for the production of the trial products, and the production of trial products should normally go through many trials and errors. Once the first trial product is ready, various tests are performed, and any errors found during the test process are fixed and reflected back into the model design. Again a new trial product is produced based on the revised design and the test & defect fix process is repeated. This process is repeated again and again until the final trial product is produced. Only after the final trial product passes the quality gate, the mass production of a new automobile can start. All the labours expended until the final ‘go’ sign is given are considered as knowledge labour. It is not until the proper labour process is prepared based on the knowledge produced in the knowledge production process that direct labour can be expended to produce new automobiles.

In conclusion, the commodity production process is composed of the knowledge production process and the labour process. Hence, we need to clearly distinguish between the knowledge production process and the labour process, and look into details of each process separately from the other. However, one cannot exist on its own separately from the other. What is important is to explain how the two processes are interrelated. One may be predominant over the other, depending on the type of final product. For example, in our example of software package, the knowledge production process is much more important than the labour process, which is the reason why the distinction between Source and Installer appears to the extreme degree.

4. Knowledge production process, production of value and extra surplus value

Then how is the knowledge production process related to the production of value? As mentioned earlier, knowledge – the product of knowledge production process – is presupposed in the labour process, but is not affected by wear and tear. This means, regardless of whether or not knowledge has value, knowledge does not transfer value to the product of the labour process (commodity). Put differently, labour expended in the knowledge production process never produces value of commodity either directly or indirectly. But, it is not the case that the knowledge production process has nothing to do with the production of value in that knowledge produced in the knowledge production process determines the productivity of direct labour of the labour process and makes it act as intensified labour.
1) Different levels of knowledge within a sector and productivity of labour

Let us look more closely into what is meant by the statement that knowledge which is presupposed in the labour process determines the productivity of labour. For Marx, productivity of labour refers to ‘the degree of effectiveness of productive activity directed towards a given purpose within a given period of time’ (Marx, 1867: 137). Hence, comparison between labours in terms of productivity of labour is possible only when they produce the same commodity, i.e. the same concrete labour.

Suppose that there exist two individual capitalists that produce the same commodity. If one has a higher productivity of labour than the other, this can be accounted for by two reasons. First, the level of knowledge of the labour process is higher. Knowledge of the labour process presupposes the development of division of labour in the capitalist mode of production, where the use of machinery and efficient organisation of production are often involved in enhancing the productivity of labour. As discussed earlier, this knowledge is produced in the knowledge production process. Second, assuming that there are no differences in the methods of production, workers employed by one capital are more skilled than the other. Why are some workers more skilled than others? Because superior knowledge or technique for the production is embodied in them. This embodiment of knowledge can be done through the knowledge production process if capital provides workers with education and training opportunities.

The increase of productivity of labour is very important from a viewpoint of individual capitals. If the productivity of labour increases by adopting new methods of production, the individual value of the commodities the capital produces decreases accordingly, thus the capital having competitive advantages over other capitals. In other words, and more importantly, the capital can realise extra surplus value as much as the difference between (social) value and its individual value. Knowledge labour innovates the methods of production, increases the productivity of labour, and this leads to more (social) value given the same labour time. Put differently, knowledge labour makes direct labour of the labour process act as ‘intensified labour’ (Marx, 1867: p.435). Hence, through the distinction between Source (knowledge) and Installer (commodity) and the distinction between the knowledge production process the labour process, extra surplus value appears on the stage as the central category for the study of the price and value of software package.

![Knowledge Labour Diagram](image)

Figure 4 Knowledge determines the productivity of labour

Kim (2008) criticises the notion of ‘intensified labour’ as, from his perspective, it ‘can leads to the conclusion that the source of extra surplus value is not labour but ‘productive power’ itself’. However, if a worker labours under better conditions of production, he (she) can produce more commodities given the same labour time, hence produce more value. This does not contradict with any aspect of Marx’s labour theory of value. It is true that when the average or dominant productivity of labour of a sector increases, the total value produced does not change because the value of commodity decreases even though total number of products increases due to the increased productivity of labour. However, what we are concerned with here is the increase of productivity of labour of individual capitals, and in this case, the value of commodity does not decrease even though more products are

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11 Kim also says, ‘if labour with more productivity power produces more value, it means that productive power itself produces value. If we admit this, the labour theory of value collapses’ (Kim, 2008: 290).
produced. Hence, the individual capital can produce more value than before.

2) **Different levels of knowledge between sectors and intensified labour**

We have seen that different levels of knowledge within a sector lead to different productivities of labour, with capitals with higher productivities of labour than the average or dominant productivity of labour realising extra surplus value.

Different levels of knowledge between sectors also affect the production of value. If the level of knowledge that determines the average or dominant production methods of a sector is higher than the social average level of knowledge, the labour of that sector acts as ‘intensified labour’. Hence, individual capitals with the average or dominant level of knowledge of the sector can realise extra surplus value.

The average labour of a sector acts as intensified labour as compared with the average labour in other sectors in the same ways as complex labour is reduced to ‘intensified, or rather multiplied simple labour’ (Marx, 1867: 135). For example, labour of jewellers which is complex labour produces more value for a given labour time than labour of spinners which is simple labour. Complex labour produces more value because complex labour requires a significant amount of efforts for education and training, thus requiring more knowledge than other simple labours.

The distinction between higher or complex labour and simple labour is a product of manufacture, and skilled labours gradually disappear in the production based on the large-scale machinery. In the specifically capitalist mode of production, knowledge and techniques once possessed by skilled workers are separated from workers and now exist as embodied in the labour process itself. In other words, the production based on the machinery and large-scale industry separates ‘the intellectual faculties of the production process from manual labour’ (Marx, 1867: 548), and deprives ‘the work itself of all content’ (ibid.). Hence, it first acquires ‘a technical and palpable reality’ (ibid.) that the conditions of work employ the worker.

However, whereas machinery dominates workers in terms of the production of value, still labour as concrete labour uses machinery as means of production or instruments. In this respect, ‘the combined collective worker appears as the dominant subject, and the mechanical automaton as the object’ (Marx, 1867:544), which is applicable to ‘every possible employment of machinery on a large scale’ (Marx, 1867: 545). Even though knowledge that is required for the labour process (e.g. which machinery to use, how to organise the labour process) is produced in the knowledge production process separately from the labour process, this knowledge appears, in the labour process, as the knowledge of workers who are collective workers ‘formed out of the combination of a number of individual specialised workers’ (Marx, 1867: 468) and exist as ‘individualised in particular workers or groups of workers’ (Marx, 1867: 469). So even if we assume that individual workers perform simple or average labour, the knowledge embodied in the labour process makes labour of collective workers complex labour and act as intensified labour if the level of the knowledge is higher than social average. So when Ryu(2005) says, ‘even though embodied labour time required to produce Installers is just 0.001h, I think we have to consider it to count as intensified labour’, despite the criticism by Kim(2008), Chae(2004a), S. Kang(2008), he points out an important aspect of Marx’s labour theory of value.

We should consider that the difference of levels of knowledge is already reflected in the determination of value as socially necessary labour time. Hence, a worker who performs labour in several different labour processes produces different amounts of value because knowledge that determines each labour process may have different level and the level of intensification of labour may be also different accordingly. In other words, different collective workers of which he (she) is an organ have different complexities. We can also say that if the same labour produces the same value for a given period of time, the level of knowledge that determines each labour process is the same knowledge in terms of the production of value. The existence of value in the capitalist mode of production shows us that concrete labours that produce commodities in capitalism are reduced to single homogeneous labour. In the same vein, in that knowledge produced in the knowledge production process intensifies direct labour of the labour process, knowledge in the capitalist mode of production is also reduced to single homogeneous knowledge.

According to the contention that labour can act as intensified labour according to the relative level of knowledge of the labour process, we can conclude that the value of software package may be larger than 0 even though little labour is required to produce an Installer in the labour process. It is because the level of knowledge involved in the production of software package may be higher than the social average, and thus making direct labour of the labour process act as intensified labour.

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12 N. Kang (2002) also points out the importance of intensified labour.
3) Extra surplus value

As extra surplus value has been suggested as being the central category in the analysis by the introduction of knowledge and knowledge labour, we need to look into more details of the nature of extra surplus value. What Marx’s competition within a sector shows is that many individual capitals exist and compete with each other in a sector, and despite the different and diverse production methods, single social value is formed out of the competition. At the same time, the existence of single social value impels each individual capital to putting efforts in enhancing productivity of labour. Hence, it is not exceptional at all that individual capitals with different productivities of labour compete with each other, producing commodities with the same use value and with the same social value. Rather, it reveals the essence of the social processes through which value is determined. In other words, extra surplus value is a category that shows the dynamic aspect of Marx’s theory of competition within a sector. There can certainly arise misunderstandings that the category of extra surplus value signifies not only labour but also knowledge produces labour. However, it is only when the level of knowledge is higher than the social average level of knowledge that the knowledge intensifies labour. Put differently, knowledge does not produce value, but just determines the productivity of labour and the intensity of direct labour. Knowledge never creates value separately from labour.

It is worth noting that extra surplus value, in Marx’s theory, is analysed in the context of the production of relative surplus value as is the case for the concepts of productivity of labour, individual value and social value. The production of relative surplus value is one of ’immanent laws of capitalist production’ (Marx, 1867: 433), and this law ‘manifest themselves in the external movement of the individual capitals’ (ibid.). The external movement signifies that individual capitals put efforts in enhancing the productivity of labour to take competitive advantages over competing capitals. In Marx’s theory of competition within a sector, new production methods developed by an individual capitalist is eventually spilled-over within the sector due to the competition within a sector, and the value of commodity decreases accordingly. If the values of consumer goods decrease in this way, the value of labour power also decreases, and the portion of necessary labour time among the total labour time also decreases. Marx calls the surplus value appropriated by capital by this relative decrease of necessary labour time the relative surplus value.

4) Mainstream economics and knowledge

The problem of knowledge and productivity of labour is one of the main research topics of mainstream economics. Romer (1990) is considered to be the seminal work in this field. Regarding the nature of design or knowledge, Romer argues that knowledge is non-rival and partially excludable good. In this characterisation, knowledge is considered as a good which can be traded. We need to deal with this issue later, but it is not of our primary concern here. Romer's characterisation is related to two of the three premises of his new growth theory. The premise that 'instructions for working with raw materials are inherently different from other economic goods' (Romer, 1990: 72) implies that knowledge (technology) is a non-rival input. And the other premise that 'technological change arises in large part because of intentional actions taken by people who respond to market incentives' (ibid.) implies that knowledge (technology) is at least partially excludable. It is because if it is not excludable at all, the inventors cannot benefit from the new technology or knowledge. For Romer, the goods that are non-rival and excludable are of particular interest to his growth theory. He takes 'design' as the example of non-rival and excludable goods. Even though designs are the result of the efforts of the R&D activities of firms motivated by market incentives, they are non-rival in that they can be used again and again and even do not prevent from being used by other competitors. From his point of view, even the ability to add is not non-rival because it can exist only as inherently tied to human body. In other words, the knowledge or ability to add is tacit knowledge even though with the introduction of electronic calculator and computer, we can say that the tacit knowledge has been almost completely explicated.

The aspect of non-rivality is important for economic theories in that it is closely tied with the existence of increasing returns to scale. Considered as an input of production, knowledge requires a one-time investment, but does not cost anything to produce additional unit of output. In other words, knowledge is an input that requires only fixed cost, but not marginal cost, driving the average cost down as the number of output increases. Whereas non-rivality is tied with the increasing returns to scale, (at least) partial excludability is necessary for the producer of knowledge to reap the benefits of the investment. Due to the non-rivality, theoretically, the 'spillover' of the

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13 See chapter 12 or Capital 1.

14 Here we can see the difference between the view of mainstream economics and this paper based on Marx’s labour theory of value on the production of knowledge. Whereas Romer argues that the production cost of knowledge is distributed to the commodities produced based on this knowledge, we have argued that knowledge labour does not produce value and does not transfer any value to commodities produced based on this knowledge either.
knowledge to other competitors can happen. Even though the secrecy is ensured, it will take the competitors less effort to imitate the knowledge. The excludability is often established through such legal means as intellectual property rights and patents. In that sense, ‘excludability is a function of both the technology and the legal system’ (Romer, 1990: 574).

We can find a similar theme as knowledge as non-rival and partially excludable goods in Marshall (1920). Marshall explains the difference between rent and quasi rent by way of supposing an imaginary stone which is ‘harder than diamonds (Marshall, 1920: Book V, Chapter IX)’ and analyses its impact on the productivity of labour. When this stone is used for the production of commodities requiring cutting of metal or stone, the productivity of labour will become significantly higher than when using diamonds which, currently, is the instrument for cutting with the highest productivity of labour. Marshall considers three cases:

First, a few thousand large stones fell all in one place from the sky and they were all picked up at once. So they are only available for one firm and there is no more supply. They are so hard and not affected by wear and tear, which means they can be kept forever without any changes to the quality. Hence the owner of the stones benefit from the increased productivity of labour which takes effect permanently, and this benefit is the source of rent when he (she) gives rights to use them to other firms. If we replace stones with knowledge, we can say that knowledge which can be sustained permanently and cannot be imitated by other competitors is the source of the permanent difference between the productivity of labour of the firm and the average productivity of labour. Whether or not this difference should be conceptualised as rent will be examined later. In this case, the knowledge is non-rival (provided that it is not affected by wear and tear, and stones are sufficient enough) and perfectly excludable.

Second, he considers the case where the stones were not all found at once but were scattered over the surface of the earth on public ground, and that ‘a laborious search might expect to be rewarded by finding one here and there’ (ibid.). The stones are hard enough and the use of them during the production does not cause wear and tear as in the first case. If we replace stones with knowledge again, it represents the case where knowledge is non-rival and partially excludable. In this case, whereas the stones attained by one firm can be given to other firms in return for money, they have another choice. They can put effort on searching these stones, and they might be able to find some of them. In other words, spillover of the knowledge (stones) is possible, even though it incurs cost. Now the stones are the source of increased productivity of labour, but it can vanish depending on the activities of other competitors. And the effect of stones will completely vanish when using the stones becomes the norm of the industry. Marshall conceptualises this temporary increase of productivity of labour with quasi-rent. More importantly, this case corresponds to the nature of knowledge (non-rivality and partial excludability) based on which Romer built his growth theory.

Finally, the stones are brittle, and are soon destroyed; and that an inexhaustible store existed from which additional supplies could be obtained quickly and certainly at a nearly uniform cost. In this case, the stones are used as an instrument of labour, and have nothing to do with productivity of labour. Marshall associates interest with this case. This remuneration view is worth being criticised from a Marxian perspective.

So we can easily see the affinity between Romer's knowledge as a non-rival and partially excludable input for production and Marshall's concept of quasi-rent. We do not need to go further to show that increasing returns to scale and imperfect competition are inevitably derived from this understanding of the nature of knowledge, as this is not of our primary concern here. We will just focus on the insights of Romer and Marshall into the nature of knowledge and its implications for our subject, especially for Marx's theory of competition within a sector.

5) Example: knowledge production process and labour process, distinction between machinery and knowledge

It is important to understand the meaning and significance of the new concepts introduced in this paper - knowledge production process, knowledge labour and knowledge. So we will take an example here. With this example, it is also intended that the distinction between machinery and knowledge is well drawn because in many cases, machinery is considered as the materialised knowledge. But it will be shown that knowledge required to produce machinery is clearly distinguished from the machinery itself.

Let us suppose that there are some individual capitals that pick apples that grow naturally, which means picking apples is at the same time production of apples. The individual capitals compete with each other by enhancing the production methods and the productivity of labour. So the theory of competition within a sector applies. Let’s assume that there are two production methods available.

1) Average or dominant production methods: In this case, no instruments are used, and workers just use their hands to pick apples. However, even this simple way of picking requires knowledge. Capital specifies how to pick apples. For example, given the fact that sometimes workers need to climb up trees to pick apples, capital sets a rule
that every worker should pick 200 apples, and then climb up trees and pick another 100 apples. After that, workers can have 10-minute break. This rule is intended to enhance the efficiency of labour and specifies how the labour process should be organised. The rule, the way of production, is produced in the knowledge production process. Let us assume that this is the average or dominant production method of the apple production sector. With this production method, an average worker can produce 100 apples per hour.

2) But, if the workers don’t have to climb up trees, the productivity of labour can significantly increase. Individual capitalist A has noticed this point, and asks his ‘knowledge production team’ to work on the new production methods using sticks. Knowledge production team makes sticks, tests whether or not the productivity of labour actually increases when using sticks, and develops the technologies needed to produce sticks. The new production methods developed by the knowledge production team is reported to and approved by the capitalist A. Now the new knowledge – do not climb up trees any more, but hit apples with the stick; how to produce good sticks – is used in the labour process. Let’s assume that 1) producing sticks based on the new knowledge does not require any instruments of production; 2) the capitalist does not have to buy raw materials; 3) it takes 1 hour to produce 1 stick; after hitting 500 apples, a stick becomes useless. And with this new production method, one worker can produce 500 apples per hour.

So the knowledge of labour process has been changed as follows:

- Old knowledge: workers do not climb up trees and pick 200 apples; after that workers climb up trees and pick 100 apples; after picking 300 apples, workers can take 10-minute break; All the 100 workers produce apples.

- New knowledge: workers do not climb up trees and just hit the apples with stick; the knowledge of how to produce stick (specifications); 50 workers produce sticks, and other 50 workers pick apples with sticks.

In the labour process based on the original knowledge, 100 workers work for 1 hour, and 10,000 apples are produced. If the value of an apple is 1, then the total value produced is 10,000.

In the labour process based on the new knowledge (with sticks), assuming that stick production does not require more complex labour than apple picking, 50 workers work for 1 hour and produce 50 sticks, and then other 50 workers work for 1 hour to produce apples. Now, with the increased productivity of labour (500 apples per hour, worker), the 50 workers produce 25,000 apples. In this labour process, 25,000 apples are produced, and 50 sticks are produced and used entirely for apple picking. So at the end of the labour process, we have 25,000 apples and no sticks.

From a capitalist perspective, as he (she) hired individual 100-labour-hours, the produced individual values are the same. But with the new labour process, more apples (2.5 times) are produced, and more social value (2.5 times) is produced than before. In other words, the labour in the new labour process appears as intensified labour (2.5 times). Before and after the labour process, no changes are made to the knowledge for the new labour process.

What we can also see in this example is that stick (machine) is not materialised knowledge. Rather, machine is produced in the labour process based on the new knowledge, and productively consumed during the labour process. The workers producing knowledge act as an organ of collective ‘apple-picking’ worker. Namely, labour that produces machine (stick) is part of labour producing apples in the new labour process. As can be seen, knowledge about developing new machine that enables enhanced productivity of labour is part of the knowledge for the new labour process.

5. **Price of Software Package: Determined by Value or Monopoly Price?**

From now on, we go back to our original question – the value and price of software package – based on the new theoretical framework. Does the value of software package determine its price, or the price is determined by other factors than value, thus being monopoly price?

So far we have argued that we should introduce the knowledge production process as an essential process of commodity production in capitalism. We have also argued that knowledge labour and direct labour play different roles in producing value. On the one hands, this corresponds to Chae and S. Kang in that only the labour expended in the production of Installers (commodities) – direct labour of the labour process – produces value. On the other hands, due to the differences between individual productivities of labour or the differences between required levels of knowledge between sectors, direct labour of the labour process can act as intensified labour. This implies that even though the direct labour time of an individual capital is close to 0, the value produced in the labour process can be larger than 0. But we cannot say that the value of a commodity which is larger than 0 always determines its price, and nor can we have definite answer to the question of value and price of software package, but can only present several possible cases.
First, as Chae and S. Kang argue, the value of software package may be close to 0. In this case, the price of software package is monopoly price as the price is much higher than 0.

Second, as others argue, the value of software package may be larger than 0, and price may be determined by its value. However, it is not because R&D labour (knowledge) indirectly produces value of Installers (commodity) by transferring value during the labour process, but because the knowledge involved in the labour process make the direct labour in the labour process act as intensified labour.

Third, even in case where the value of software package is larger than 0 due to intensification of labour, price may not be determined by value. In this case, the price of software package is monopoly price, and capital realises monopoly profit.

Examining the three cases involves not only concrete analysis on the sectors that produce software package but also the study of Marx’s theory of competition within a sector, his categories of extra surplus value and monopoly price, and the social processes through which value is determined.

1) **Competition within a sector and actual forms of competition**

There are two reasons for reviewing the way knowledge is conceived in mainstream economics earlier. First, we can get insights about knowledge from mainstream economics and how knowledge can be incorporated into economic theories. Marxian political economy should do the same thing based on Marx’s labour theory of value. Second, we need to see the differences between the approaches of mainstream economics and Marxist political economy. Seemingly, Marx’s theory of competition within a sector looks insufficient in that Marx only explains the case where the innovation of individual capital is always spilled-over and thus generalised. It gives the impression that the way capitals compete with each other within a sector is always like this, extra surplus value exists only exceptionally and the establishment of monopoly by exceptionally high productivity is not conceivable. On the contrary, Romer’s theory provides more cases of the production and spill-over of knowledge, and he also considers intellectual property rights in his theory. In this sense, it looks as if Romer’s theory is more concrete and realistic. Then what we should do is extending Marx’s theory of competition within a sector as Romer has done? Or should we introduce new concepts that apply to each actual form of competition as Marshall did with quasi-rent?

The answer is no because the competition within a sector is not an analysis of actual forms of competition, but the analysis of social processes through which immanent laws of capitalist production manifest themselves in the external movement of the individual capitals. Marx’s theory of competition within a sector does not correspond to perfect competition of mainstream economics. It should be seen as being asserted in and through a number of actual forms of competition (perfect competition, oligopoly, monopoly and so on) suggested by mainstream economics. Marx’s intention is that through and despite diverse forms of competition, capitalism tendentially produces the relative surplus value, thus leading to the increase of the organic composition of capital and LTRPF eventually.

Then, let us look at the aspect that Marx’s theory of competition within a sector has nothing do with actual forms of competition. As mentioned earlier, Marx shows that innovative production methods developed by an individual capital is eventually spilled-over within a sector, and this establishes the new average or dominant productivity of labour and decreased social value of commodity. Let’s take an example.

Suppose the value of commodity produced in sector 1 is 40. Individual capitalist A develops a new method of production, and now A’s individual value becomes 20. Individual capitalist A realises extra surplus value of maximum 20. However, other competing capitals catch-up A and eventually develop the same or equivalent methods of production as A’s, and this method of production determines the average or dominant productivity of labour of the sector. The social value of commodity decreases from 40 to 20 accordingly.

Then, suppose that assuming that A can supply as many goods as demanded within the sector, individual capitalist A sets the price as 30, and successfully kicks-out all other competing capitals before they can catch up. Then monopoly is established due to the exceptionally high productivity of labour of individual capitalist A. If intellectual property rights exist, the kicking-out process would be much easier. Once the monopoly is established, the monopoly capital can set the price between 20 (individual value) and 40 (original social value). However, as can

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15 Given that all the firms have access to the same set of resources (technology, inputs, and so on) in the theory of perfect competition, there is no competition around the productivity of labour in this form of competition. Cho (2008) says that ‘we have few theoretical tools with which we can explain the actual forms of competition except perfect competition’. This is correct in that we need tools to explain the actual forms of competition in capitalism. However, as it views Marx’s theory of competition within a sector as an analysis of the actual forms of competition, it is flawed.

16 Suppose that there is no difference in the levels of knowledge between sectors.
be seen, the original social value is still involved in the determination of price because if the price is higher than 40, the competing capitals kicked-out temporarily can enter the sector again. We cannot say that the individual productivity of labour or monopoly capital is the average or dominant productivity. Rather, it is so high that it can be used to kick out capitals with average or dominant productivity of labour. In that sense, still the social value is 40, and monopoly capital can set the monopoly price between its individual value and social value.17

So, when monopoly is established due to exceptionally high productivity of labour, we can say that the individual value and social value of commodity produced by monopoly capital can be different, and price can be determined by value. We have also argued that due to the differences in the productivities of labour within a sector, and the differences in the levels of knowledge that determine the average or social method of production between sectors, an individual capital can realise extra surplus value and labour of this capital can act as intensified labour. Now we add another case where individual capital can realise extra surplus value. In sum, monopoly capital can realise extra surplus value and its labour acts as intensified labour when monopoly is established by exceptionally high productivity of labour of the monopoly capital.18 Similarly, value and extra surplus value exist irrespective of actual forms of competition.

2) Monopoly Price of Marx

So far we have seen that due to extra surplus value and intensification of labour, the value of software package can be larger than 0, and in case of the monopoly established by exceptionally high productivity of labour, value can determine price. Hence, now we have to deal with monopoly price.

In the Debate, writers have theorised monopoly price in two different ways. N. Kang (2004) and Cho (2008) argue that whether or not the price of software package is monopoly price depends on actual forms of competition. In case of oligopoly and monopoly, the price is monopoly price. In case of perfect competition, it is not monopoly price. Chae (2004a, 2008) and S. Kang (2008) argue that the price of software package is monopoly price because the value of software package is close to 0. In other words, because the price is not close to 0 contrary to the value, the price can be nothing but monopoly price. Here, the existence of intellectual property rights is indispensable in establishing the monopoly price in that software package cannot be commoditised and its price can be set far above 0 without intellectual property rights.

In case of N. Kang and Cho, we can point out that monopoly price is considered to correspond to specific forms of competition. Marx says in his theory of absolute rent, ‘whether this absolute rent is equal to the whole extra value over and above the price of production, or only to a part of this, agricultural products are always sold at a monopoly price’ (Marx 1894: 897). Here monopoly price is established because absolute rent is levied in the same way as tax is levied even if there are many individual capitals producing agricultural products. We can see that the price of a commodity is monopoly price not because the commodity is produced by monopoly capital, but because the price is not determined by the value or price of production irrespective of the actual form of competition.

In addition, and more importantly, Marx analyses a ‘genuine monopoly price’ (Marx 1894: 898) which is not formed by agricultural rent. This monopoly price ‘is determined neither by the price of production of the commodities nor by their value, but rather by the demand of the purchasers and their ability to pay, consideration of which therefore belongs to the theory of competition’ (ibid.). Marx takes an example of the price of wine produced in a vineyard which ‘produces wine which is of quite exceptional quality but can be produced only in a relatively small quantity’ (Marx 1894: 910), and suggest the price of wine as monopoly price.

In sum, for Marx, monopoly price is established when there exist barriers for new investment, or monopoly of methods of production or land that are necessary to produce commodities with exceptional use value. Cho (2008) says, ‘when monopoly is dominant, <price of information commodity = price of production + monopoly profit>. In order to see if this is consistent with the concept of Marx’s monopoly price, we need to check how the monopoly is established. So far we have examined monopoly established by exceptionally high productivity of labour, monopoly established by the barriers of new investment and monopoly established by commodities with exceptional use value. We have also seen that in case of monopoly established by exceptionally high productivity of labour, the price of commodity can be determined by social value (or price of production). So in this case, Cho’s formula does not apply.

In case of Chae and S. Kang, as their starting point is that the value of software package is close to 0, it is

17 This is consistent with the view of mainstream economics in that monopoly price in mainstream economics is higher than marginal cost.
18 This is different from the view of Cho (2008) who argues that when oligopoly or monopoly exists, monopoly profit is added to the price of production, and extra surplus value does not exist in monopoly.
inevitable that the price of software package which is far larger than 0 is considered as monopoly price. And this corresponds to Marx’s concept of monopoly price. However, the argument that the price of software package is monopoly price is automatically derived from their argument that the value of software package is close to 0. And in their argument, it is implicit that the value of each and every software package product is close to 0, and the price of each and every software package is monopoly price. We have already seen that even though the individual labour time required to produce an Installer is close to 0, the conclusion that social value of software package is close to 0 does not automatically follow.

It goes without saying that monopoly price can be formed even if the value of software package is not close to 0. However, the existence of intellectual property rights does not ensure that monopoly price is always formed. As we can see in Marx’s analysis of differential rent I, intellectual property rights can contribute to the increase of individual productivity of labour, intensification of labour and realisation of extra surplus value. However, in this case, the price is determined by the value or price of production. Intellectual property rights can certainly establish monopoly, but not always. If monopoly is formed due to intellectual property rights, it is because the owner of intellectual property rights can levy a sort of service charge in the same way as tax is levied, or technologies or knowledge protected by the intellectual property rights are necessary to produce commodities with exceptional use value, hence only capitals who own the intellectual property rights can produce that commodity or software package.

3) Summary

So far, we have tried to explain the divergence between the price and production cost of software package, which has involved the introduction of new concepts like knowledge labour and the examination of meaning and significance of Marx’s theory of competition within a sector and monopoly price. Our starting point was the outstanding divergence between price and production cost of a unit of software package. However, rather than explaining the nature of price and value of software package, we have just laid out a new theoretical framework through which this problem can be viewed. This is not disappointing because explaining the nature of value and price of a particular commodity requires analysis of the concrete production processes and the actual form of competition in the market. It is not a promising research topic to study how much the value of Windows XP is!

We have also critically reviewed the different views proposed through the Debate, and pointed out that there are flaws and problems inherent in each viewpoint. In the most cases they are caused by the unclear distinction between the individual and the social. For example, the observation that the production cost of an Installer for an individual capitalist is close to 0 leads to the argument that the value of software package in general is close to 0. And the fact that the production cost per commodity changes as the number of produced commodities increases, and it poses the question of proper price leads to the argument that the value is determined ex post by the number of commodities produced, and the difficulty of pricing is considered as the difficulty of the labour theory of value as well. However, we need to make sure that contrary to mainstream economics, it is presupposed in Marx’s theory that the social can never be reduced to the sum of the individuals. Even though it is true that the social exists through the individual, we can never derive the social from the observation of the individuals.

In that sense, the starting point of any theories based on the labour theory of value should be the real existence of value as social category. Marx discovers value in the exchange relations of capitalism, and derives immanent laws of the capitalist production by starting from the first determination of value as socially necessary labour time. In the course of this, Marx introduces the concepts like surplus value, extra surplus value, individual value and so on, not to derive the concept of value from these more complex concepts, but because they are necessary for the further analysis. In that sense, though the new concepts always help better understand the category of value, they never alter the first determination of value as socially necessary labour time. Hence, any extension of the labour theory of value should be done in such a way that it can be derived systematically from the first determination of value as socially necessary labour time.

It goes without saying that concrete analysis is important because it provides clues for the analysis of social processes and structures in the capitalist mode of production. More importantly, analysis of phenomena that seemingly contradict Marx’s theory often leads to the better understanding of Marx’s theory. In our example, the introduction of knowledge production process was possible due to the observation of the outstanding divergence between price and production cost of software package.

19 For example, the discovery of ‘value’ in the exchange relations has nothing to do with underlying mode of production. As Marx develops immanent laws of capitalist mode of production, it becomes clear that value is the category of the capitalist mode of production.
6. Rent

Chae (2004a, 2004b, 2008) and S. Kang (2008) criticise the argument that value of software package includes rent. The category of rent presupposes the existence of the class of land proprietors, and is transformed from surplus profit or extra surplus value and appropriated by this class. Hence, we agree to the view of Chae and S. Kang that the category of rent presupposes the existence of the class of land proprietors, and is transformed from surplus profit or extra surplus value appropriated by this class. Hence, we agree to the view of Chae and S. Kang that we should not use the category of rent in explaining the nature of the value and price of software package which has nothing to do with the land proprietor class. Especially, as S. Kang (2008) provides a detailed, thorough and persuasive analysis of the category of value, we will not discuss this issue in detail. But some points which have significance in the context of this paper will be elaborated.

First, as Fine (1979) points out, in the analysis of rent, ‘Marx’s starting point then is the existence of landed property as a specific means by which surplus value can be appropriated in the form of rent’ (Fine 1979: 248). Rent is ‘immediately linked to the historical conditions of existence of landed property’ (ibid.). ‘There is therefore no general theory of rent’ (ibid.). In conclusion, ‘rent cannot be analysed simply on the basis of its effects’ (ibid). Hence, we can criticise the view that the category of rent can be applied to theories intellectual property rights. Intellectual property rights are the barrier to capitalist investment in that the use of protected technologies or knowledge requires paying service fee. However, we cannot use the same category because intellectual property rights have the same effect as landed property has.

Second, Marx’s analysis of differential rent I is useful in analysing knowledge based on the labour theory of value. Marx’s analysis of DRI shows that capitals invested in different lands with different fertilities will have different productivities of labour. The productivity of labour of individual capital invested in the worst soil determines the social value of commodity, and other capitals realise extra surplus value which is transformed from extra surplus value and appropriated by land proprietors. Similarly, due to the different levels of knowledge produced in the knowledge production process of individual capitals, they have different productivities of labour. In this sense, the analytical structure of DRI informs the analysis of knowledge and knowledge labour and its relation with the production of value. For example, if knowledge produced by individual capitals can be perfectly protected by intellectual property rights, the extra surplus value arising from this can be permanently maintained as in DRI.

Third, we can think of the new class who produces knowledge, and through the monopolistic privileges backed by intellectual property rights, appropriates the permanent extra surplus profit. If this class exists, we can introduce a new concept in the same way as the concept of ground rent is introduced. As intellectual property rights actually exist, we can say that there are logical possibilities of the existence of such class.

7. Conclusion: knowledge production process in capitalism

So far, we have argued that the commodity production in capitalism involves both the knowledge production process and the labour process, and based on this distinction, we have discussed how we can understand the value and price of commodity in general, and software package in particular. The objective of this paper is to present a theory of knowledge and knowledge labour in a consistent manner on the basis of Marx’s labour theory of value. This has required us to examine main categories and theories of Marx’s labour theory of value. In addition, we have also critically reviewed the literature of the Debate.

We can summarise the paper by focusing on the discussion about knowledge and knowledge labour.

First, the distinction of Source (knowledge) and Installer (commodity) is important, and in that each Installer has its material substance, we should consider Installer as commodity – the object of analysis. This is because the commodity production is basically mass production and replica production. In that sense, this distinction also applies to commodity production in general. The labour expended in the production of Source (knowledge) and that expended in the production of Installer (commodity) are qualitatively different, and we have introduced concepts like knowledge production process, knowledge labour and knowledge to theoretically distinguish between them. Knowledge labour that produces Source (knowledge) does not produce value of Installer (commodity) either directly or indirectly, but determines the productivity of direct labour of the labour process and enables it act as intensified labour, and in that sense, is related to the production of value.

Second, when knowledge produced in the knowledge production process of an individual capital determines its individual productivity of labour that is higher than average or dominant productivity of labour of the sector it belongs to, the direct labour of this capital acts as intensified labour, and the individual capital realises extra surplus value. Once the knowledge is spilled-over and generalised, the extra surplus value vanishes. In addition, if the level of knowledge that determines the average or dominant production methods of a sector is higher than social average, the direct labour of the sector acts as intensified labour. So, knowledge is important in terms of the production of value because it makes direct labour intensified and enables its owner to realise surplus value. However, knowledge
itself does not have value and thus is not a commodity. It can be just priced and sold because it has the use value of intensifying direct labour that is expended based on the knowledge.

Then, let us go back to the original distinction between the knowledge production process and the labour process. As mentioned earlier, analysing the labour process in capitalism in the chapter 7 of Capital 1, Marx analyses the labour process as labour process as such first, and then he points out that the labour process in capitalism is the valorisation process at the same time. In the same vein, the knowledge production process has the duality – knowledge production process as such and knowledge production process in capitalism.

These days, there are lots of discussions about knowledge and knowledge labour and we have many different approaches to them. On the one hand, as the portion of knowledge labour in the economy increases, some argue that capitalism is in the new stage, and similarly, companies and countries should accelerate the transition to knowledge company and knowledge economy so that they can survive and thrive. Hence, it is not surprising at all the people like Daniel Bell proclaim the end of Marxian theories, as often Marx’s theory is considered as theory of labour only that lacks theory of knowledge. On the other hands, among leftist, post-workerism argues that the labour theory of value is not valid any more by introducing a new concept of immaterial labour, and now we have a different form of exploitation and class struggle. In addition, some proponents of labour process theory (LPT) which has critically analysed the labour process in capitalism have already parted from Marxism, and have argued that the core of labour process theory is not the Marxian theories but the tendency of deskilling and the deepening of control which do not necessarily require Marxian theories.

However, our starting point should be the firm trust on Marx’s labour theory of value. We should not ‘be blown here and there by every wind’, but should respond to these theories on the basis of Marx’s labour theory of value. We have mentioned that, in case of mainstream economics, much has already been achieved in theorising knowledge. Given that the problem of knowledge and knowledge labour are often used as the basis of argument and polemic that Marx’s labour theory of value is not valid any more, in Marxian political economy, knowledge and knowledge labour should be incorporated in a consistent and systematic manner. So the conclusion of this paper is that we need Marxian theories of knowledge and knowledge labour, and more aggressively, we need a new chapter of Marx’s Capital – knowledge production process in capitalism – that forms a pair together with chapter 7 – the labour process and the valorisation process.

Some of the points that need to be developed are listed as below:

First, we need to have theories of knowledge as such irrespective of modes of production (e.g. distinction between tacit knowledge and codified knowledge). In other words, we need to analyse knowledge production process as such. In addition, rigorous definitions of knowledge and knowledge labour should be provided, and with these definitions, Marxian theories of knowledge should be differentiated from that of mainstream economics. We have already argued that knowledge labour is knowledge labour not because it requires high level of knowledge but because its role in the production of value is different from direct labour.

Second, we need to more develop the distinction between knowledge production process and labour process and make the meaning and significance of this distinction more clearly. For example, we have seen that some of knowledge that is required in the labour process cannot or does not have to be produced in the knowledge production process. This also implies that the distinction between the knowledge production process and the labour process does not require the complete separation between conception and execution or separation between intellectual labour and manual labour. Though capital tries the complete separation by transforming tacit knowledge into codified knowledge – deskilling, many have argued that it is not so simple.

Third, tendential laws involved in the knowledge production in capitalism should be derived in the same way as Bravermann (1974) suggests deskilling thesis. For example, we need to deal with the theoretical meaning and significance of intellectual property rights, and explain what is actually meant by the increasing awareness of the importance of knowledge and knowledge labour. At the same time, how these tendential laws have contributed in the formation of the structure of the knowledge production in capitalism (e.g. in capitalism, we can see the division of labour in knowledge production – knowledge production in universities and research institutes, knowledge production in companies, etc.).

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20 See Dyer-Witheford(1999), chapter 2
22 About cognitive capitalism, see Vercellone (2007). About general intellect, see Virno (2007).
23 See Kitay (1996).
production led by states and knowledge production in individual firms). This also raises the question of education.

And this will be the basis of the study on the existence of the new class.

References

(in Korean)
Kang, S. 2008. Study on the value and price of software, Ph.D thesis (economics, Seoul National University)
______. 2004b. On some issues of the value of information commodities.

(in English)