

Paper prepared for

***The 2008 World Congress on National Accounts and Economic  
Performance Measures for Nations***

**May 12-17, 2008**

Key Bridge Marriott

Washington DC

USA

**On the Treatment of Intangible Assets in National Accounting**

**Itsuo Sakuma**

School of Economics

Senshu University

JAPAN

First draft 13/April/2008

Revised 7/May/2008

For additional information please contact:

Itsuo Sakuma  
School of Economics  
Senshu University  
2-1-1, Higashimita, Tama-ku,  
Kawasaki,  
214-8580, JAPAN  
E-Mail: sakuma@isc.senshu-u.ac.jp  
FAX: 81-44-900-7815

# **On the Treatment of Intangible Assets in National Accounting**

**Itsuo Sakuma**

1. Introduction
2. Popper's Three Worlds
3. Access to the World 3
4. Topics on Selected Intangible Assets
5. Concluding Remarks

## **Abstract**

The purpose of this paper is to give some suggestions on the treatment of intangible assets in national accounting. Knowledge ("World 3" in Karl Popper's term) is a sort of environment for human beings. As people more and more come to think that knowledge is an important factor for economic growth, and as it is often said that the environment must be placed under conscious control of the society for sustainable development to be attained, it is natural to think knowledge as well should be so placed. Thus, the society comes to believe knowledge is capital. However, it is not easy to treat knowledge as capital. In this paper it is proposed that knowledge access should be focused instead of knowledge and in addition it is maintained that socially constructed assets like patent rights should be treated differently from produced assets and that goodwill is not a national accounting concept. (150 words)

## 1. Introduction

Knowledge is a sort of environment for human beings. Like the (natural) environment in its ordinary sense, it is an essential prerequisite for production and consumption, that is, economic life as a whole. Not only that, economic activities may transform the knowledge environment just as economic activities may change the natural environment. It is often said that the environment must be placed under conscious control of the society in order for sustainable development to be attained. So, it is quite natural to think that knowledge as well should be placed under conscious control of the society and by doing so, it may be expected that economic growth will be accelerated. Naturally, people more and more come to believe that knowledge (as is used in production) is capital, the accumulation of which is an essential factor for economic growth as revealed in the following citation: “R & D expenditures contribute significantly to the productivity (value added) and output of the firms, and the estimated rates of return on R & D investment are quite high --as much as 20-35 percent annually-- with the estimates varying widely across industries and over time.”<sup>1</sup>

However, clearly, they cannot be treated like ordinary capital assets. Just like in the case of the natural environment, for which the SEEA (the System for Integrated Environmental and Economic Accounting) may be considered to be a typical example of efforts in the direction towards recording the situations involved in an appropriate accounting framework as far as the natural environment is concerned, knowledge as environment also needs a special accounting treatment. For example, the possibility of spill-over and externalities involved should be taken into account among other things. Thus, businesspersons typically feel: “Spillovers from intangibles create significant opportunities to learn from others (reverse engineering, for example).”<sup>2</sup>

In this paper, some suggestions on the treatment of intangible assets and related matters will be given. After introducing Karl Popper's famous concept of “World 3” in the section following this introduction, it will be stressed that to have access to the World 3 is essential to any production activity. An economy's or a firm's accessibility to the World 3 --what part of it is available for them to use in their productive activities -- may affect its productivity among other things.

People or organisations make more than a little effort to get access to the World 3. For example, people are keen to be better educated. Organisations are ready to spend not a little money on R & D as well as training of employees. These activities need much time spent by people as well as intermediate and primary inputs such as school teachers' labour input. Moreover, the tangible objects which contain information, such as books, magazines, newspapers, films, photos, music scores, and records of clients, etc. as well as capital stock in the ordinary sense like school buildings are used in activities to acquire or maintain the access to the World 3.

However, it might be worth noting that knowledge access may be obtained through various ways including rather not so typical market transactions like headhunting (employing other company's professional staff), a certain kind of contracts as well as M&A because the access may be embodied in labour input or so called human capital. In

---

<sup>1</sup> Lev (2001), p.55.

<sup>2</sup> Lev (2001), p.36.

addition, organisations may have the knowledge that is not easily accessed from outside. Accounting for knowledge access is necessary and clearly it is somewhat different from accounting for R & D.<sup>3</sup>

In addition, it should be understood that knowledge access may be blocked at least made unusable for production purposes by, say, a patent holder. Thus, some legal rights (typical intangibles) give the right holder ability to block the use of certain knowledge in the production processes controlled by the firms that do not pay royalties. At least in a short run, clearly such legal rights make the production possibility set of the economy smaller and this might have implications on people's well being like in the case of certain drug patents. The very fact gives the rights economic value. Clearly, policy considerations are necessary about whether such legal rights should be given at all or if so, how. National accounts statistics must provide policy makers with information needed for such decision. It should be recognised that the kind of information that national accountants need to offer is sometimes totally different from what business accountants think they should offer.

Also in the section, the treatment of "intangible fixed assets (capital)" in the 93SNA such as computer software, mineral exploration, entertainment, literary or artistic originals will be discussed as it is claimed in the 93SNA that they are produced assets, that is, outputs of some productive activities, which are, from our viewpoint, closely related to the knowledge access activities.

In the next section, some topics on patents and other similar intangible assets will be taken up. In the 68SNA, they are called "intangible assets, not elsewhere classified" or "intangible assets except claims." However, in the 93SNA, they have come to be called intangible non-produced assets. This naming is not so good because typical intangible assets like patents and financial assets are both non-produced as well as intangible. Among the topics covered, the problem of goodwill will be raised as an illustration of the above mentioned differences in viewpoints between business and national accounting. Thus, it will be shown that goodwill should not be considered to be one of the asset categories in national accounting although it appears among asset categories in business accounting.

Some concluding remarks will be given to close the paper.

## 2. Popper's three worlds

Let us start by introducing this famous term of Karl Popper's to facilitate the discussion in what follows. According to Popper (1979, 1994), the world 1 is the world of physical states and processes and the world 2 is the world of mental states and processes. The world 3 is the world of the products of human minds, more specifically problems, theories, discussions as well as architecture, art, literature, music. Although his focus is naturally on science (and scholarship), his comments on artistic and literary works are very interesting from the viewpoint of national accounting.

"By 'world 3' I mean, roughly, the world of the products of our human minds. These products are sometimes physical things such as the sculptures, paintings, drawings, and buildings of Michelangelo. These are physical things, but they are a very peculiar

---

<sup>3</sup> See OECD (2002) for a typical example.

kind of physical things: in my terminology they belong to both the worlds 1 and 3. Some or other products of our minds are not precisely physical things.”

“Take a play by Shakespeare. You may say that the written or printed book is a physical thing like, say a drawing. But the performed play is clearly not a physical thing, though perhaps it may be said to be a highly complex sequences of physical events. But now please remember that no single performance of *Hamlet* can be said to be identical with Shakespeare’s *Hamlet* itself. Nor is Shakespeare’s play the class or set of all of its performances. The play may be said to be represented or reproduced by these performances, in a way similar to that in which a building or a sculpture may be said to be represented by one or several photographs, or in which a painting or a drawing may be said to be reproduced by prints of varying quality. But the original painting itself is different from its reproduction. And in a somewhat similar way, Shakespeare’s *Hamlet* clearly is not. Although its reproductions may be said to belong both to the world 1 of physical things and to the world 3 of products of human mind, the play, *Hamlet* itself, belongs only to the third world.”

“It is similar with a symphony. The written score of Mozart’s Symphony in G Minor is not Mozart’s symphony, although it represents Mozart’s symphony in a coded form. And the various performances of Mozart’s Symphony in G Minor are also not Mozart’s symphony: they stand to the symphony in the relation of reproductions. These performances simultaneously belong to both world 1 and world 3. But the symphony itself belongs only to the third world – that third world which comprises architecture, art, literature, music and – perhaps most important – science and scholarship.”<sup>4</sup>

It may be mentioned that in the 68SNA, sculptures and paintings as purchased by producers except own house occupiers as well as buildings of Michelangelo are fixed capital formation while in 93SNA, sculptures and paintings have been reclassified as valuables the new, third category of capital formation. On the other hand, authoring a book (like *Hamlet*) and composing a piece of music (Symphony in G Minor) are outside the production boundary of the 68SNA, while in the 93SNA, they have come to be regarded as entertainment, literary or artistic originals, another new category in the 93SNA, “intangible fixed assets.” It is easy to find correspondence between Popper’s assignment and national accounting practices.

The relation between Shakespeare’s *Hamlet* and its performances or that between Mozart’s symphony and its performances is somewhat like the relation between a building’s plan and the building itself or that between the signifiers and the signified<sup>5</sup> in the theory of semiotics. Of course, there may be a variety of performances of *Hamlet* or Mozart’s symphony. In the case of sculptures and paintings, clearly the physical objects belong to the World 1. Sculptors and painters as well have had their plans for the works. But, it is the physical objects themselves that should be deemed to be “authentic” in these cases. It is worth noting that it is a common fact that plans or designs exist for any human products. These plans belong to the World 3, so in that sense, any physical product belongs to both World 1 and World 3.

---

<sup>4</sup> Popper (1994), pp.5-6.

<sup>5</sup> According to the well known (Saussurean) two-part model of the sign, a signifier (*signifiant*) is the form which the sign takes; and the signified (*signifié*) is the concept it represents. See Eco (1976) for example.

Table 1.1 below shows the treatment of selected items in 68SNA and 93SNA and their “residence” in Popper’s three Worlds. <sup>6</sup>

Table 1.1 The Treatment of Selected Items and Popper’s view

Items	68SNA	93SNA	Residence in Popper’s three Worlds
Sculpture	Fixed Capital Formation if purchased by producers	Valuables	World 1 and World 3
Paintings	Fixed Capital Formation if purchased by producers	Valuables	World 1 and World 3
Literary works	Outside of production boundary	Originals should be treated as Intangible Fixed Capital Formation	World 3
Music composing	Outside of production boundary	Originals should be treated as Intangible Fixed Capital Formation	World 3
Music Performances	Services; Intermediate or Final Consumption	Master tapes, etc. should be treated as Intangible Fixed Capital Formation	World 1 and World 3
Computer Software	Intermediate or Final Consumption (with exceptions)	Intangible Fixed Capital Formation (Not detailed description, particularly concerning the originals/ copies problem)	NS
Mineral exploration	If successful, Fixed Capital Formation; If unsuccessful Intermediate Consumption	Intangible Fixed Capital Formation	NS

<sup>6</sup> Some of the items are what will appear later in this paper. Correspondence between the treatment in national accounting and residence in Popper’s worlds is quite clear.

In passing, you can understand better the 68SNA's treatment of sculptures and paintings in the Table above if you consider that they are furniture of a kind placed in a building. It may be interesting to note this treatment is consistent with the philosophy behind the Bauhaus movement (1919-33) in that Walter Gropius, the founder of Bauhaus wrote in the Manifesto: "The ultimate aim of all creative activity is a building! The decoration of buildings was once the noblest function of fine arts, and fine arts were indispensable to great architecture. Today they exist in complacent isolation (...the rest is omitted.)."

About the role of the World 2, it is worthwhile to note that World 2's main function is, according to him, to produce World 3 objects, and to be acted upon by World 3 objects and that it interacts not only with World 1, as in Cartesian body-mind problem, but also with World 3. Thus, the World 2 is thought to function as intermediary. Here, we introduce "objective knowledge" and "subjective knowledge," two of the well known terms of Popper's. Let us compare the following two expressions:

It is well known that water consists of hydrogen and oxygen;

He knew that water is composed of hydrogen and oxygen.

The former refers to knowledge in objective sense or objective knowledge, while the latter refers to knowledge in subjective sense or subjective knowledge. Objective knowledge belongs to the World 3, while subjective knowledge belongs to the World 2 and as seen from the above comparison, "an important part of subjective knowledge is objective knowledge taken over by some subject." But, he described: "the largest part of subjective knowledge consists in inborn potentialities: in disposition, or in modification of inborn dispositions." <sup>7</sup> Thus, that part of subjective knowledge is described as consisting of dispositions, inborn or acquired, to react in certain ways to certain situations.

He takes up an important example of acquired dispositions: language. "For example, speaking English or French is an acquired disposition. But the basis -the disposition to learn some human language- is an inborn characteristic of the human species alone."<sup>8</sup> "Once they have learned a language, they can, as it were, plug into the third world."<sup>9</sup>

One of the most important characteristics of the World 3 is its autonomy. <sup>10</sup> He takes an example of "prime numbers." "The Babylonians were the first, so far as we know, who designed a number system." "You probably know what prime numbers are – numbers that are not divisible except by themselves and by the number 1. So, 2, 3, 5, 7, 11, and 13 and so on are prime numbers. Now, prime numbers not only have not been made by us but are already quite beyond our control in a certain sense. We do not know much about their distribution." "Now this shows that there is something here to be

---

<sup>7</sup> Popper (1994), p.13.

<sup>8</sup> Popper (1994), p.14.

<sup>9</sup> Popper (1994), p.15.

<sup>10</sup> Despite of its autonomy, unlike Plato's concept of idea, the World 3 is, after all, man-made.

discovered. Although the numbers are made by us, there are certain things above them which are not made by us, but which can be discovered by us. And this is what I call the 'autonomy' of world 3."<sup>11</sup>

This is the very reason why a question arises concerning whether creation of knowledge, or any "output" to the World 3, should be considered to be within the production boundary or not. Suppose a new resident of the World 3 appears. Why can you say it is a result of a particular productive activity? Or simply, it is due to the autonomy of the World 3.

The autonomy apart, as Popper (1979) states, knowledge grows through error elimination by way of systematic rational criticism.<sup>12</sup> The following is his famous schema:

$$P_1 \rightarrow TT \rightarrow EE \rightarrow P_2.$$

“That is, we start from some problem  $P_1$ , proceed to a tentative solution or tentative theory  $TT$ , which may be (partly or wholly) mistaken; in any case it will be subject to error-elimination,  $EE$ , which may consist of critical discussion or experimental tests; at any rate, new problems  $P_2$  arise from our own creative activity; and these new problems are not in general intentionally created by us, they emerge autonomously from the new relationships which we cannot help bringing into existence with every action, however little we intend to do so.”<sup>13</sup>

For example, some problem-situation, say increase in autism ( $P_1$ ), may have caused someone to think that the administration of the combined MMR vaccine which started in the early 1970s in the United States may be the reason for that ( $TT$ ). The publication of the theory that the MMR vaccination may cause autism was followed by a thorough process of critical discussions. Among them, it was reported that even after the cease of the administration in 1993 in Japan due to side-effects of the vaccine, the increase in autism has continued there ( $EE$ ). It is quite natural that this should make people to rethink about the hypothesis and reformulate the problem ( $P_2$ ). For example, some people may come to look for the true reason why autism increased.

In this way, the World 3 grows. So, it is not consistent with the view national accountants typically have that economic production is something that is carried out under the control and responsibility of some economic unit.<sup>14</sup>

Moreover, “output” to the World 3 or the creation of knowledge lacks reproducibility- so to speak, which should be considered to be an essential property that any meaningful production activity should have. And this seems to be a logical consequence of the assertion in Hill (1977, 1979) known as the “third party criterion”<sup>15</sup> concerning the definition of economic production. In fact, at the outset of Hill (1979, p.31), we find the following: “‘Do-it-yourself’: the very phrase implies that if you do not do it, someone else do it for you.” Thus, the *possibility* of having other people do the same thing as you do is considered to be an essential condition that any activity should be

---

<sup>11</sup> Popper (1994), p.20.

<sup>12</sup> See p.121 in Popper (1979).

<sup>13</sup> Popper (1979), p.119.

<sup>14</sup> See paragraph 6.15 in the 93SNA.

<sup>15</sup> Or “third person” criterion, as originally appeared in Hawrylyshyn(1977), p.89.

recognised as economic production. An implication is that intrinsically unique actions cannot be economic production.

*Hamlet* is a unique, non-reproducible work. Thus, Shakespeare could not have asked someone to write *Hamlet* for him. So, literal application of Hill's principle results in a conclusion that the creation of knowledge cannot be production. It is worthwhile to note, on the other hand, that sculptures, paintings or architectural works can be reproducible at least in principle.

Despite this, it seems that the production boundary of the 93SNA runs through the whole three Worlds by introducing the category of intangible fixed assets as is shown in the Figure 1-1 a.

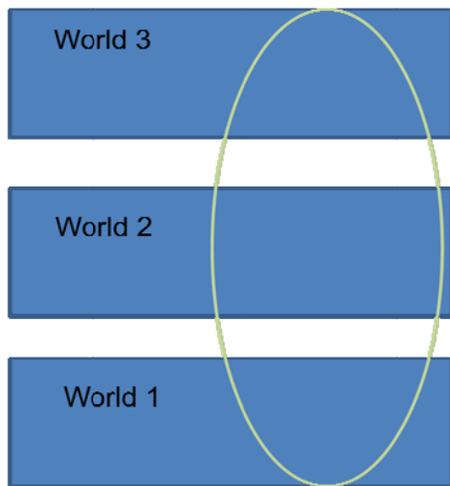


Figure 1-1a

In contrast with the current 93SNA, it is plausible to think that the 68SNA's boundary runs through the World 1 and 2 as in the figure 1-1b below. One problem that should be raised may be about services affecting persons that cause mental changes. It may be asked whether you can really cause other persons' mental states. Probabilistically, maybe yes.

However, for example, education needs so much effort as well as their capability on the part of people who receive it. Mental changes may be better regarded as a possible outcome rather than service output. Therefore, at least without taking into account such efforts (including time spent by them, etc.), it cannot be said that the situations involved are fully described.

Possible ways out may be (i) to include studying itself within the production boundary; and/or (ii) to define education services and other services of the similar kind without referring to the mental changes in question. If you would like to describe education as something different from taming a wild horse or educating cats, time spent for studying by people receiving it should be described explicitly like in (i), under which an outcome (mental change) might be said to be obtained through a kind of a joint production. Concerning (ii), in the case of education, for example, you may think of the services as those offering a kind of environment so that you can study efficiently. Lectures, like performances, are, after all, sequences of physical events which contain some information possibly.

We would like to propose that the World 2 in addition to the World 3 should be excluded from the description of economic production. The implication is of course that the location of the production boundary should be within the World 1 as in Fig. 1-1c below. One of the reasons for the exclusion of the World 2 from the concept of economic production in general is that economic production is something from “utility” production as utility is a high-profile inmate of the World 2.

However, according to Hill (1977), it is an essential condition for the changes in question to be deemed as services that there is prior consent between the units involved. As "consent" required belongs to the World 2, the services are still defined by using the World 2 if the requirement is to be maintained. If any change is brought about without prior consent required, this should be deemed to be externalities rather than services. To do the exclusion of the World 2 more completely, here, we define "serex" as a combined category of services and externalities. By adopting this definition and the above mentioned (ii), we can exclude the World 2 from the description of economic production completely.<sup>16</sup>

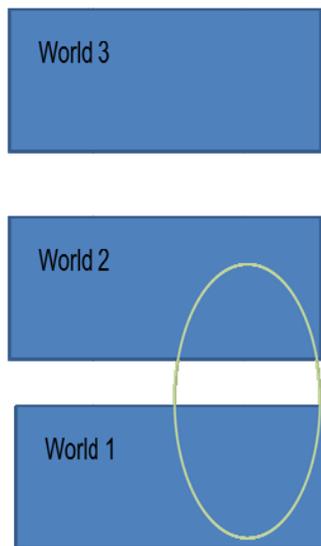


Fig. 1-1 b



Fig.1-1 c

Finally in this section, it may be worthwhile to think about whether the World 3 is shared by the humankind as a whole? Although the World 3 per se is in the public domain, some World 3 objects seem to live only in some restricted area like a particular linguistic area or a so called *nation*. The employees of a company or a particular section of the company may have their particular World 3, to which some efforts are needed to get access from outside the group. Even an employee (for example, a shop attendant) may have her/his personal knowledge that may be useful for the company as well as

<sup>16</sup> It should be noted that this proposal is about the general production boundary not that as a statistical convention like in the SNA. And even in the proposal, the World 2 may still take part in the evaluation of goods and services.

herself/himself, which has not been “socialised” yet. For example, she /he may know something about her/his customers. The knowledge may be explicit or tacit.<sup>17</sup>

So called “knowledge management”<sup>18</sup> tries to mobilise the kind of knowledge that is often likely to be not easily accessible, by socialising it so that it can be shared by a wider group of employees. By doing so, it might be explained in this paper’s context that the autonomy of the World 3 can begin to work to help develop their knowledge, skill, etc., further.

### 3. Access to the World 3

“At any rate, today, people all over the world benefit from the breakthrough discovery of the zero by an unnamed Indian, which he/she never dreamed of. And both then and now, it is seldom heard that self-proclaimed landmark work is truly a landmark achievement.

From Yoichi Yoshida(1898-1989), *The Discovery of the Zero*, first published in 1939.<sup>19</sup>

What are the main functions of education? Perhaps, by receiving education, you will be better at calculation. But more importantly, you will come to be able to get access to the World 3 more fully. This leads to the theme of this section: "the access to the World 3."

In this section and the section that follows, we will examine the access to and preclusion from the World 3.

As we noted, knowledge is environment of a sort for us. So, like the environment in the ordinary sense, it is a prerequisite for any production activity. But, if the firm does not have access to particular knowledge, it cannot use it. The focus of our accounting model may be access to knowledge instead of knowledge itself.

For example, even when a certain chemical product is known as an effective drug specific for some disease and the patent for the specific expires, a developing country may not have the access to the technological details about manufacturing them and the specific may not be available in the country. Often generic producers may not be interested in supplying developing countries.

Our proposal is that knowledge access rather than knowledge itself should be focused.

Firstly, as we noted in the previous section, knowledge creation should not be considered to be production. Secondly, although knowledge itself is deemed to be in the public domain (the World 3), the access to it may not be freely available. For example, it is a time consuming process for a student to come to understand the relation between the current balance, the net lending, and the saving-investment balance. Thirdly, as we noted earlier, the World 3 includes Popperian knowledge growing processes inside, in which starting problems are raised, then tentative theories are offered and followed by the processes of error eliminations (or critical discussions), and then new problems are

---

<sup>17</sup> Polanyi, M.(1966).

<sup>18</sup> About “making tacit knowledge explicit,” see Nonaka and Takeuchi (1995).

<sup>19</sup> Yoshida(1979), pp.36-37.

addressed. It is relatively easy to say a researcher can participate in the leading-edge discussion (or reaches the most advanced level) in the field, Although it is often said that someone most contributes to a particular theory, in most cases quite a few researchers have contributed in fact. *Knowledge creation is, after all, a cooperative process of human society as a whole. In addition, the process goes along with the help of the autonomy of the World 3.*

Once a person (or a firm) gets access to the leading-edge level of a knowledge area, it is a matter of *probability* so to speak whether he/she/it succeeds in inventing something or fails. And, even if he/she/it failed, the experience obtained through the failure may be useful to not only the person/firm engaged in the development process but also other persons/firms possibly.

So, instead of knowledge itself, the access to it is addressed in our accounting model: *Knowledge Access Accounting*. Some basic understandings behind are: (i) knowledge access may be described as the *state* of an economic unit or a group of economic units of which the multi-dimensional distribution measure may be constructed; (ii) human resources are the key to knowledge access as it is accumulated or embodied in them; (iii) in order to maintain or to extend the access, some activities (*access as activities*) must be conducted and they are costly processes which need primary as well as intermediate inputs; (iv) to describe the processes above, not only the purchase but also the existing stock of books and similar tangible assets for the knowledge access (“information assets”) including small-sum items, which are often treated as intermediate consumption rather than capital formation should be considered explicitly; (v) knowledge access includes education including staff training as well as R & D as analysing the latter only is like seeing just the tip of the iceberg - so to speak; (vi) in doing so, time spent by students (at least graduate and undergraduate) for studying should be explicitly taken into account.<sup>20</sup>

Concerning (i) and (ii), it may be suggested that a matrix (Fields x Levels) the elements of which are the numbers of persons employed who has access to the particular knowledge field/level should represent the knowledge access status data for an establishment/enterprise/geographical area/nation, etc., where fields may be chemistry, physics, econometrics, etc., or more detailed fields, levels may be most advanced, advanced, graduate, etc., so that the knowledge access status data is like that presented in the Table 2-1.

---

<sup>20</sup> An ad hoc extension of production boundary is made here. A possible interpretation may be that the society devolves (using a term in Hill (1977)) part of the cooperative efforts to particular people.

Table 2-1.

Field\Level	.....	Faculty level and equivalent	Graduate level and equivalent	Advanced	Most advanced
Chemistry		*	*	*	*
Physics		*	*	*	*
Econometrics		*	*	*	*
Organisation-specific		*	*	*	*
.....					

Let us assume that a firm uses a particular existing knowledge in its production activity. The figure below (Fig.2-1) describes the situation. The particular knowledge is in the public domain called “Knowledge Environment.” The arrows in the figure may be called knowledge flows. If the firm has the access to the particular knowledge, it can use it in its production activity as in the figure above. If not, it cannot use the knowledge. Whether it can use or not may be known from its knowledge access status matrix as described above.

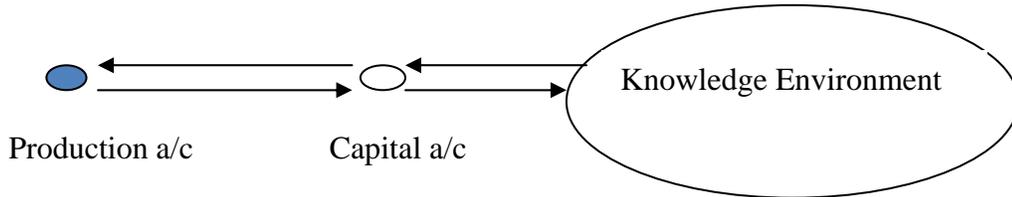


Fig. 2-1

The capital account in the figure is a special capital place adjacent both to the production place and the knowledge environment (KE). In order to show the accessibility to particular existing knowledge by the firm that control the production, in the figure, knowledge flows pass through capital accounts to (from) production accounts. Of course, as knowledge is not consumed by using it, knowledge used in the production returns to the KE like in the case of the use of land or other environmental factors (in the case of adequate utilisation). It should be noted that even if the access status of the unit is not enough for the particular knowledge, the tangible capital stock it has accumulated may make it possible to get access to it.

Let us consider the case in which knowledge creation is necessary. Because knowledge creation (creation of a new inmate of the World 3) is not economic production, a special treatment is needed to recognise and record the cooperative efforts involved. We propose later in this section that the activities for knowledge access including knowledge creation should be treated as quasi-public expenditures made by private bodies. However, if we notice the similarity between development-type expenditures and work-in-progress-

type expenditures, it is rather easy to show that the treatment of development cost as work-in-progress is possible and quite reasonable particularly from the viewpoint of individual business units though current business accounting practices do not allow the treatment of development cost as assets but for exceptional cases.

Suppose a new environmental regulation is introduced and new technology must be developed to clear it. If the firm has access to state-of-the-art environmental technology, it can possibly invent, say some devices for it, though it may fail. Let us assume that it needs one accounting period to develop the technology and it will begin to produce in the way that satisfies the regulation in the second period. In this case, the first period may be deemed to be a preparatory stage to the production.

Consider what looks to be a plausible treatment in national as well as business accounting. That is, we consider what we call a work-in-progress type treatment. In the treatment, a kind of work-in-progress entry is recorded for the development cost in the first period and record the same amount of intermediate consumption in the second period.<sup>21</sup> See Table 2-2a.

Table 2-2a A work-in-progress-type treatment of development cost

Production Period 1		Production Period 2	
Intermediate consumption (50)	Development cost (150)	Development Cost (150)	Gross output (500)
Time spent for development by workers(75)		Other Intermediate consumption (100)	
Fixed capital consumption including Access assets used up (25)		Employees' compensation (100)	
		Fixed capital consumption(20)	
		Operating surplus (130)	
Capital	Period 1	Capital	Period 2
Development cost (150)			Development cost (150)

<sup>21</sup> Concerning the treatment of work-in-progress, see for example, para.10.98 of the 93SNA. It may be worthy of noting that work-in-progress entries may be recorded for services as well as goods. For example, in the case of repair services it may take longer than one period to finish. In this case, work-in-progress entry should be needed. That same is true for computer software.

It might look reasonable but an immediately raised problem with this treatment may be that the technology developed in the first period can be used in later periods as well as period 2. This is clear when a certain device is produced in period 1 and come into use in period 2. Naturally, the device continued to be used in periods 3, 4 and so on.

Table 2-2b Work-in-progress-type treatment of development cost 2  
(Capital consumption case: life=3 years)

Production Period 1		Production Period 2	
Intermediate consumption (50)	Development cost of the devices(150)	Development cost included in the capital consumption of the devices(50)	Gross output excluding the device (500)
Time spent for development by workers and other employees' compensation(75)		Intermediate consumption (100)	Own account capital formation =device(150)
Fixed capital consumption including Access assets used up (25)		Employees' compensation (100)	
		Fixed capital consumption excluding development cost (20)	
		Operating surplus (380)	
Capital	Period 1	Capital	Period 2
Development cost of the devices (150)		Own account capital formation =the device completed (150)	Development cost (150)

In the cases where the new technology is embodied in the devices, we can consider that the capital consumption measure of the devices includes their development cost as well. In addition, the life of the devices is more or less similar to that of new technology, considering Simon Kuznets' famous view on "modern economic growth."<sup>22</sup>

<sup>22</sup> See Kuznets (1979), "Capital Formation in Modern Economic Growth (and some implication for the past)," pp.121-164 , in particular.

Table 2-2c Work-in-progress-type treatment of development cost  
(Sales case: life=3 years)

Production Period 1		Production Period 2	
Intermediate consumption (50)	Development cost (150)	Development cost included in the capital consumption of the devices(5)	Gross output (950) including the sale of 9 devices (@50)
Time spent for development by workers and other employees' compensation (75)		Development cost for the production of the devices(135)	Own account capital formation (50)
Fixed capital consumption including Access assets used up (25)		Other intermediate consumption (200)	
		Employees' compensation (200)	
		Fixed capital consumption excluding development cost (20)	
		Operating surplus (440)	
Capital	Period 1	Capital	Period 2
Development cost (150)		Own account capital formation (50) including development cost (15)	Development cost (150)

So, if the R & D is embodied in capital equipments and it is used by the firm which has developed the technology only, both development cost and tangible capital asset formation (the device) involved are considered to be treated properly in the ordinary national accounting framework in the manner described above as in Table 2-2b, where the economic life of the device is assumed to be three years. Note in this treatment, development cost ostensibly disappears as early as in the second period. Instead, the entry of tangible capital assets appears. It is reasonable in that tangible assets embody most advanced technological knowledge available at the time point they are produced.<sup>23</sup>

<sup>23</sup> We assume in the table, the prototype model made in the course of the development continues to be used in the production process in the second period or later. So, the

The technology developed can be used by producers other than the firm that developed the technology originally. The technology itself is in the public domain, KE. But the latter firm may get a patent for it so that the access of other firms to the technology is precluded. However, let us assume that the firm is the only producer of the devices because of some reason or other. And it is assumed that 10 devices (including own use) are produced in the second period. The price of the device it set will include the development cost (the total development cost divided by ten) as well as current production cost. So, in this case as well, the total measure of capital consumption adequately reflects the development cost born by the firm that first developed the device. See Table 2-2c.

Table 2-2d Work-in-progress-type treatment of development cost  
(Technical advisory services case: rendered only in period 2)

Production Period 1		Production Period 2	
Intermediate consumption (50)	Development cost (150)	Development cost transferred to intermediate consumption for the production of technical advisory services(150)	Technical advisory services sale ( 400)
Time spent for development by workers and other employees' compensation(75)		Other intermediate consumption (50)	
Fixed capital consumption including Access assets used up (25)		Employees' compensation (75)	
		Fixed capital consumption excluding development cost (20)	
		Operating surplus (105)	
Capital	Period 1	Capital	Period 2
Development cost (150)			Development cost (150)

development cost is transferred to fixed capital. Of course, other methods of recording might be possible.

Even if the firm itself does not produce the devices but provide another firm that produce the devices with the technology, it may be claimed that the total measure of capital consumption of the devices reflects the development cost if the services provided (technical assistance, etc.) has the market value that includes the cost.

On the other hand, the new technology may not be embodied in capital goods. This might be, say change in materials in the direction towards zero emission. In this case as well, if technical assistance services or something like that can be sold on the market and the development cost is covered in the service prices, the treatment just described may be applied almost just as before (see Table 2-2d) where it is assumed that the services are sold in the second period only.

Instead, if the services or devices are produced and sold in the third and or fourth period as well, the development cost as a capital item will continue to appear in the second period and some later periods. See Table 2-2e.

Table 2-2e Work-in-progress-type treatment of development cost  
(Technical advisory services case: rendered in period 2 and 3)

Production Period 1		Production Period 2	
Intermediate consumption (50)	Development cost (150)	Development cost transferred to intermediate consumption for the production of technical advisory services(75)	Technical advisory services sale (300)
Time spent for development by workers and other employees' compensation(75)		Other intermediate consumption (50)	
Fixed capital consumption including Access assets used up (25)		Employees' compensation (75)	
		Fixed capital consumption excluding development cost (20)	
		Operating surplus (80)	
Capital	Period 1	Capital	Period 2
Development cost (150)			Development cost (100)

However, in the cases where the technology is freely available, similar devices (services) will become available in the market if other firms have knowledge accessibility relevant for them to make devices with similar functions with much less development cost.<sup>24</sup> The firm, the original developer, may also sell the devices on the market but the price it will receive cannot cover the development cost because of the very fact that knowledge is in the public sphere. So, the firm may have a strong incentive to get patent rights. Of course, once it gets the patents, the treatment described in the previous paragraphs may be applicable again.<sup>25</sup> But, it may fail to get relevant patent rights, in which case the cost born will be not covered but its contribution to the society must be recognised and recorded as such. There may be cases where the firm tries to develop the technology but fails.

It should be noted that if because how long and how many the devices and services in question continue to be sold may not be known in advance in general, the recording of development cost can be ambiguous in character. It may be necessary to record impairment entries or other changes in volume entries concerning development cost as a capital item. And another ambiguity may be that caused by the possibility of failure. Treatment of failure, for example those related to exploration cost is a typical difficulty.<sup>26</sup> In addition to the technical problems involved, because those costs are partly or wholly, born by the public bodies quite often, political difficulties including those with the measurement of the public sector's financial position may arise.<sup>27</sup>

The problem that should be addressed is how we treat "publicness" in activities in the private sector. On top of R & D just described, philanthropic activities in profit earning businesses and certain functions performed by banks and other financial institutions as well as so called activities of non-profit bodies. The current practices of the SNA do NOT succeed in dealing properly with the above mentioned activities. In

---

<sup>24</sup> License contracts may be considered to be a form of such services rendered. In such cases, royalties related with some intangible non-produced assets, or even outright transaction of such assets may be involved. If this is the case, services or a certain financial assets related with advance payments of services includes royalty elements (or outright value of the rights) in addition to payment for services themselves. National accounts should record these payments as services (and financial claims) as far as services are involved in the transactions in question.

<sup>25</sup> Preclusion using measures other than patents is possible. Find an example of Gaviscon case at <http://news.bbc.co.uk/go/pr/fr//2/hi/programmes/newsnight/7282627.stm> (BBC Newsnight on 7/March/2008).

<sup>26</sup> Because development process is the process of trial and error, failure often takes place in the process. However, it matters whether the failure takes place in the continued process or not. The continuation is not that the same exploration company conducts the exploration activities in question.

<sup>27</sup> For example, JOGMEC (Japan Oil, Gas and Metals National Corporation) established SPC's to give financial support to private-sector exploration companies through the acquisition of up to 75% equity capital of an exploration project.

addressing the problem raised, the difference between business accounting and national accounting should be reconsidered carefully.

In business accounting, what are concerned may be, among other things, the cost-benefit situations involved of the particular economic agent. In contrast, what national accounting should describe is, among other things, how cooperative efforts among people work. For business accountants, intangibles recorded in their accounts may be an important evidence for profitability of the business. But we should know that it is highly dependent on (international) public policy towards intellectual property rights or knowledge access. Too high profitability might mean that such rights are protected to a greater than needed level perhaps in TRIPS.

We propose that an account which shows knowledge access activities inclusive of those related to knowledge creation as well as maintenance or improvement of access in terms of by which sector (or industry) the expenditures are born, toward what kind of fields/levels the expenditures are directed. It is worthwhile to note that even in the cases of failure in technological development, it may be thought that knowledge access capabilities are well maintained or even improved by the unsuccessful efforts of the unit.

Table 2-3 Account for Knowledge Access Activities

Field/Level	Industry	Sector	Goods and Services including time spent
Environmental/most advanced	Agriculture	Public sector	...
Environmental/advanced	...	...	...
...	Education	Private sector	...
...	...	...	...

The expenditures on the debit sides of the production accounts that are deemed to be made for the knowledge access purposes are reclassified by goods and services (non-factor and factor) categories including time spent by knowledge workers <sup>28</sup> valued in monetary terms and copied to the rightmost column of the table. The other three columns of the table may be considered to reclassify the expenditures of the rightmost column. Public sector/private sector division may be the most important one to be distinguished because of differences in funding among other things. <sup>29</sup> See Table 2-3.

In the satellite framework off the main body of the SNA, in addition, the expenditures related to such activities as knowledge access including knowledge creation, which may be called quasi-public activities, might be separated out and transferred to the production account of quasi-public activities as in Table 2-4 below.

<sup>28</sup> The extension of production boundary may be considered here.

<sup>29</sup> In addition, a funding column may be added to the table. But it may look too demanding here.

Table 2-4 Accounting for quasi-public activities  
 Production a/c of the firm which makes knowledge access expenditures

Debit	Credit
Goods and services consumed for the knowledge access or similar purposes	Quasi-public expenditures (knowledge access)
Production a/c of the quasi-public activities	
Debit	Credit
Quasi-public expenditures (knowledge access)	Quasi-public purposes

As seen from the above table, the expenditures in question for knowledge access purposes are treated as if they are part of (collective) government services. Under this treatment, it may be claimed, the development expenditures made by the enterprises and those by the governmental units or private non-profit bodies can be more consistently treated. And this treatment may be considered to be more consistent with the view that knowledge once created will immediately come to be placed on the public sphere (KE) than the work-in-progress- type treatment.

#### Computer software and other "intangible fixed assets" items

At the end of section, we will discuss the treatment of computer software and some other items, which are called "intangible fixed assets" in the 93SNA.

"Intangibles" have two categories in the SNA: "intangible fixed assets" and "intangible non-produced assets." The latter will be the focus of the next section.<sup>30</sup>

Firstly, it should be stressed here that most computer software is tangible in proper sense of term.

Let us take an example of electrical home appliances. They are often programme-controlled recently. Even small remote control units include programmes in them. Different functions may be performed by the appliances by switching from one programme to the other. Clearly, these devices are tangible. Even if the programmes are contained in CR-ROMs or other media rather outright and traded, we do not need to change our position. Computer software should be considered to be a sort of a "component" of a machine.<sup>31</sup>

Strange as it may sound, in order for computer software to be "machine-readable," it must appear as physical objects.

Programmes themselves are in the World 3 in Popper's term. The relation between computer software which we consider to be parts of machines and programmes may be the same as that between books and a novel contained in it. Computer

<sup>30</sup> Note the word "fixed" implies it is produced and "fixed assets" and "fixed capital" are synonyms.

<sup>31</sup> Takahashi (1983, pp.174-175) wrote: "Computer software is a machine just as the computer hardware."

programmes and novels are both copyright entities (works). In order to function in computers,<sup>32</sup> programmes need to be contained in physical objects like CD-ROMs just as novels are contained in books.

You can also download a new programme for your appliances, say, your mobile device, to have its functions improved. This change is of course due to the services rendered to your mobile device. In SNA, the tradition is that it should be treated as fixed capital formation like major improvements to fixed assets or so called capital repairs if it is not small-sum and you are a producer.

Thus, computer software is better treated as fixed assets in the traditional sense rather than “intangible fixed assets.”

The above is only half the story. There is a notorious question called the original/copy problem in 93SNA. Computer software mentioned above should be regarded as the copies rather than the originals. Not only packaged software but also design- to-order software should be regarded as copies outside original producers.

As is well known, it is assumed that two- stage production takes place with regard to computer software and several other items in 93SNA.

The first stage is concerned with the production of originals inclusive of the development of the software. The second stage refers to the production of copies. The main claim we should like to make is that the copies including computer software and other items (books, DVD, etc.) may be fixed capital formation or intermediate or final consumption depending on ordinary accounting rules.<sup>33</sup>

As far as the production processes of the originals are concerned, it seems that the development cost related with the production of computer software (copies) or other copies (books, etc.) may be treated like other development cost that we have discussed earlier in this section. In line with what we have discussed so far, development cost as a capital (asset) item should be recorded here as well. This may be considered to correspond to the production process of originals of computer software, etc.

Like in the case of other development cost, often other changes in volume entries need be recorded including the entries related to impairment.

However, a different view was shown in the 93SNA, paragraph 6.144.<sup>34</sup>

To examine the proposal included in the paragraph, let us consider a software company that is specialised in only one title of computer software. Suppose the shares of the company are put on the market. Also the total market value of shares of the company is supposed to adequately reflect the assets and liabilities of the company, though it is not

---

<sup>32</sup> The real meaning of the word “machine-readable” may be that it can function in computers.

<sup>33</sup> When the accounting is addressed to production processes of libraries, museums, schools, etc., somewhat different criteria might be needed from ordinary accounting rules. Note in passing that original manuscripts of authors should not be regarded as originals in the sense of paragraph 6.143 in 93SNA. Of course they are museum items. So they are prerequisite to production processes of museums, etc. and they need to be treated as fixed capital formation in the ordinary sense rather than valuables because they are not simply stores of value, to which conservation and restoration (maintenances) are needed, for example.

<sup>34</sup> See below.

the case clearly. Under these assumptions, the proposal seems to mean negative net worth of the (hypothetical) software house should be regarded as the value of originals of the computer software in question.<sup>35</sup>

If other intangibles are adequately evaluated in the accounts, this might be a possible solution if related information is available. However, because intangibles are traded only in exceptional cases including M & A, often this assumption does not hold. So, this method may result in giving a mixed-up measure of the fixed assets.

The development cost (work-in-progress) type treatment concerning software originals as well as entertainment, literary or artistic originals seems to be more suitable. It is worth noting that business accounting practices concerning master recordings, etc. (SFAS 50) may be considered to be consistent with our view.

### Appendix to Section 3

The followings are the paragraphs in 93SNA related with the problem of production of originals and copies:

6.143. The production of books, recordings, films, software, tapes, disks, etc. is a two-stage process of which the first stage is the production of the original and the second stage the production and use of copies of the original. The output of the first stage is the original itself over which legal or de facto ownership can be established by copyright, patent or secrecy. The value of the original depends on the actual or expected receipts from the sale or use of copies at the second stage, which have to cover the costs of the original as well as costs incurred at the second stage.

6.144. The output of the first stage is an intangible fixed asset that belongs to the producer of the original (author, film company, program writer, etc.). It may be produced for sale or for own-account gross fixed capital formation by the original producer. As the asset may be sold to another institutional unit the owner of the asset at any given time need not be the original producer, although they are often one and the same unit. If the original is sold when it has been produced, the value of the output of the original producer is given by the price paid. If it is not sold, its value could be estimated on the basis of its production costs with a mark-up. However, the size of any mark-up must depend on the discounted value of the future receipts expected from using it in production, so that it is effectively this discounted value, however uncertain, that determines its value.

6.145. The owner of the asset may use it directly or to produce copies in subsequent periods. Consumption of fixed capital is recorded in respect of the use of the asset in the same way as for any other fixed asset used in production.

---

<sup>35</sup> About negative net worth in national accounting, see the next section.

6.146. The owner may also license other producers to make use of the original in production. The latter may produce and sell copies, or use copies in other ways; for example, for film or music performances. In these cases, the owner is treated as providing services to the licensees that are recorded as part of their intermediate consumption. The payments made by the licenses may be described in various ways, such as fees, commissions or royalties, but however they are described they are treated as payments for services rendered by the owner. The use of the asset is then recorded as consumption of fixed capital in the production of services by the owner. These services are valued by the fees, commissions, royalties, etc. received from the licensees.

Canberra II Group recommended amending the above paragraph 6.146 as follows:

Proposed amended paragraph

The owner may also license other producers to make use of the original in production. The latter may produce and sell copies, or use copies in other ways; for example, for film or music performances. Two cases arise: Where the license is an operational lease, the owner is treated as providing services to the licensees that are recorded as part of their intermediate consumption. The payments made by the licensees may be described in various ways, such as fees, commissions or royalties, but however they are described they are treated as payments for services rendered to the licensee by the owner. The use of the asset is then recorded as consumption of fixed capital in the production of services by the owner. These services are valued by the fees, commissions, royalties, etc. received from the licensees. Where the licence is not an operational lease, the sale of the licence should be considered as a sale of all or part of the original. The decline in the value of the original to the owner is recorded as negative fixed capital formation and not as consumption of fixed capital. The eventual decline in the value of the licence in use will be recorded as consumption of fixed capital in the accounts of the licensee, now recorded as the owner (and user) of part of the asset.

#### 4. Topics on selected intangible assets

In this section, we will consider another category of intangible assets in the 93SNA, “intangible non-produced assets.” They are typical intangible assets, which are deemed to come into existence other than through production. They are constructs of society.

Although, in the SNA, they appear as reconciliation items, they should be considered to appear in flows between right holders and the society's central unit (Government). See Figure 3-1 below.<sup>36</sup> If you would like to analyse the income distribution side of the matter, you can reroute rent flows included in commodities' prices

---

<sup>36</sup> Concerning the graph-theoretical presentation of accounting systems, see Sakuma (2006).

via the central unit. The outright assets may be considered to have the market value which may be calculated by capitalising the rent flows involved. By putting these items in other changes in volume of assets accounts as reconciliation items, the distribution side involved in the matter would be obscured.

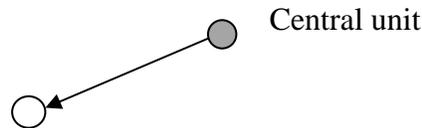


Figure 3-1

Such constructs devised by society include patent rights<sup>37</sup>, copy rights, trademarks, exploitation right, etc. A new comer arrived quite recently: emission rights. In addition, in 93SNA, purchased goodwill is included in this category.

Often the public authority grants patent rights or other similar exclusive rights to persons to whom particular “knowledge creation” is attributed (supposed inventor, supposed author, and supposed discoverer etc.) in order to further knowledge creation including authoring, composing or other creative activities. However, it must be stressed whether it does so or not (and if so, how and to what extent) is a matter of policy. There is no natural value of knowledge creation.<sup>38</sup>

While patent rights and other typical intangibles come into existence by legal actions, goodwill does come into existence through accounting action rather than legal action.<sup>39</sup>

In what follows in this section, the focus is on the concept of (purchased) goodwill. Although it is an established business accounting concept, purchased goodwill is a very special category in that it appears only when a company purchases another company. According to a typical business accounting description, it can be thought of as a “premium” for purchasing a business. That is, it is the difference between the purchase price of the company acquired and its book value, which equals to the shareholder equity (the total current market value of shares when it is acquired) minus all the intangible items (patent rights, trademarks as well as goodwill).<sup>40</sup>

When a company purchased another company, two alternative accounting methods may be applied: pooling of interests method and purchase method.

Because when the pooling of interests method is used, the balance sheets of the two businesses are simply combined and no goodwill is created, this method looks

---

<sup>37</sup> See 93SNA, paragraph 13.19 uses the term, “patented entities”, but this seems to be confusion in terms. For, the term “patented entities” looks as if they mean knowledge or knowledge access behind the rights although socially constructed assets are rights themselves.

<sup>38</sup> Incidentally, in 93SNA, an inadequate convention about royalties was introduced, unfortunately, in which they are treated as if they are services.

<sup>39</sup> See 93SNA, paragraph 13.17.

<sup>40</sup> The book value is sometimes called net tangible assets.

very clear and rather familiar to national accountants, who often combine (or consolidate) accounts of plural economic units in order to form sectoral accounts.

While the pooling of interest method as a business accounting practice uses historical cost valuation, this valuation method is not appropriate for national accounting, in which current price valuation is thought to be the suitable valuation method.

When the purchase method is used, the acquiring company will put the premium they paid on their balance sheet under the heading "Goodwill." Typical accounting rules require the goodwill be amortised in the course of 40 (or 20) years or impairments should be recorded if they take place. If you follow the purchase method and compare the combined account before and after the acquisition in question, you will find a new asset called goodwill appear in the latter rather abruptly. See Figure 4-1a through 4-1e.<sup>41</sup>

B Company

Assets	Liabilities
1000	600
	Capital
	400

Total market value 900

Figure 4-1a

T Company

Assets	Liabilities
1500	1000
	Capital
	500

Total market value 1100

Figure 4-1b

T+B Company

(Pooling of interests method)

Assets	Liabilities
2500	1600
	Capital
	900

Figure4-1c

T+B Company

(Purchase method: T purchased B)

Assets	Liabilities
3000	1600
Of which	
Goodwill	Capital
500	1400

Figure4-1d

<sup>41</sup> It is assumed that share holders of Company B (the company acquired) agreed to exchange their shares with those of the acquiring company. In addition, it is also assumed that intangibles had not been recorded till the time of acquisition in the accounts of the both party involved.

T+B Company (Pooling of interests method: national accounting version/before and after the acquisition)

Assets 2500	Liabilities including shares 3600
	Net worth -1100

Figure4-1e

Seeing the above accounts naturally suggests some important points:

(i) Recorded goodwill may be regarded as current valuation gain. In other words, it is the difference between net worth in current prices and that in historical cost. Such valuation change should not be recorded in flow accounts within the national accounting framework; (ii) Though apparently goodwill seems as if it were an established accounting construct, ways it is recorded vary including the cases where no goodwill is recorded. Even if the purchase method is adopted, amortisation rules vary;

Business accountants might say goodwill is a kind of proxy to various intangibles involved. But actually it is an accounting concept needed simply for both sides of the account to balance out. However, (iii) the “minus (independent) net worth”<sup>42</sup> item as appears in Figure4-1e instead of that badly made balancing item may serve the purposes that the concept is supposed to do.

Thus, the concept of goodwill is a business accounting concept rather than a national accounting one. The focus should be the analysis of negative net worth with due attention being paid to the fluctuation of market prices.

## 5. Closing Remarks

Some forty years ago, 68SNA, in its introduction, stated in a section titled “The new system and the future (g) the functional classification of inputs” as follows:

1.93 In the new SNA intermediate inputs are classified by commodity and other inputs are classified by the components of value added but no attempt is made to classify these inputs further. They may, however, perform a number of more or less distinct functions in addition to providing a basis for productive activity. Some may be used to maintain recreational and medical facilities which, in part at least, are of direct benefit to employees though they may also contribute to

---

<sup>42</sup> In national accounting, net worth is calculated as total value of assets minus total value of liabilities including the second party liabilities (shares and other equities). So, it is called “independent” net worth.

productiveness. Others may be used to maintain research and development facilities and it is not altogether clear that these should be regarded as current inputs at all since this year's research and development work can hardly be expected to contribute to this year's output unless this work can itself be regarded as output.

1.94 A first stage in dealing with this problem would be to assign the inputs already distinguished to different functional categories, such as current production, welfare or research and development, a task which in general would involve a further subdivision of these inputs. This would lead to a second stage at which it would be necessary to decide how to treat expenditure on the different categories. (...The rest is omitted.)

Where are we now? At the first stage as described above of "functional classification of inputs"? Or at the second stage of deciding on the treatment (of the current/capital boundary)? It seems advisable not to go too far. For, there are many issues involved to rethink about. Our work-in-progress type treatment of development and similar cost will be a minimum step because in the treatment, they are treated as if they were traditional work-in-progress.

A combination of a satellite treatment of knowledge access and a work-in-progress type treatment of R &D, software originals, and entertainment, literary or artistic originals in the central framework accounts will be our recommendation. We believe it is suitable for the present.

#### References

- Eco, Umberto (1976) *A Theory of Semiotics*, Indiana University Press.
- Hawrylyshyn, Oli (1977) "Towards a Definition of Non-market Activities," *Review of Income and Wealth*, 23 (1), pp.79–96.
- Hill, T. P. (1977) "On goods and Services," *Review of Income and Wealth*, 23 (4), pp.315–338.
- Hill, T. P. (1979) "Do-it yourself and GDP," *Review of Income and Wealth*, 25 (1), pp.31–39.
- Kuznets, Simon (1973) *Population, Capital and Growth: Selected essays*, W. W. Norton & Company.
- Lev, Baruch (2001) *Intangibles: Management, Measurement, and Reporting*, Brookings Institution Press.
- Nonaka, Ikujiro and Hirotaka Takeuchi(1995) *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation*, Oxford University Press.
- OECD (2002) *Frascati Manual: Proposed Statistical Practice for Surveys on Research and Experimental Development*, 6th edition.
- Polanyi, Michael (1966) *The Tacit Dimension*, Routledge & Kegan Paul.
- Popper, Karl R. (1979) *Objective Knowledge: An Evolutionary Approach*, Revised Edition, Clarendon Press.
- Popper, Karl R. (1994) M.A. Notturmo (ed.), *Knowledge and the Body-Mind Problem: In Defence of Interaction*, Routledge.

- Sakuma, Itsuo (2006) "A Graph-Theoretical Approach to the Axiomatisation of National Accounting," paper presented at the 29th General Conference of the International Association for Research in Income and Wealth, Joensuu, Finland, 20 - 26 August 2006.
- Takahashi, Hidetoshi(1983) *The History of Information Science(Joho Kagaku no Ayumi)*, Iwanami Shoten (in Japanese).
- Yoshida, Yoichi (1979) *The Discovery of the Zero(Rei no Hakken)*, Iwanami Shoten (in Japanese).