Chapter 6
Value Representing Technology and Knowledge

Technology and capital are knowledge driven devices used by humans to improve the capacity to better adapt and prosper in the natural and social contexts. They are socially available forms of knowledge. That capacity originates in individual human knowledge, it reveals as action and work and eventually it results in produced goods. Thus, knowledge is the basic element of survival and success, as it builds on the conscience of what we are and what we can do.

How do individual and social knowledge act and impact within society? They act in many different ways, which are delimited by a metric that adjusts their impacts on society. Indeed, the social need to exchange goods and ideas requires a scale and a balance on which trade decisions and innovations are based. That scale is used accordingly to a specific concept that substantiates and quantifies every act humans perform, in agreement with their individual need to survive and grow and balanced by the general needs of other individuals and society: That scale is part of the concept of value. People attribute value to what they need and want, and to what they produce for trading. Just as human knowledge, value has subjective and objective components. I propose a justification of how and why the existing value reflects and is proportional to the available human knowledge.

The word value originates from the Latin *valore*, which is mainly linked to the idea of being strong. Its Indo-European roots are traced through the suffix *wal* in Germanic and Slavic languages as well as Latin with a connotation also related to power and government. The concept applies to the individual, where the attribute to be more or less strong is recognized, and to the social, where it matches what is more or less needed and desirable by the group. Moreover, the concept includes attributes of two different kinds, one qualitative and other quantitative. In other words value seems to be a metric, comprising a criterion (qualitative), and a scale (quantitative). We will see that, for the economic value, a reasonably objective quantification is plausible.

A. S. C. Fernandes, *The Contribution of Technology to Added Value*,
DOI: 10.1007/978-1-4471-5001-5_6, © Springer-Verlag London 2013

6.1 The Origins of Value

Need and therefore dependency are essential components of ecosystems, with or without human presence. Plants grow up in search of light and the roots spread to find water and nutrients. The needs for water and the sun's energy are variables of the survival equation, they are parameters to which we attribute value. These parameters, essential to our scale of needs, belong to the deepest layers of the value concept, as they deal with the development of the species, a subject matter that is being adaptively filtered and innovatively optimized for 3 or 4 billion years. It is a natural development, genetically imposed, illustrating a form of local and elementary determinism. This is common to all living organisms, constituting a first factor that informs and qualifies our notion of value. This is my first work hypothesis.

In the structure of primitive societies, observed as very simple social organizations, there are two notions that fundamentally contribute to survival and prosperity of both the individual and the group: The sharing and exchange of goods; and a concern for efficiency. The first notion includes issues like safety, food, tools, and cohabitation; in the second, physical strength, reproductive aptitude, personal and group skills. This simple framework describes a primitive model of value, where the dual most essential aspects of what is needed, desirable and thus valuable are represented: (1) What is more convenient to the community; (2) and what benefits the individual. As the individual and the group are inextricably linked, they cannot present a hierarchy between them. They are the two sides of the same coin. I believe that this description of a primitive society is still valid for a complex civilization. I propose that this permanent and compulsory duality provides a second factor that qualifies in essence the notion of value. This is my second and last work hypothesis. My objective is to justify a close conceptual link between value and human knowledge.

6.2 Axiology and Other Types of Value

The theory of value is deep rooted in ancient philosophy. Value was acknowledged by the proximity to the truth, which overlapped with the ultimate end of things or the first cause. The truth was equivalent to good and its absence was the opposite, evil, principles that generated the constructions of ethics and morals mostly associated to socioreligious systems, which, in turn, stand as common ground to all civilizations. The (written) law is the first product stemming from ethical and moral conduct principles.

The Greek etymon *axios* expresses the property of having value. The equivalent English word axis means a direction or the center of a spatial dimension, which illustrates the idea that societies develop around privileged directions, their attractive axis, i.e., their main values. Axiology studies the evolution of values from a philosophical point of view.

Accordingly, even a specific geometry of value was devised illustrating an evil-good axis, pointing the good upwards and evil downwards. This geometric metaphor was used often by the Greek classics [1–3] and in the Renaissance [4]. Aristotle considered that virtues were up and vices down; Plato in his Allegory of the Cave depicted the truth as with sunlight out and up contrasting with the cave's shadows. Dante drew the axis of good and evil from up in the skies where paradise was to down deep on earth where he placed hell. This axis reminds the sun's energy source from the skies, the energy source of all living things, and the death and decomposition beneath the earth.

The most important values and virtues were common to most civilizations, what was said to make part of the natural law [5–7], though not with the same priority. For instance, Confucianism said that filial love was the first virtue, whereas for the Western culture of the same period this virtue was positioned in fourth place after reverence to gods, the spirit of the deaths, and the spirit of the nation.

Along the times, Rome, Christianity and Scholastics, the migrations of Goths from the East and the Vikings from the North did not change the fundamental values of the European older civilization. Indeed, the great majority of the population lived in the rural world where the basic agricultural production and commerce were gradually developing, keeping the vast inertia of survival, family related and local basic values. Newcomers settled down resulting in renewed societies with slow changing sets of values.

Humanism started a slow transfer from a god's centered value system to the individual capacity to build their own knowledge base and to a civil society founded on less transcendent principles, like wealth, work, competencies, and other earthly powers. Slowly, new values emerged related to work and skills triggered by new commerce opportunities. Rationalism, Empiricism, and the Kant's synthesis in his Critics definitely relocated the knowledge's source to humanity, both the individual and the social. Individuality and social values emerged as the central duality, opposition and complement, onto which nations would build their social systems and prosper. Simultaneously, industrial development and international trade became increasingly important, and with them the economy of offer and demand, a knowledge area where the concept of value developed a particular meaning.

6.3 Economic Value

Savings and wealth accumulation are as old as the history of man. Goods have to be saved, on the one hand to ensure future consumption, and on the other hand for barter with other communities. Wealth accumulation improves surviving chances and therefore it is termed as valuable. The idea of value is strongly linked to usefulness, either for consumption or for trade. This fundamental characteristic continues today to be a quality criterion of economic value. Thus wealth stands for goods with recognized value.

Considering the above, the methodological framework with which the economic value concept evolution will be analyzed here assumes value as a metric, containing a criterion and a scale, the former related to subjective aspects and the latter defining its assessment objectively.

Early forms of wealth were cattle, land, slaves, and precious metals. The introduction of the coin favored long distance trade, contributing decisively to the formation of empires where ships, armies, and strategies became visible and important forms of accumulated wealth. In the Ancient Greece, Xenophon [8, 9] explained how use value of a flute was different from its exchange value and laid down various fundamentals of economics, like showing that there cannot be wealth (value) without knowledge and also that knowledge values nothing without work. Use value and exchange value are still today two fundamental distinctions of the value concept. Aristotle [1, 10] showed how property degraded with time and the need to keep on investing to maintain its value. This is another fundamental characteristic of value: By default, it naturally degrades with time, in whatever form it is embedded. It is just like a boat rowing against the current, when stop rowing it halts and moves backwards. Similarly, humans know that the same happens with their own knowledge and with the outputs of their production.

Assessing and quantifying value using an objective scale has always been a matter of discussion. Utility and demand, on the one hand, offer and associated costs, on the other hand, stand as this matter's main sides. Thomas Aquinas, circa 1224–1274, clarified that neither the seller nor the buyer must prevail and that therefore it must be found a fair price [11]. But Duns Scotus, circa 1264–1308, felt that the fair price was an intrinsic value, which corresponded to the cost of production, wages, and other costs [12, bibliographic notes, Chap. 3]. The two scholars showed two different sensitivities to economic value,[1] the first subjective, the second objectively linked to work and other production costs. In England, Francis Bacon (1561–1626) theorized on the mercantilist capitalism, where the fair value concept evolved to the concept of market value, which was equivalent to the older exchange value [14]. Along the same line, William Petty, circa 1623–1687, defended international capital markets, stating that trade was the source of wealth creation. However, Petty proposed that value should be measured by labor and land, and land assessed by the amount of work it could provide [15, Chap. 4, no. 18–20]. He added that the market price statistically revolved around the natural value, a new concept, which would be intrinsically linked to work and to the minimum subsistence level of workers and families. This link would be developed by Karl Marx, two centuries later, and is the foundation of his theory of value objectively based on labor value. The origin of economic value was also traced to the land and labor in France by Richard Cantillon stating that "…intrinsic value of a thing in general is the measure of the land and labour which enter into its

[1] The concept of fair value is still in use today (see Directive 2003/51/CE from the European Parliament and the Council, 18 June 2003). In a similar fashion, the fair salary is defined by the Catholic Church social doctrine (Catéchisme… [13], 2434).

production…" [16, part I, Chap. 10]. At that time, Physiocracy, slowly replacing Mercantilism, became the main economic theory, seeing the land as the source of all economic value, accrediting no relevance to manufacturing and commerce. Its leading representative, Francois Quesnay [17], developed the first economic model where the new concept of added value, still today in the center of value accounting, was introduced. To the value of the land, which was a *don gratuit*, labor and capital values were added matching the final value of products.

Adam Smith returned to work (labor) as the origin of wealth creation and therefore of value. Value originated not only on wages, but on land rents and capital costs, including capital depreciation, interest, and profits. However, the part of the price that was not originated on wages would be equivalent to the effort the buyer would save to acquire that product [18, Book I, Chap. V]. He also made clear the difference between natural value and market value, the former being equivalent to total production costs, and the latter resulting from the market forces of offer and demand (Chap. VII). Finally, he endorsed the old concepts of use value and exchange value or market value (Chap. IV). Ricardo did not add anything substantial to the concept of value [19, Chap. I, Sect. II], either origins or variations, but Malthus and especially Say [20, Book II, Chap. I] moved slowly the emphasis of the origin of value from the offer side, production costs, to the demand side, and utility. Say also emphasized the importance of knowledge and entrepreneurship, prior to labor (Chap. VI), in order to create value and wealth.

By around 1871, Marginalism moved definitely the emphasis of the origin of value from the production side to the utility sensed on the demand side, though without overlooking the importance and relevance of production costs. Carl Menger and Friedrich von Wieser (1893) [21], from Austria, Jevons [22], from England, and Walras [23], from France, laid the foundations of this new theory, beginning the neo-classic economic era. The degree of the user's potential satisfaction, the utility, would be the main criterion of a valuable good. This new vision carried a higher weight of subjectivity. However, Walras subsequently developed a general equilibrium theory, defining effective demand and effective offer, the latter coinciding with the utility curve. The two curves were represented by two equations that lead to a mathematical result, which is the transaction value. A rigorous mathematical theory of value would need another 50 years to be complete [24]. This corresponds to a suitable scale to assess and quantify the value of a product. The price is the transaction value per unit of the transacted goods. Alfred Marshall in Cambridge developed and analyzed extensively Walras markets' general equilibrium, what would be known as local equilibrium theories, explaining how both production costs and utility contribute to find the transaction value, just as the upper and under blades of a pair of scissors contribute to cut a piece of paper [25, Book V, Chap. 3, point 7]. The Marshallian cross representing the two curves effective demand and effective offer became the transaction value paradigm up to the present days.

It can be concluded that if considering value as a metric, its criteria comprises both the offer side, with its corresponding objective productions costs, and the demand side representing the consumer's subjective utility. Moreover,

that metric's scale is given locally by the result, the price, found in the process of an economic transaction. Finally, whatever criteria are assumed, the economic value can only be quantified when an economic transaction takes place. At that point, once established the value of a product, one can trace how that amount of value was built, how much was objective and how much was subjective, how was it added along the value chain, and how much is consumed or substitutes and restores depreciated value or, alternatively, how much represents new created value (CV). Objective and measurable concepts of value consumed, value restored, and value created will help to understand how close to knowledge the concept of value is.

6.4 Value Consumed, Restored and Created

What is sometimes referred to as Schumpeterian economics has the concept of innovation at its heart, and the importance of innovation can only be understood within the context of the value concept. Innovation is consensually recognized as the main growth engine, and can be attained by a service or a product that brings extra value to society. What Schumpeter [26, Chap. VII] pointed out was that new processes and products, besides incessantly revolutionizing the economy structure, they also incessantly destroy the old one. How can that extra value delivered to society be measured? Methods like net present value (NPV) do it easily, comparing investment and returns when using or not using the innovative good, or comparing returns to those of a reference investment. This is typically linked to local management decisions on an investments' portfolio. But in a larger scale how can one objectively know if a firm, a sector or a whole economy has been innovating? I would answer this question by computing the value created by that firm, sector, or economy. The problem with this simple answer is that the concept of value creation is not consensual, and thus there is no standard accounting algorithm to compute it.

I start by clarifying the concept of value added,[2] and proceed explaining what I consider as value consumed, restored, and finally created value (CV). These notions will provide the rational to understand how creating or destroying value within society reflects on knowledge and vice versa.

This rational builds on the following assumptions:

1. A society produces and consumes goods and services to which value is attributed.
2. Value cycles may be described using flows and stocks of value.
3. Consumption sustains and develops human knowledge.

[2] By value added it will be used the economic concept of gross value added (GVA) as defined in ESA [27], 1.15 and 8.89.

4. The society's stock of value has two components: assets net value and human knowledge value.
5. All forms of value depreciate with time.

6.4.1 Production, Consumption and Investment

Along the value chain, each economic unit adds value to the intermediate products to build the final products value, as shown in Fig. 3.2. The final products value may be consumed by the final client or may act as an intermediate product value that will feed the next economic unit along the chain. In a whole economy, the added value by all economic units makes the economy's gross value added (GVA), and that is the produced value by that economy.

Simplifying, without restricting the model's validity, we can model an economy with no state and without exchanges with other economies. In this economy, the produced value equals the families' income value and that income value equals their expenditure value.

This is depicted on Fig. 6.1, where arrows represent value flows, out of and back in the stock of value. Following Fernandes [28], the resources value is the stock of value, where one may distinguish two parts: One is the capital's value, which is quantified on all the economic unit's balance sheets; and the other is the families' knowledge value, which is unquantifiable. Production uses two flows

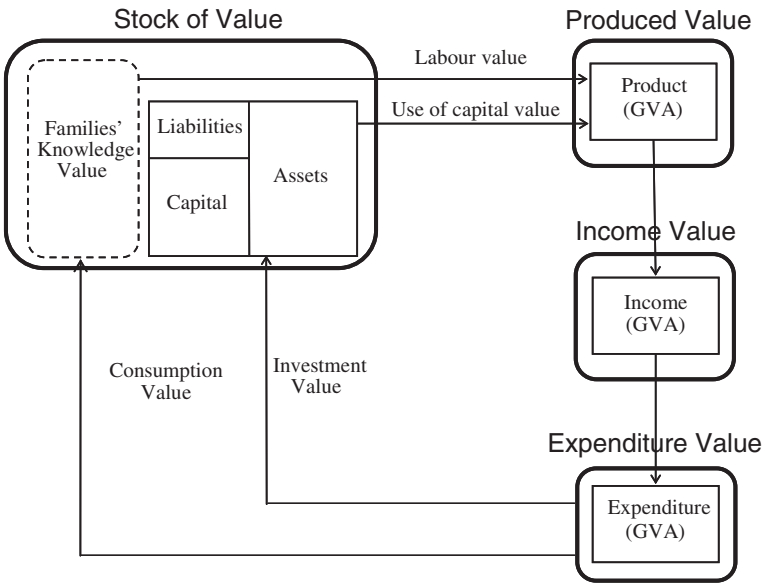

Fig. 6.1 Value cycle (Fernandes [28], reproduced with permission from Inderscience Publishers)

of value: Labor value, which one might think of as originated in the families' knowledge stock and materialized as action and work; and the value corresponding to the use of capital, originating in the capital stock and materializing in its use. As capital stock, I consider the capital value computed as the net assets value minus liabilities. Both the labor value and the use of capital value are objectively accountable and so is the produced value (or the product, or the GVA). As said above, the produced value is also the families' income value and their expenditure value. The families' expenditure has two parts: Consumption and savings (investment). Consumption value corresponds to what families expend in order to sustain and develop their knowledge, here including their physical existence. Investment is the value of capital forms that will more or less compensate the capital value depreciated along the previous cycle. The value cycle starts with value outflow from the stock into production, income and expenditure, and ends with value inflow back to the stock. Macroeconomic national accounting standards quantify precisely all the described flows and the part of the stock related to assets [27].

Where is the value consumed, restored, and created? The value consumed is the value related to consumption and can be easily quantified. For instance, in Portugal between 1997 and 2003, final consumption was about 95 % of the GVA [29]. There are no direct ways of calculating the amount of consumption needed to keep stable the families' stock of knowledge or to increase it. Indirect measures assess health and education metrics and similar issues. On the other hand, we know precisely how much capital value is used in a cycle, and thus how much value did flow out of the stock into production. In other words, we know how much investment value we need in order to keep constant the capital stock of value. Hence, the value restored is the consumption value plus part or the total of the investment value, which can be precisely computed. Finally, where in the cycle is value created or destroyed and how can we calculate it?

6.4.2 Minimum Value to Return and Created Value

To help defining CV and establishing an algorithm to quantify it, I will start by introducing the idea of the minimum value to return (MVR). This is here defined as the quantity of value to be returned to the stock such that, along one cycle, the stock retains the capacity to regenerate the same present value on the next cycle. One might think, at this point, that to be able to regenerate the same present value on the next cycle means to have the same value at the end of the cycle as there was at the beginning; but no, because that would be the case of a context with no competition and no inflation. What it means is that the stock of value must keep its present value, like in the NPV algorithm that was referred to above. Thus, a constant present value implies that there must be a value returned that equals the value expended plus an interest. Accordingly, this definition of MVR implies that a minimum interest rate should be established in order to act as a reference. It will be seen below what this interest rate might be.

Finally, we are able to define and quantify the CV. It is the difference between the expended value (which equals the GVA) and the MVR. When GVA is higher than the MVR there is value created; if it is smaller there is value destroyed.

As pointed out, there is one uncertain constituent in this cycle, which is the families' knowledge value. As this value is not measurable, accounting systems do not reveal its balance. It will be seen that this is not impeditive for computing both the MVR and the CV, even if it introduces some ambiguity. Actually, it is precisely within the families' knowledge stock where the value creation likelihood is triggered. How does that happen? It happens by what it is known as innovation. This happens when human knowledge devises a process (incremental or new) or a product that originates value creation. Figure 6.2 describes this situation, where innovation takes place and there is value created. In this cycle, there is an initial stock of value and there is a final stock with a higher value, as the GVA exceeds the MVR and so there is a positive CV.

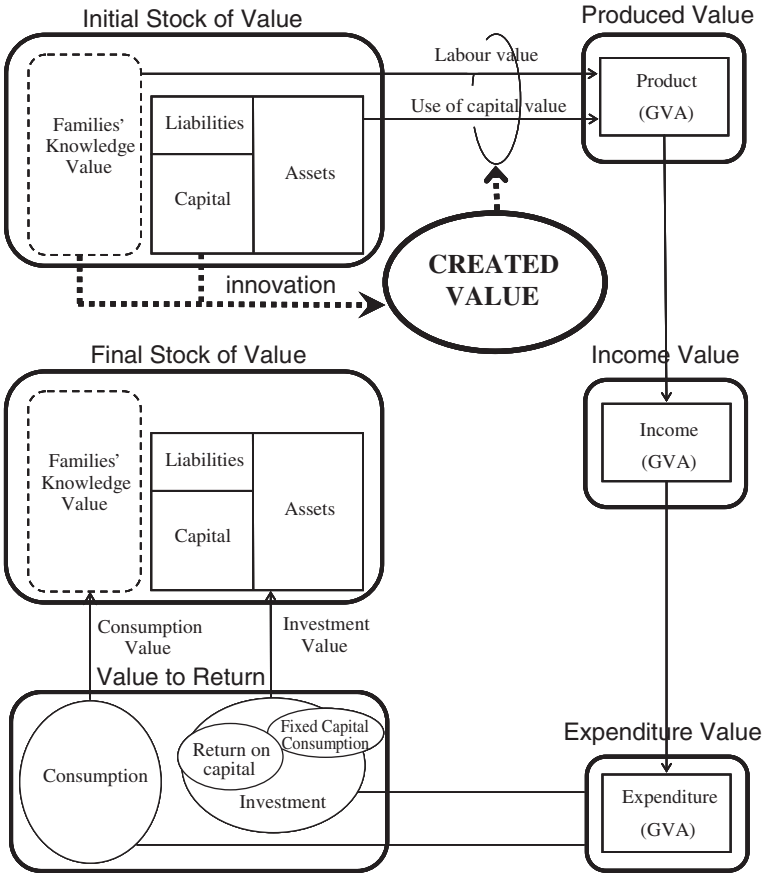

Fig. 6.2 Flows of value showing an increasing stock of value and value created (Fernandes [28], reproduced with permission from Inderscience Publishers)

Using the accounts as in Chap. 3, both the GVA and the MVR can be written as sums of accounts and easily computed for firms, sectors, or whole economies:

$$\text{GVA} = 6 + 7 + Y + 21 - [(16 + 9\,\text{to}\,11) - (12 + 13 + 17)] \tag{6.1}$$

$$\text{MVR} = 6 + 7 + 13 + Y + r \cdot C \tag{6.2}$$

Equation 6.1 reads as follow: GVA equals the sum of (6) wages and social security costs, plus (7) depreciation on fixed assets and provisions, plus (13) interests and other charges on financial debts, plus (Y) taxes on profits, plus (21) profit for the financial year, minus [(16 + 9/11) – (12 + 17)]. This last term is incomes minus costs of financial and extraordinary activities; and so it is the profit of financial and extraordinary activities.

Equation 6.2 reads as follows: The MVR equals the sum of (6) wages and social security costs, plus (7) depreciation on fixed assets and provisions, plus (13) interests and other charges on financial debts, plus (Y) taxes on profits, plus a new term ($r.C$) that reflects the minimum return on the net capital used in the economic process under evaluation. C is the capital net value and r is the return on capital coefficient (reference interest rate). This last parameter has to be valued according to the local situation, like inflation and objective investment opportunities. The last term ($r.C$) is the minimum return on the capital that capital owners invested. How much should this return be? This question can have a very (apparently) complete and sophisticated answer or it may be simplified to an uncomplicated working number. The first approach would consider i different types of capital, like, cash, technologies, buildings and so on, and consequently return coefficients r_i specifically calculated for each one. Also, for technological and other capital forms, either the book value or the market value could be considered. And again, the market value will have to take into consideration the specific investment opportunity to which those assets are committed to and the corresponding discounted cash flows (DCF). This last calculation will depend on a number of market parameters. This approach becomes very easily dependent on tricky and subjective forecasts. The second approach, which I favor here, considers for r (interest rate) an average national number for each year and, for C (capital and reserves), its book net value. For the coefficient r, it is proposed the year's average EURIBOR[3] interest rate at 12 months (or an equivalent interbank rate in other economic regions). In this way, an approach that is both objective and simple is favored such that the MVR is easily calculated. Finally, the CV may be computed:

$$\text{CV} = \text{GVA} - \text{MVR} = \{21 - [(16 + 9/11) - (12 + 17)]\} - (r \cdot C) \tag{6.3}$$

Following Leal and Fernandes [30], we may analyze the value created in some sectors of a few European countries and illustrate this new concept. It was considered a set of nine sectors covering the activities related to Mining and Quarrying

[3] Euribor® (Euro Interbank Offered Rate) is the rate at which euro interbank term deposits within the euro zone are offered by one prime bank to another prime bank. http://www.euribor.org/default.htm (accessed May 2008).

(sector B), Manufacturing (C), Electricity (D), Water (E), Construction (F), Trade (G), Transport (H), Hotels and Restaurants (I), and Communications (J). For the European Union countries, data were used from the Bank for the Accounts of Companies Harmonized (BACH) [31]. The data collected included information relating to Austria, Germany, Belgium, Spain, France, The Netherlands, Italy, Poland, and Portugal. It was adopted the year's average Euro Interbank offered rate (EURIBOR) for the period of 12 months as the minimum return on capital coefficient *r*.

Computing the ratio CV/GVA, results are depicted in Fig. 6.3. We can see that Austria and Poland have had the highest average percentages of CV. On the other hand, Belgium has cycles of value destruction for most of the period analyzed, reaching only in 2004 and 2005 stages where no value is created or destroyed. In almost half of the period considered, the countries with the worst performances are Italy, from 2004 to 2005, and Portugal, from 2005 to 2008. Italy did not register any cycle with positive CV. It is relevant to highlight that on 2008 all countries show a sharp drop and between 2002 and 2004, a generalized improvement was registered, that lead all countries, except Italy, to positive amounts of CV.

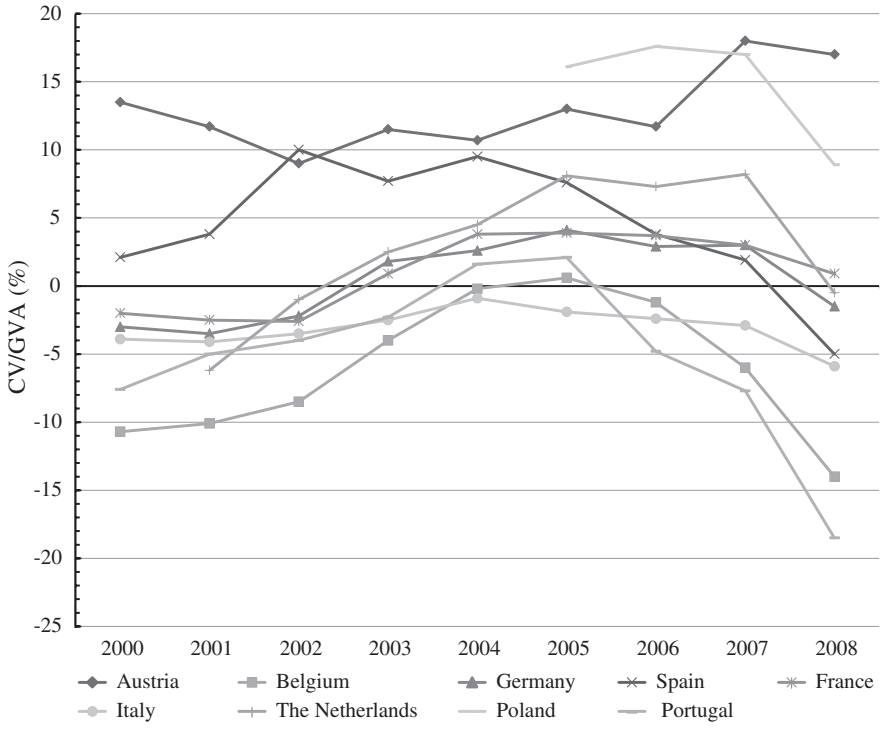

Fig. 6.3 Ratio created value/gross value added for nine EU countries—results group together sectors B, C, D, E, F, G, H, I, and J (NACE rev. 2)

Concluding, it was presented and analyzed the concept of (economic) value, in its main expressions, what is relevant to understand how value represents knowledge:

- Stock of value: assets net value and human knowledge value.
- Flows of value: activities that transfer value.
- Produced value: value (GVA) that flows from stocks to goods and services, through the use of labor and capital.
- Income value: value received by the families both from their work and as a return from their capital.
- Expenditure value: value expended by the families for consumption and investment in capital.
- Restored value: the consumption value plus the fixed capital consumption value.
- MVR: the quantity of value to be returned to the stock such that, along one cycle, the stock retains the capacity to regenerate the same present value on the next cycle.
- CV: the positive difference between the GVA and the MVR.

6.5 The Cycle Knowledge-Value-Knowledge

In a comprehensive and socially meaningful economic analysis, human society must be considered as the beginning and the end of the economic system. Therefore, any model to represent flows and stocks of value must reflect people's gains and losses.

Human knowledge is the concept that better aggregates all dimensions of the humans and Nature interaction, and each dimension works for the purpose of surviving and prosper. As such, human knowledge, with Nature in the background, triggers the appropriate actions and work, both individually and within their complex social system, in order to achieve those ends. The social fabric, the economic system, the culture, as well as particular parts like capital and technological forms are instruments and ways of assisting the path of anticipation for prosperity. Capital and technology forms are human knowledge embedded and encrypted in natural materials, serving the purpose of adapting to a special situations and multiplying the efficiency of humans' work.

The simplest cycle shows that humans act and work, and subsequently consume. As such, human knowledge triggers work and in return is supported and develops through consumption. This is depicted in Fig. 6.4, which shows the cycle of knowledge, beginning and ending in humans: Knowledge–work–work products–consumption–(renewed and more) knowledge. In our present culture, the cycle described: Work–work products–consumption is assessed objectively using the concept of value. Thus, the conclusion that value represents human knowledge along the cycle and so is directly and univocally comparable to it.

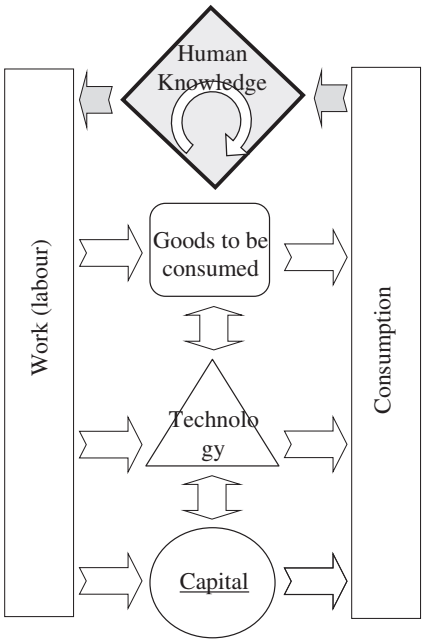

Fig. 6.4 The cycle knowledge-value-knowledge (adapted from Fernandes [28], reproduced with permission from Inderscience Publishers

6.5.1 How Value Represents Knowledge

A more objective reasoning can be proposed, which will prove that value is equivalent to knowledge, assuming that labor value is the best possible proxy to assess human knowledge value and so human knowledge itself.

Let us take the final product value (FPV) = 100 of a specific good representing all possible final consumption goods. The concept of value chain, as presented in Figs. 5.3 and 5.4, will also be used. The value chain of a product to be consumed represented in Fig. 5.3 can be drawn in a slightly different way, described in Fig. 6.5.

The GVA was replaced by its two main components: Labor value L and a surplus SP, as shown in (6.4):

$$\text{GVA} = L + \text{SP} \tag{6.4}$$

As such, the FPV = 100 equals the GVA = 40 plus the IPV = 60 of the second level, and the latter equals the FPVs of the third level firms, and so on. The FPV of the specific good under analysis can then be described as shown in (6.5):

$$\text{FPV} = L + \text{SP} + \text{IPV} \tag{6.5}$$

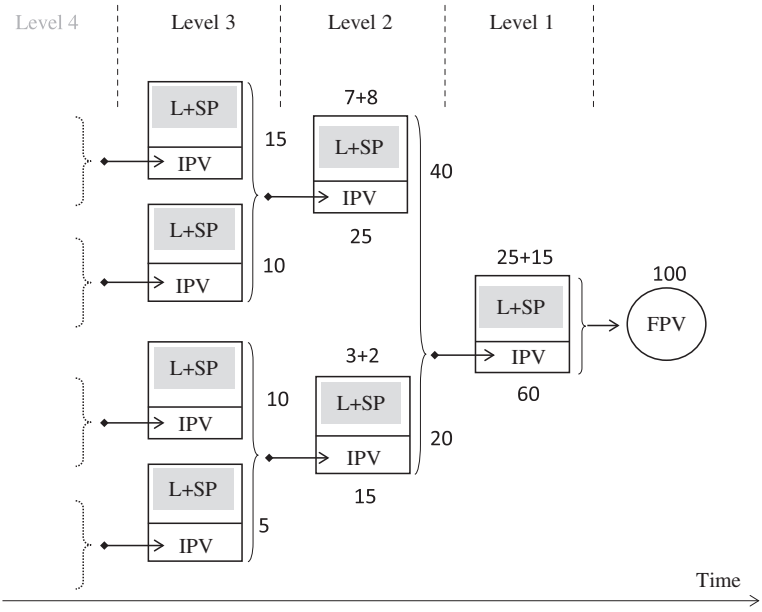

Fig. 6.5 Value chain of a final consumption good, which final product value is FPV = 100

It was proved in Chap. 5 that the FPV is the sum of the GVA of all products belonging to its value chain. In fact, the intermediate product values (IPV) are the values of intermediate products, which are goods that can be subject to exactly the same value chain analysis. Hence, IPV can also be described as a sum of terms L and SP and other IPVs. Mathematically, the expression (6.5) can then be described as (6.6), where the rest is as small as we want, depending on how many levels we use to analyze the value chain. Assuming that the value chain has infinite levels, if we would tend to take those infinite number of levels the rest would tend to zero.

$$\text{FPV} = \sum L + \sum \text{SP} + \text{rest} \tag{6.6}$$

This conclusion also expresses what was proven in Chap. 5, that the value of a product FPV is the sum of the GVA of all products belonging to its value chain.

Now, let us consider that the surplus SP is proportional to capital C, such that $\text{SP} = m \cdot C$. The value of capital C being the value of goods (assets) that performs the task of capital, so C is a value that can also be analyzed in the same way. The factor m is a parameter dimensionless and almost always positive [32]. Thus, (6.6) can be written as (6.7):

$$\text{FPV} = \sum L + \sum m \cdot C + \text{rest} \tag{6.7}$$

Considering C as a fictitious one single asset contributing the fraction $m_i \cdot C$ in each part i of the chain, along the whole value chain (and so totally used), the sum

$\Sigma\, m_i \cdot C$ will necessarily equal to C. In other words, $\Sigma\, m_i = 1$. Thus (6.7) is written as (6.8):

$$\text{FPV} = \sum L + C + \text{rest} \tag{6.8}$$

This asset's value C is the value of a good and so it can be analyzed in the same way, hence C itself may also be expressed by a similar identity, then with another C_j, which would value less than C, and another L_j. And so on, repeating the same logic. Considering an infinite number of such steps, we would end up with the following expression (6.9):

$$\text{FPV} = \sum L + \sum L_i + \sum L_j + \sum L_k + \cdots + \text{rest} \tag{6.9}$$

As such, with an infinite value chain, the rest = 0 and FPV equals the whole amount of labor value summed up along the whole value chain.

This reasoning implies a level of abstraction that is sometimes difficult to follow. To put it clearer, I propose a simple example describing a value chain of the activity of a small society of fishermen. It is a closed extremely simple economy without state producing along 1 week, from Monday to Saturday, and resting on Sunday. On Monday, they start the week's work with one new fishing net, which value is C. The net has a working life of 5 days, such that each fishing day, Monday to Friday, it wares out one-fifth of its value. The fishermen work is fishing for their daily consumption and for consumption on Saturday and Sunday. On Saturday, the fishermen do not go fishing; instead they stay at home producing a new fishing net, for what they only need their knowledge and work plus woof made out of bark from a few local trees.

According to the main economic identities, the GVA produced every day is shown in Table 6.1, bottom line.

The GVA produced from Monday to Friday is calculated in (6.10). This is the value of the fish produced and consumed. As there are no IPV, this GVA = FPV.

$$\text{GVA} = \text{FPV} = \sum L_{2\,\text{to}\,6} + \sum m_{2\,\text{to}\,6}.C = \sum L_{2\,\text{to}\,6} + C \tag{6.10}$$

Moreover, C is produced on Saturday using the labor value L_{Sa}, such that C values L_{Sa}. Thus

$$\text{GVA} = \text{FPV} = \sum L_{2\,\text{to}\,6} + L_{\text{Su}} \tag{6.11}$$

Table 6.1 Day's GVA produced

C working life is 5 days						
Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
L_2	L_3	L_4	L_5	L_6	L_{Sa}	–
$m_2 \cdot C$	$m_3 \cdot C$	$m_4 \cdot C$	$m_5 \cdot C$	$m_6 \cdot C$	–	–
$L_2 + m_2 \cdot C$	$L_3 + m_3 \cdot C$	$L_4 + m_4 \cdot C$	$L_5 + m_5 \cdot C$	$L_6 + m_6 \cdot C$	L_{Sa}	–

This is the same result as showed in (6.9). What was proved is that the value of final consumption products is the value of the labor used along their value chain. Then and finally, assuming that labor value is the best possible proxy to assess human knowledge, we may take the conclusion that value is the metric that societies use to assess knowledge.

6.5.2 Value as the Criterion for Knowledge

Economic value was concluded to be a metric. In Sect. 6.3, it was said that the metric had criteria and a scale, the former being the user needs from the demand side and the producer needs from the offer side; and the latter, the scale, was set continuously in every transaction, locally or globally, by its corresponding price.

If economic value assesses knowledge that is economically meaningful, as concluded above, then value, in general, might assess human knowledge, not only from the restricted economic point of view, but also from a socially perspective, as pointed out at the first two sections of this chapter. Even if the above demonstrations are not complete, as it is always the case in social sciences, I am inclined to believe that value is the basic metric for assessing human knowledge, and thus value reflects the available human knowledge, that is, the knowledge embedded in technology and capital and the knowledge to act and work in order to producing goods to be consumed. Being true, that would bring economics to the center of social evolution, the Schumpeter vision.

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