

On the Road to a System of National Information Accounts

1. Critical assessment of the [DSP] approach

As far as we know, there are no systems that attempt to account all information phenomena in a unified, homogeneous form other than the Japanese experiments and [DSP]. As it is obvious from the previous chapter, [DSP]'s approach has proved to be useful to describe some information phenomena at a macro level, nevertheless, the following problems could be noticed:

- The indices cannot comprise the complexity of the information phenomena. For instance, they don't measure transborder communications flows i.e. information "exports" and "imports", and the indices don't measure accumulation/stock/wealth of knowledge, even which - as expected - should be in direct interdependence with communications flows and national income and wealth.

Reddy's [Red79] and Green's [Gre91] studies based on a linguistic analysis of phrases incorporating the word "information" in a textual database show that "information" can be not only supplied, or consumed. Among frequent occurrences, there were "information source", "produce information", "provide information", "contain information", "exchange information", "give information", "demand information", "retrieve information", "information-poor" etc. If "information" can flow, can be stored and of that can be much or little, then it should have something like volume, and conservation laws known in thermodynamics and transport theories should be valid. Word usage suggests applying a complete good/service approach, or in a broader context an approach of the general transport theory used in thermodynamics, with intensional and extensional parameters.

Anyway, new indicators are needed to reflect all the phenomena including those that cannot be described in the [DSP] system.

- The indices in [DSP] cannot be related directly to macroeconomic description of the countries. The cost indicators are not directly related to items of SNA. Porat [Por77], [Rub86] and several authors studied information phenomena in the frames producing/consuming a commodity, but didn't deal with volumes expressed in natural terms. Indices and units of the system are to be chosen so that information phenomena will be measured in value and natural (bit) terms simultaneously. This provides an opportunity for making a comprehensive information policy, which can handle together economic and non-economic aspects with a dualistic, value-and-volume valuation of various information sources.

- [DSP] in 1984 is not yet sure, that oranges and apples - various information goods and services - can be compared and valued under the concept of "information". They felt such conversions to be beyond the state of the art; and meant that "it strains the limits of audacity to throw all explicit words together". Therefore [DSP]'s survey is short of several goods and services. In the past decade, however, complex computer handling (both production and use) of pictures, data and texts has become ubiquitous, and multimedia and optical drives make it obvious - even for the man in the street - that all kinds of information can and should be measured together. Information goods and services became commensurable as a consequence of the massive impact of IT and commensurability became obvious for the observers. However, word units aren't proper means for measuring volumes of information, indeed.

- Word units are meaningless while measuring pictures, music or drawings. One can speak about pictures or music, but pictures and music don't consist of words, at least of such words like the words used in everyday language communication. Words can be considered as a major component of verbal communications (like a TV program) but other components must not be neglected. Universal measuring unit is to be applied which is inherently apt for measuring all types of information phenomena. Bits are capable to represent apparent form of communication as well as its sense and meaning.

2. The following aims were formulated.

a/ [SNA69] - as it was adopted by the fifteenth session of the Statistical Commission - provides a comprehensive and detailed framework for the systematic and integrated recording of the flows and stock of an economy in value terms. This is used thoroughly by government and marketplace actors all over the world.

The efforts should be concentrated at a similarly comprehensive and detailed framework in natural unit terms for information phenomena based upon [SNA92]. In accordance with this, our main concern will be to give a simplified, but comprehensive account of volume of each and all information goods and services which became commensurable as a consequence of the IT revolution, in order to monitor the society at a moment. This account will be referred to as System of National Information Accounts (SNIA).

A real per capita gross domestic information production and use, can serve as indicators of information welfare. Time-serial analysis may detect the developments in a country over a period. The standard accounts and tables are intended as guidance to the compilation, which should be useful for the purposes of economic and social analysis and decision making. Since it will integrate and link the definition and classifications of all flows of information and stocks of knowledge into a coherent structure, it will furnish an excellent means for planning the collection and gathering of data, and compiling of their coordinated bodies, required for purposes of economic and social analysis.

b/ The account should be internally fully consistent and comparable with SNA, as much as possible. This may help to assess the political significance of the individual media, goods and services.

Any attempt to carry out this whole program is premature, but it is now thought, that the time has come to suggest extending and revising SNA to provide a full and detailed treatment of information/knowledge stocks and flows in the society by defining SNIA. In the chapter 5, our objective was to establish the general outlines and the first draft of SNIA. This system was elaborated in the frames of a pilot study. It cannot be viewed, as a formal proposal or recommendation of the Hungarian Central Statistical Office or any other governmental or intergovernmental body. The framework of the system is to be elaborated into full definitions and classifications and into standard accounts and tables under the protection of UNSO.

In case of interest, UNSO, UNESCO, ECE or other regional organizations might cooperate to define an official recommendation, which then should be agreed. A similar recommendation may give hint and prospective directions to states so as to develop their statistical system. This is a decade long process. SNIA - if officially accepted at international level - could provide a conceptual framework, which ensures the consistency of the definitions and classifications, used in various information industries and branches, and orientate official statistics.

c/ As for now, in most countries information phenomena are regulated on department, agency (U.S.), or ministry (continental Europe) level. Heads of departments have their own professional, industrial and political considerations, while horizontal partners (other agencies) remain out of the consideration or their influence remains limited. By providing a consistent statistical picture on information phenomena, a series of national information accounts may be useful in describing state and processes of the „information household” of the country as a whole. The SNA report explained some of the uses of national accounting data, and emphasized the role of simple kinds of analysis and even inspection of the figures. SNIA shall enable a wide range of problems, related to telecommunications policy, mass media policy, cultural policy, education policy, IT policy and other policy issues, called altogether „information policy”.

The system's fundamental concepts should be apt for systematizing policy issues across various information industries, and to find general principles and guidelines to formulate government's comprehensive policy at a higher-than- ministry level. SNIA may be the fundament of comprehensive policy-making in an information society. The system shall provide a common conceptual and numerical background to ministers involved.

d/ A major objective is to have a simplified, but comprehensive model, which extends to each kind of information goods and services in a country, which is fully consistent with data, and can explain, and forecast information phenomena at a macro level, to

support policy making at the level of the central government, to understand the causal mechanisms in society at work, and to make sociometric analysis.

e/ The system shall provide a standard form for reporting national information accounts, whose data may be widely used for international comparisons by sociologists, politicians, observers and analysts. They can influence the judgments about such crucial issues, like social structure, democracy, centralization, freedom of information, free flow of information, ethnic problems, information poor and information rich, relative success of social policy, and advance in modernization.

f/ Later on, SNIA should be suitable to build models for explanation and forecast the group-behavior of countries communicating with each other, or simulation of a country or a region. These studies may be valuable, although their significance shouldn't be overestimated.

g/ Fundamental concepts and notions should be defined like in SNA, which is suitable to study not only countries, but regions, and smaller units as well. In a "Europe of regions", regional aspects of policy making will gain importance.

General concepts within SNIA depend only transport theory, and deeply rooted concepts of language, so presumably allow their usage in various developing and developed countries, though for traditional cultures in developing countries and with less developed IT the approach, which handles and values together various sources of information, may be alien. Nevertheless, SNIA may be suitable to characterize the differences of various cultures and societies in a quantitative manner.

h/ SNIA reflects only the quantitative aspects of the various information phenomena. Qualitative aspects of the information phenomena remain outside the scope of the present study. For information statistics, Petőfi's best masterpiece is equivalent with even some items in a dictionary which contains the same volume of information.

3. Preliminary Considerations - Relation of SNIA and SNA

SNA is composed of definitions of

- concepts,
- classifications
- procedures

to account national economy.

Theoretically, SNIA has a broader scope than SNA, it goes well beyond economy and handles information flows in the society as well, for government shouldn't intervene in the private sphere but has to know the consequences, induced by its measures.

In principle, at least three ways could have been followed.

Way 1. Conservative
Embedding of SNA in an unaltered form.

This implies the use of all concepts as those have been defined in [SNA69] and try to compile bit figures to value termed figures. In addition to this, the introduction of a more detailed subclassification of commodities, industries and sectors may lead to simple, traditional satellite accounts. In this approach the [SNA] concept of production would be applied, and to this concept, volume of information conveyed/contained in/on the produced/output goods and services can be estimated. Similarly, concepts of consumption, capital etc. would be applied as those were defined in SNA.

This implies that if something is considered as a good in [SNA], it should be considered a good in SNIA, as well. All information goods should be goods in [SNA] either. If a piece of an information good happens to be considered as accumulation in SNA, then it should be included in information accumulation in SNIA and those that are not classified as accumulation in SNA may not be regarded as information accumulation in SNIA.

In this way SNIA would consist of a second set of accounts with roughly the same structure as that of SNA so that respective tables with value terms and natural terms would cover each other. Of course, several figures in the SNA accounts would not have their bitwise counterparts.

The problems with this approach are as follows:

- There are activities (e.g. indoor management) which aren't interpreted as production although significant volumes of information products are created.
- Government's and households' consumption is considered mostly final consumption. It's a matter of fact, that government's information products as laws, court decisions etc. are used in the production process. Also learning in households is nothing else than (re)production of human knowledge. Human knowledge is overwhelming in the society, without which no economy or society could exist. Thus learning may not be qualified, as final consumption, when information is considered.
- [SNA92] refers to CPC to enlist goods and services. However, there are goods that are taken into account in CPC as services, but are goods (though not commodities) indeed. This can be illustrated by jurists' products, like drafts to contracts, contracts, petitions, or the consolidated balance sheets made by accountants' firms under full responsibility, medical X-ray photos, copies of customs software, engineers plans and projects' documentation etc..

- Some subclasses of SNA seem to be meaningless wrt. SNIA. For instance, separate handling of financial and non-financial corporations seems irrelevant, when speaking about information.

A too strict adherence to SNA may obviously make impossible to found the system so, that it will reflect the information phenomena, both present and future.

Way 2. Radical.

A new SNA

It was already recognized by Machlup decades ago, that the restructuring of information activities, new information societies - based upon IT - will call for changes in SNA. There is an opportunity to redefine and reclassify goods/services, transactors, transactions and indicators, exclusively due to the logic of general transport theory (adapted to information phenomena), and disregard from definitions and classification in [SNA69], and [SNA92]. It can be assumed, that if the decisions at this were made properly, this might give rise to a "future century SNA".

However, a completely new system doubtlessly would be received with reservation by the community of statisticians and users. Respective financial (value) figures were not available from SNA, those were also to be redefined and computed.

Way 3. Compromise

Satellite Analysis in a Satellite Account and SNA

The satellite systems and accounts allow for the provision of additional information on particular social concerns of a functional or cross-sector nature with the use of complementary or alternative concepts, new relevant indicators or aggregates and the linkage of physical data sources to the monetary accounting system. Stäglin [Stä] has recommended and performed a satellite system to SNA. This comprises economic significance of information in various industries.

As page 2. of Chapter XXI concludes, satellites may lead to various types of solutions, from just introducing some additional figures to redesigning the main concepts of the central framework. In the following text, I shall prove that a major redefinition work is needed to reflect most important information phenomena. The suggested solution may, however, be viewed as a satellite system. Introduction of SNIA in the nineties, can be viewed as introduction of a new satellite system to SNA.

The approach recommended

One may define a complete coincidence at the level of as many fundamental categories as possible and certain apart at lower levels. This approach was adopted. The coincidences and differences are as follows:

Coincidence:

Generic, principal definition of the set of

- observation units
- transactors
- transactions
- goods and services
- elementary categories at the highest level, as production, exports, imports, accumulation, capital, etc.

Differences:

- Operationalization of generic definitions: the environment within which transactors and transactions are to be observed and qualified as production, transport etc. is a wider environment called "society".
- classifications

4. Definition of a System of National Information Accounts (SNIA)

4.1. Object of the measurements

In our opinion, nature and ontology of information are frequently misunderstood in economic and political studies. Frequently, information is considered to be an object which is or isn't a resource or good [Rep89]. We believe that "to contain or convey information" is an attribute of goods or services. Some analogies are given:

- It is neither "weight" nor "metric ton", which is a good or resource but it is a "gold bar" (which weighs e.g. 1.5 ton), which may be a good.
- It is neither "volume" nor "cubic meter", which is a good/resource but it is "natural gas" of volume (of e.g. 1.5. million cubic meter), which may be a good.
- It is neither "amount of information ", neither "volume of information", nor "gigabyte" which is a good/resource, but it is a "book" - or a "disk with data", a "database consisting of several disks" - of volume of e.g. 2 gigabyte, which can be a good/resource.

It is no information indeed which is produced, consumed, transported, but the goods and services that carry/convey information. It is no information which is a good or service or a resource, but information goods and services are those.

That's why the objects of measurements are information goods and information services particularly their stocks and flows together with their complementers i.e. non-information goods and services. In principle, these concepts altogether - as will be defined in the next chapters - delineate a set of objects which is the same as what is addressed in SNA. Practically a wider set of objects will be addressed within this concept, than what is accounted in SNA, since a wider set of objects is thought to satisfy the general, principal definition of goods and services. The same definition will be interpreted in a wider sense. These have been produced, stored, consumed etc. in economic units of the country. [SNA69] makes distinction between "commodities" and "activities" and extends to both of them. This is a meaningful distinction and will be used in the same sense.

4.1.1. Information goods

4.1.1.1. Definition

In [SNA92] "Goods are objects for which a demand exists and over which ownership rights can be established."

A tangible good will be called an information good if it functionally contains or conveys some information. That is, the good was designed so that its destination is to carry information. A (copy of an) information good has one or more producers, proprietors, owners, and users. Ownership or proprietorship of the copy doesn't involve the intellectual property rights of the author (if such exists).

Attention! Apart from several studies like [Sta89]'s it is no computers, telecomm devices, typewriters etc. which are called information goods in this book.

A great number of information goods and services are enumerated in SITC, ISIC, CPC and HS. Some information goods usually don't become a commodity and so aren't contained in these systems, as memos in the offices, bills, statistical reports on questionnaires, mails etc.

The goods not included in information goods will be called non-information goods.

4.1.1.2.1. Special problems

4.1.1.2.1.1. Intangible assets

The concept of intangible assets constitutes a major problem in economics. Their way of account is under discussion. The concept itself is quite confused and interpreted in many ways. While documentation of industrial technologies, manuscripts, applications and submissions for patent protection, patent documentation and even license agreements are par excellence information goods, intangible assets - as copyright, patent and goodwill - aren't information goods, because they aren't either goods or services.

4.1.1.2.1.2. Banknotes and coins

Does a banknote or a coin functionally contain information?

A banknote is a printed matter. Its printed signals (characters, words, pictures) convey round 2 Mbit information each, at the sensory level. This information is transferred/transported while paying. No new information forms in this transfer.

The banknote as a whole conveys information as well. This emanates and is communicated by the payer/owner at any time while paying with it. The information which flows at perception level when a 100 \$ banknote is transferred is tentatively about "This is a 100\$ banknote." or consequently "I have my right to buy things in value of 100 \$ and hereby I transfer my right to the payee". This cannot be exactly formulated and so measured, but a round 1 Kbit can be obtained with assuming 17.6 bit/stroke. At the same time, it is practically almost completely insignificant in this transaction, what is written or seen on the banknote or on the coin, if it is publicly accepted as a banknote or a coin, as a legal tender.

The destination of a banknote, i.e. its function is not to be read but to be infallibly recognized as being a banknote and then to pay with it, i.e. transfer the message "I have...". What is important regarding to these goods, it is inimitability. The thousand times as much visual information printed on the banknote is merely to make sure the truth of the 1 Kbit of "I have my...".

Banknotes should be considered as information goods, whose signals should be taken into consideration as the production of the printing office and as transport at paying. The quantity of information on the banknote will be defined as that of its picture. Nevertheless are banknotes goods whose function is to produce and supply information while paying. As such, banknotes are ranked as information capital. Volume of information carried by the banknote as a whole while paying will not be measured.

4.1.2. Non-durable signals

Radio/TV broadcasting towers, direct broadcasting satellites, sensors of electronic railway supervision systems and several other devices and instruments supply non-durable electromagnetic signals. These non-durable signals - being invisible and inaudible - are not subject to human consumption. Human speakers' speech or the sound emitted by consumer electronic devices, light signals of beacons and traffic lamps, each and other objects are examples of perceptible non-durable signals. These play an important role in the society and some of them are also surveyed by official statistics.

Signals can be supplied to a number of consumers who consume them. Copies of signals have producers, consumers and users. Their producer may have intellectual property rights.

4.1.3. Durable signals on or in non-information goods

Paintings on aeroplanes, or ubiquitous inscriptions on and inside of buildings, and everywhere, even on such things like pencils or T-shirts are good examples of durable signals on or in non-information goods. Durable signals on/in non-information goods are also obtained with inserting of tables, preprogrammed chips, and other information goods in them.

As a rule, durable signals in/on an object have their producers and users but have no other proprietor, owner and consumer than that of the object's.

4.1.4. Information services

4.1.4.1. Definition

[SNA92] defines the general concept of a service as follows: "The distinguishing feature of a service is that it is produced for the benefit of a specific individual or institutional unit or group of individuals or units. By the time the production of a service is completed it must also have been delivered to the consumer or user." Of all non-durable signals which are present everywhere, only those will be accounted that have been supplied intentionally or unintentionally for another unit, which consumed, i.e received them. Then, this definition in [SNA92] well fits the provision of durable and non-durable signals. Therefore the supply of durable and non-durable signals together with repair of information goods will be defined as information services. As [SNA92] emphasizes, "Changes in the mental conditions of persons" is a usual output of services.

4.1.4.2. Problems

4.1.4.2.1. Self service

In some instances, intra-unit services can be and were considered. A notable exception in SNA is government, whose units have limited financial and informational independency.

4.1.4.2.2. Difference between beneficiary and the party passing the order

There are several services, whose beneficiary and the party, who gives the order or covers the costs, don't match. Those are always the beneficiaries, who are requested to pay for the service. Partly or completely government financed services provide good examples for this. Regulation can create sophisticated situations on this area, so that

the interested parties cannot articulate their interests and the service becomes dysfunctional.

For instance, schools in Hungary provided services at the compulsion by the government to their students (education and training) and also to the government (supply of information, provision of "right" or "proper" value of various indicators and indices). As far as government support and supervision was of primary importance, many schools were going to prefer providing services for government organs. Fulfillment of requirements from the representatives of the government was more important than services to their students, beneficiaries of the education services.

4.1.5. Human knowledge

Knowledge in human brains will also be considered as an object. As far as possible, its stocks, production, use and consumption will be attempted to account in the frames of the very limited opportunities available.

The owner and proprietor of human knowledge is the individual though his/her scope to use his/her knowledge may be limited by others or the law.

4.2. Valuation and revaluation

4.2.1. General definition of the unit of measurement

The goods and services that are so as to carry/convey information are called information goods and information services. Volume of information carried/conveyed by signals on/in information- and non-information goods and services is equal to volume of binary storage capacity

- needed to record (input) these signals
- at the average level of technology available at the moment of the account
- in a digital form so that
- the record will be sufficient
- to reproduce the signal so that
- the reproduction would allow its equivalent use
- with the original.

Let's plunge into some details of the definition and cast a glance at paper-based documents like printed matter; dailies, books, stamps, forms and handwritten or typed scripts.

These documents display texts, pictures or line-drawings. Recording has been made with various technologies. A technology is a process within which humans and machines cooperate.

Though high tech OCR devices were available as soon as in the late sixties, the typical technology for text reproduction was repeated keypunching. In the late eighties this was replaced by scanners. Digitization of an A/4 sheet with a monocolour scanner yields about 2 Mbyte typically on magnetic discs. Actual file dimensions depend on file structure, compression, storage device or media plus random momentary factors.

Keypunching is an intelligent reproduction, in the course, of which a human scans the document, recognizes its elements like columns, pictures etc. and finally recognizes and reproduces characters in the proper way with an electronic typewriter. Machine scanning implements a regular grid perception, human visual perception is smarter; eyeballs seem to find and follow the sequence of key points, but the details are not yet known. As a consequence of the human picture processing and compacting intelligence and printers, a surprising small quantity of information is needed to the apparent reproduction of the very same sheet, particularly a round 2 Kbyte, one thousandth of the scanner's. In the course of processing, smart human digitizer disregards everything, which is though perceivable, still he believes irrelevant to the communication, which leads to a dense compaction. Intelligent software products, like RecognitaPlus™, are capable to imitate intelligent human reproduction to some extent. Routine keypunching may fail, when individualities of the scripts or the document are important like for historians, investigators and graphologists with handwritten texts. A bloody stain on a book will be disregarded by a keypuncher, but never by a policeman. The complete view of a document can be reproduced from a file obtained by regular scanning.

Line drawings were digitized with a digitizing pen or tablet since the early eighties. Follow-up digitizers provide pairs of vector coordinates for succeeding points of the curve. Digitizing head is to be moved by a human. Tablets provided a raster map of the tablet. Thanks to human intelligence, graphs can be recorded in a much more compact form with follow-up digitizers. Pictures could have been digitized by drum and flatbed scanners since the seventies, however these devices were exploited only in some scientific institutes for technical purposes.

In sum, either human or scanner digitization technology needs scanning, which is the first step. Technologies yield more or less compacted information as their output. Due to the definition, in the accounts, the storage capacity needed at this primary "sensory level" recording was considered rather than the capacity for the storage of compacted output.

In accordance with this, the knowledge of scanning parameters is a cardinal issue. As far as human use is given in minute units, channel capacity of the human visual channel is a fundamental parameter.

Access to how much information and how much access to information.

Human brain consists of massively parallel organs and organelle, a number of which are responsible for perception, i.e. voice/letter, word and conceptual level

representation of knowledge. This way of accounting presumably estimates how much information will be addressed to the character level. Hence it can be referred as to "perception level" figures, though perception would assume all grammatical, semantic and practical levels either.

Desktop and electronic publishing produce the originals of newspapers on magnetic media.

The way of accounting affects the magnitudes of figures and the conclusions. If pictures and texts are considered separately in the "perception level" account, volume of information of a product depends on the quantity and quality of pictures. In the "sensory level" accounts, however, volumen depends on the surface of paper bound in the product and neglects the fact that pictures represent more information. Both accounts were prepared, and the perception level is in Appendix IV. Sensory level account provides more significance for paper-based media.

In man, there is a powerful continuous flow of information at sensory levels, which is much less intensive at character/letter or conceptual levels. Thus the phenomena, when reflected at sensory levels as bare pictures or noise are accompanied with more information, than the high level.

It is another corollary of the definition, that each copy of the newspapers, books etc. do convey the same amount of information, henceforth each will be taken into account with the same volume of information, despite the fact a reader at the second reading of a book will not be twice as much informed, as he was after the first reading. Therefore volume of information will be additive over copies of information products and services.

For broadcasting the definition is by and large equivalent with the definition of channel capacity [Rez64].

4.2.2. Implementation of valuation and revaluation

4.2.2.1. Valuation in traditional natural units of measure

The multiple (quadruple) entry principle would prescribe a transaction be recorded on-site at the same value all through the accounts of both or more parties involved in the transaction.

There are several problems with this.

In many cases, natural characteristics of production, sales, use etc. are not recorded at all.

4.2.2.1.1. Bits are not recorded

When a record is made on a transaction, recording is frequently one-sided, only one party records it. Bits are recorded in exceptional cases only.

4.2.2.1.2. The records are made in different traditional natural units of measure

In case of double recording, they may be made in different units of measure. For instance, sales of newspapers and magazines are recorded in copies at distributors. Libraries - when receiving newspapers and magazines - consider each copy is a "library unit", and this is done so, until the monthly/annual issues will somewhen be bound into a volume. Before binding, the copies are added to volumes. After binding, several "library units" will turn to one library unit, particularly a bound volume.

4.2.2.2. Revaluation in common natural units of measure (bit)

4.2.2.2.1. Substitutability of information and of media

Impact of electric energy, the opportunity to transport energy in this form and technical development made energy-containing materials replaceable to a great extent and this opened up avenues in front of a comprehensive energy policy. It's only heat capacity of the materials which is regarded here.

Information goods and services are less replaceable and this depends on their contents and language. A lexicon on theoretical physics cannot be replaced with a volume of Playboy even if the latter conveys as much information as the former.

Various kinds of amusement and entertainment information are replaceable to a great extent.

Thanks to various new input and converter units, various (information-bearer) media (with the same contents) became practically convertible and replaceable without any technical limitations.

4.2.2.2.2. Transition to bits

In the best case, the data for various information goods and services are available in various natural units of measure. Then these data should be converted to bits. In practical computations, several equivalents (constants or functions of time) are used. These equivalents express the average number of bits per an "n", a character, a minute of broadcasting with a given bandwidth and noise, videocassette, etc... Multiplying values of production, use, consumption, exports, imports of information expressed in traditional natural units of measure by equivalents, the respective indicators will be obtained in bits.

4.2.2.2.1. Particular problems with transition

There are several problems with this transition. These problems will be discussed in details in Chapter III.

4.2.2.2.1.1. Reproduction, equivalent use

It is quite clear what is to be understood in Definition 5.2.1. under reproduction of a text. Most problematic situations occur with other signals. There is a wide class of objects like medals, decoration, heralds, stamps and playing cards whose destination is to carry some information but not just the information written on them. The problem of coins and banknotes was addressed in a former chapter.

How much information is needed to reproduce what a three-color traffic lamp with four states (go, stop, wait, out of correct regime) provides? It is two bit when considered at logical/conceptual level of the user. This is repeated about four times a minute, which makes 540 bit/hour, almost 5 million bit per year.

The very same lamp provides at least some terabits per year when accounted at visual sensory level of a man. That is, if the visual picture of a working lamp is to be reproduced, it requires much more information than just reproduce the work of the controlling unit an existing traffic lamp or the information eventually used at conceptual level by a driver.

In automatic traffic control systems, logical level information is communicated, thus reproduction was interpreted as a logical level reproduction.

Pictograms constitute a not completely standardized class of signals. Their class is open, their number is not limited, the number of bits to encode them at the level of meaning is not computable. A limited set of pictograms also have a clear meaning as "No parking", "No smoking".

4.2.2.2.2. Need for Regular Revaluation

[SNA92] supposes that all stocks shall be revaluated as prices are changing. A similar problem is available with information.

According to the general definition, conversion to bits should be done so that it will reflect the actual average technical conditions. In the early eighties texts were keypunched by eight bit characters. Scanning is to become dominant in repeated digital input in the nineties. If a printout by an eight bit printer will be scanned, the scanner may provide sixteen bit characters. Information density of primary scanning (used at pictures and figures) is also growing. Processors also tend to handle more and more 8, 16, 32, 64 bits. So, all figures that have been expressed in "n"-s or characters, should be regularly revaluated due to the actual information density of a character.

Due to this factor alone, volume of accumulated and produced information goods may grow by a 5-10 percent factor yearly.

4.2.2.2.3. Channel Capacity and Volume of Information

Communications theory has dealt with the quantity of information transmitted by broadcasting and other telecommunications systems. The simplest way to modulate signals is to use telegraph signals to insure that the channel has one of two states: with current or without current. The fastest signaling rate of such a communication channel is called the "baud rate". When only two level signaling is used, the baud is also equal to the rate of information transfer. Each single communication channel has a certain bandwidth. The frequency domain outside which the transmitted attenuation rises rapidly is called bandwidth. For instance the amplitude response of a standard telephone channel has a bandwidth of about 3 kHz from 300 Hz to 3.3 kHz. It has been shown by Nyquist that for all methods of modulation, the maximum signaling rate is about twice the frequency bandwidth. The maximum information transfer rate is related to both the baud rate and the number of levels of coding used. Shannon has shown that the maximum information transfer rate or channel capacity in a noisy channel is " $\text{bandwidth} * 2 \log (1 + S / N)$ " whereover S / N is the ratio of signal strength to that of random noise level. Our definition suggests applying channel capacity for the estimating rate of information transfer, i.e. "information density" of broadcasting.

4.3. Implementation of the Accounting System, Estimations

4.3.1. Data-subjects and Transactors of the System

4.3.1.1. Transactors of the Physical Level of Information Flow

At physical level, those are human individuals and machines who can directly communicate through an interface.

In a society with a population given, human information production and consumption abilities are always limited, while machine production and use of information can grow without limitations, because both information productivity/consuming capacity and population of machines may grow. Introduction of machines into production and use of information is the main source of physical level information productivity of the society. Therefore this issue is very important. However, these individuals belong and machines are affiliated to institutional units, which determine their behavior. Many times they act on behalf of institutional units. That's why institutional units are studied mostly. Physical level transactors are accounted only at the interface of institutional units, and transfer will be classified as machine/human output and machine/human input at the interface of various institutional units.

Also those are institutional units which provide data for surveys.

4.3.1.2. *Institutional units*

The institutional units defined in [SNA92] will be applied in SNIA. Henceforth that definition will be recapitulated here.

As far as many transactions involve the exchange of ownership of a good or asset, the institutional unit must be an entity, which is capable of owning assets in its own right and of incurring liabilities, engaging in economic activities and in transactions with other entities on their own account. Their characteristics comprise:

- Entitled to own goods or assets on its own right
- Able to exchange the ownership
- Able to incur liabilities on its own behalf
- Able to enter into contracts
- May be involved in litigation on its own account
- Able to take decisions and actions for which is held to be directly responsible at law
- Either a complete set of accounts exists or it would be feasible if they were required

There are three clearly discernible groups of units of [SNA92]:

- Legal or social entities in the form of corporations or non-profit institutions, whose existence is recognized by law or custom in the society
- Units of central, state or local government
- Households

Corporations, non-profit and government institutions sometimes must be divided into narrower, more homogeneous establishment type units. Establishment is a unit, which is in principle engaged in one economic activity and observable, but which may also cover secondary activities.

4.3.1.2.1. *Kinds of institutional units*

4.3.1.2.1.1. *Corporation* is a legal entity created for purpose of producing goods or services for profit, which is collectively owned by shareholders, who have the authority to appoint directors responsible for its management. Subsidiaries (incl. ancillary corporations) and associate corporations also belong to this group.

4.3.1.2.1.2 *Non-profit organizations* (NPI) are legal or social entities, created for the purpose of producing goods and services, but not for the purpose of generating an income, or providing a financial return. NPI-s are not necessarily engaged in non-market production, and may charge fees, which are geared to their average production costs. NPI-s, like professional chambers and trade associations, provide a considerable amount of information to their members. Churches, trade unions, political parties with membership's registers, experts' staff, press contacts etc. are large information producers, although their information activity is hardly accountable.

4.3.1.2.1.3. *Government units* are legal entities, which have legislative, judicial or executive authority over the institutional units within a given territory. Governments provide collective services and free or greatly reduced priced services to individual institutional units and redistribute income.

4.3.1.2.1.3.1 Units within central government - SNA's view

[SNA92] holds the opinion that "Central government is an exceptionally large and complex institutional unit. From an economical point of view, it is not feasible and desirable to try to break it down into smaller institutional units. Central government may be composed of many large departments, each of which may be responsible for considerable amounts of expenditure, but they are nevertheless not separate institutional units. Each department is not capable of owning goods and assets, engaging in transactions, incurring liabilities in its own right, that is independently of central government as a whole."

Obviously, if central government is accepted as a single unit, all interdepartmental transactions should be classified as intra-unit transactions, and volume of output and input may be radically less than if informationally or economically independent units are considered. However, this issue isn't just a technical one, it concerns foundations of the government and state.

4.3.1.2.1.3.2. Discussion

Independence or dependence of government agencies of a country is a matter of fact indeed, and a good account (both SNA and SNIA) should reflect the character of the government (and state). Such an approach wouldn't ab ovo declare the government as one entity in every country and wouldn't ab ovo define the position of government units in the system. Notion of "control" as defined in [SNA92] for corporations in a modified version seems suitable for defining

- independent and
- subordinated governmental units.

In Hungary, at least the one-chamber Parliament, the President, the Prime Minister, Court of Constitution, Supreme Court and Supreme Prosecutor can be considered to be independent. Independency of the Parliament is doubtless. The rest of the organs are chaired by heads elected by the parliament. Independence has been provided by the provision of law that they cannot be summoned unless they commit crime.

Just such an approach could make SNA (and SNIA) suitable for drawing not only economical but - what is inseparable - social conclusions. Volume of information flow between agencies would illustrate factual activities of the government.

Departments in a total state are totally subordinate to the head of the government, the state is monolithic. At the same time, in a democratic and constitutional state,

departments can freely undertake contractual contacts with private and non-private units, and the state budget contains several separate items for many of them, which items aren't redistributable. They also have the right and obligation to manage the assets that are assigned to them, and are economically independent to a significant extent.

What concerns information, it doesn't flow freely within government, not even in total states. In a democratic constitutional state, which respects privacy, free flow of information is not only impossible, but forbidden by law, which defines the scope of various authorities, and measures in order to protect privacy.

For instance, informational independence of Hungarian Inland Revenue Office is guaranteed by law, so, that transfer of data from the Office is prohibited except signalization.

In several countries, the relation between the departments and body of government looks like that, between a holding and its subsidies rather, than that between the intra-unit departments.

Government agencies accomplish mostly information activities. In their traditional shape, these agencies had no goods that could have been exploited as capital goods. A new situation emerges with impact of government data banks. With tying up some plus efforts to organize the data into a database under an on-line database management system, the whole system automatically turns to a capital good. A database can be exploited so, that it is able to provide on-line services. Many of them operate as working capital indeed, which is not characteristic for a non-profit organization. At this point, regulation of independence and interfaces of government agencies has got more significance.

Since telematics had entered the scene, interagency information transfer became a particularly important subject to legal regulation in the U.S.. Mutual account of services provided by government units to other government units is held to be a good measure to reduce double effort and paperwork burden, and is held desirable.

Federal Paperwork Reduction Act acknowledges, that information is a valuable resource and it should be managed in the administration as such. U.S. regulation OMB Circular No A-130 declares that agencies shall share their information technology facilities with users from other agencies to the maximum extent feasible, but will recover full costs from Federal users of facility.

4.3.1.2.1.4. Households

A household is a small group of persons who share the same living accommodation, who pool some, or all, of their income and wealth and who consume certain types of goods and services collectively, mainly housing and food. Families constitute private households, members of religious orders living in monasteries, prisoners and long-

term patients belong to institutional households. This definition in [SNA92] and its interpretation are accepted, though the concept of "household" could have been defined by common information production and consumption either.

It may be questionable that households alone, or households and their members will be considered as units in the system.

Such household information stocks - like family libraries, family photo-albums, archives or collections of records - are in the common property and use of the household. Also some information services - like TV broadcasting - and the TV set are used and consumed commonly. However, some transactions are made individually - like teaching children, watching TV (using visual output from TV sets) etc.

Relation of non-formal communities to their members is an important issue of society. Therefore, distinction would be desirable in households between collectively and individually produced or consumed information.

4.3.1.2.1.5. *International organizations* like UNESCO, UNO, IAEA etc. produce and consume vast amounts of information and so play an important role in the information household of the countries.

4.3.1.2.2. *Residence*

4.3.1.2.2.1. *Definition*

The concept of residence is important in the definition of production, exports and imports. It will be defined and used nearly so as in the SNA. An institutional unit is said to be *a resident unit for purposes of the system* when it has a centre of economic interest in the economic territory of the country. A unit has a centre of economic interest in a country when it is engaged in a substantial amount of production in the country and maintains at least one production establishment which it plans to operate either indefinitely or over a long period of time. *Economic territory of a country* consists of the geographic territory administered by the government within which persons, goods and capital circulate freely.

This approach can be debated. SNA addresses political decision making by the central government. Obviously those are not only the units on the economic territory of the country but the units outside the legal authority of the government are worth studying.

This particularly involves classification of radio- and TV broadcasting stations and programs and private networks of multinationals.

4.3.1.2.2.2. Problem areas

4.3.1.2.2.2.1. Non-durable signals

Non-durable electromagnetic signals circulate freely in the frequency domains administered by the government in the frames of the international agreements. In this aspect, the definition in SNA should be modified so, that electromagnetic signals should be added to the things, which can circulate, and "economic territory" should be changed for "economic space", which would include the space over the territory.

4.3.1.2.2.2.2. Federal countries

Federal countries can be studied at the level of the federation, and at the level of republics. In a country, like the late Yugoslavia or Czech-Slovakia, republic-level account is preferred. In the latter, units are classified to the classes of republican and federal units.

In the late Yugoslavia central (federal), state (republic level) and regional programs were distributed by a number of stations deployed in various republics and owned by a federal organization. Obviously, federal organization has a centre of interest in the republics, thus their activities has to be considered as coming from the republics. This treatment may provoke critics.

5.3.1.2.2.2.3. Units operating mobile equipment

Direct broadcasting satellites supply services from a mobile equipment. According to [SNA92], there are two possible ways of treating these services. One is to allocate all the transactions to each of the countries concerned in proportion to their shares in the equity of the corporation. Another possibility would be to treat this corporation as resident in the country, in which the headquarters are located, and to treat the premises of the corporation in the other countries as foreign branches. However, the outer space, where satellites broadcast is outside the territory of the countries, so the second approach is thought to be preferred. A satellite broadcasting corporation has a centre of economic interest in a country if it broadcasts a program on a contractual base to that country. In other cases it is accounted as exports or imports.

4.3.1.2.2.2.4. Distribution of satellite TV programs by cable networks

In both cases, satellites supply information to those, who have parabolas, i.e. to cable-TV companies, micro AM replay companies and households with equipment capable to receive the program directly. Cable-TV companies should be considered as domestic producers, when provide amplified satellite programs to the end-users wired to them.

4.3.1.2.2.5. *The residence of households and their members*

Students, diplomats, military personnel, travelers and tourists, seasonal- and border workers locally recruited staff of foreign embassies, the crews of ships etc. should be treated as residents of the country, from which they originate.

4.3.1.3. *Sectors*

In the SNA, *sectors and subsectors* are defined as groups of institutional units. Purpose of grouping is to classify together the institutional units, whose economic objectives and behavior (the way they participate in the production and use of goods and services) are similar.

A given sector may be subsectored in many ways.

4.3.1.3.1. *The Sectors in [SNA92]*

[SNA92] distinguishes five domestic institutional sectors:

Non-financial corporate sector

Financial corporate sector

General government sector

Household sector

Non-profit organizations.

Non-financial corporate sector consists of corporate enterprises, which are engaged on the production of goods or non-financial services. Also, it includes non-profit institutions selling at prices, which cover costs, or which are created to provide services to non-financial enterprises, households and governments, which behave like non-financial corporations, and whose accounts are sufficiently articulated to enable them to be treated, as if they were separate corporations (quasicorporations).

Financial corporate sector comprises all corporations, whose principal activity is financial intermediation or facilitation of financial intermediation. It also includes financial quasicorporations and non-profit institutions serving financial corporations.

Most services of financial institutions (banks, clearinghouses etc.) deal with information. As it has been mentioned earlier, money itself carries nominal information (the text on the banknote) and also it carries information, when handed over. Existence and in detail analysis of electronic interbanking, funds transfer, electronic bourse, accounting and ledging proves, that these can mostly be considered as information activities, except exchange of currencies. However, from the point of view of SNIA, no distinction is needed between financial and non-financial corporate sector.

The general government sector covers all units of central, local and state governments. It also includes social security funds financed and controlled by government units.

The household sector consists of all households plus non-profit institutions serving households. Considered as institutional units, households are not only simple consumer units. They also include unincorporated enterprises owned by household members as integral parts of the household in question.

The national economy is viewed as if it were a supersector comprising all resident in the economic territory of the country institutional units.

4.3.1.3.2. *Aggregated Actors in SNIA*

National economy will be understood with those transactions that have been accounted in SNA.

Beside national economy, corporate, general government and households sectors, the following sectors should be applied.

The traditional distinction between corporate, general government and households sectors is not suitable for the description of the relations in a socialist state where these sectors all are under the control of the power "centrum". For this purpose, the "state (= socialist)" and "private" sectors were introduced which are defined according to then Hungarian official statistical classifications.

The wide-sense interpretation of the notion of information goods, services, activities and transactions goes well beyond economy. A chat between two friends in a pub, a family or schoolmates' discourse, conversation of cab-drivers on CB radio are something which aren't concerned by SNA and aren't interpreted as transactions. That's why a new global actor - called society - is needed in SNIA. The society is defined as all transactions of all institutional units extending over the production boundary of the SNA.

National economy includes primary and secondary information economies and non-information economy.

Primary information economy is defined in three senses:

- a/ those institutional units, whose dominant output is an information good or service,
- b/ those establishments, whose industry is an information industry,
- c/ those transactions, in which information goods or services are transferred from the producer to other institutional units.

Secondary information economy (in sense c/) consists of those intra-unit transactions, in which information goods or services are transferred.

Information economy is primary and secondary information economies, as defined by definitions c/.

Non-information economy is national economy less information economy.

Information sector is primary information economy, plus those units that produce information machines or materials as defined by [Por77] or [Sta88].

From the aspect of information, *sectoring according to language communities* would be desirable. There is some statistical evidence for defining similar sectors, although many difficulties may arise. A classification of all units into language communities seems impossible in many countries.

4.3.1.4. *Subsectoring*

4.3.1.4.1. *Corporate Sector*

The public, national private and foreign controlled corporation subsectors will be defined like in [SNA92].

Public corporations are subject to control by government units. Control over a corporation is defined as the ability to appoint its directors and determine corporate policy. This can be achieved by owning more than half of the voting shares or by legislative power. Foreign controlled corporations are controlled by non-resident institutional units.

4.3.1.4.2. *Subsectoring within government*

Subsectoring within government into non-market and market producers is of primary interest. Socialist regimes hold overdeveloped government (state) directed market and non-market sectors, while production for the market is not a typical government activity in the Western civilization.

Market producers and non-market producers and market and non-market industries are used in [SNA92] for the detailed study of production and products. Taking into consideration the role played or to be played by the market, this classification should be applied in the SNIA.

Non-market producers supply the goods or services they produce free, or at nominal prices not determined by costs, to individual households or to the community, as a whole.

The amounts of non-market goods and services produced for purposes of final consumption reflect the general social and political objectives and priorities of government.

Non-market producers also supply goods for purposes of intermediate consumption or capital formation of other government agencies, but which don't recover their production costs from sales (government printing agencies, computer and telecommunication agencies).

4.3.1.4.3. Subsectors of the households in [SNA91] are resident households proper and resident non-profit institutions serving households. Majority of storytellers, poets and other creative people come from the households. In SNIA, individuals and households will be distinguished within proper households.

4.3.1.4.4. *Subsectoring the Rest of the World*

Rest of the world contains all non-resident institutional units, which enter into transactions with resident units. The sector should be classified into the class of neighboring countries and some other geographic classes. Classes according to language relations will be introduced like "English-speaking countries".

4.3.2. *Transactions*

4.3.2.1. *Definition*

In [SNA92] *transactions* are interactions between pairs of institutional units, which may have one or two components. A component to a transaction is an action undertaken by prior formal or non-formal agreement between the two institutional units in which:

- the ownership of a good or an asset is transferred from one unit to other; or
- a new financial claim is created or existing claim extinguished; or
- one unit provides a service to other; or
- one unit works for the other.

In [SNA] transactions should be discerned from other types of flows, like externalities. In [SNIA] the "flow of information" is assumed to be realized in transactions. The very same general principal SNA definition for transactions will be applied, but for a wider scope of actions.

Transactions in [SNA92] need to be clearly distinguished from the activities, such as physical processes of production or consumption, of which they may be composed. The same situation is valid in SNIA.

When accounting phone calls, they aren't taken into account at every physically existing switching centre, though at every such centre new signals are produced and the input signals are consumed. Just the signals at the interface between the user and

the service supplier (i.e. at both receiver) are considered and the rest of an arbitrary number of switches, computers etc. are left out of the account.

In transactions with information, it is not uncommon, that more than two transactors take part.

4.3.2.2. *Kinds of Transactions*

4.3.2.2.1. *Overview of Transactions*

An overview of simple transactions with two transactors is shown in Table 7.

Table 7. *A Classification of Some Simple Two-partner Transactions*

The Product	its internal use		supply to other Unit		
produced by the Producer for	for reprocessing (Transformation , embeddig)	for accumulation	via sales on market prices	on non- market prices	free
own initiative and risk					
others' request, order					
others' obligation, force					

4.3.2.2.2. In SNA, a *monetary transaction* is a transaction, whose one of components consists of the payment of money by one of the parties to the other, or of the establishment of a new financial claim by one party over the other, or the extinction of a financial liability owed by one party to the other. A financial claim is essentially an asset which entitles its holder to receive a payment.

While in value terms, most of the transactions are recorded, it is not the case with volumes of information. This situation presumably will be changed in a network oriented society, when transactions will be initiated, accomplished, controlled and reported by electronic and photoelectronic networks.

SNIA is a tool for policy making for a future information society and it can be completed only in the electronized environment of an information society.

4.3.2.2.3. *Transfers in Kind*

A *transfer in kind* is a provision of a good, asset, labor or service without any counterpart. Direct mailing, advertisement actions are characteristic examples for transfers of information in kind.

4.3.2.2.4. *Obligatory Transactions*

There are several examples of obligatory transactions with information. It is not uncommon, that government agencies force individuals or corporations to supply

information, as exemplified by population censuses, statistics, taxation, customs declaration etc. Government agencies should signalize certain events to other agencies, and interested parties make testimony before court. Vendors of durable consumers' goods are obliged to enclose warranty declaration and instructions to handling of the good.

4.3.2.2.5. Intra-unit Transactions

[SNA92] requires, that a transaction should also be assumed to take place, when a unit decides to retain a good, for purposes of its own final consumption or capital formation, i.e. intraunit transactions are transactions. At Hungarian Telecommunication Company, almost 10% of phone calls is service call (telegrams, repair and maintaining calls etc.). These are intraunit transactions (providing non-durable signals). SNIA recognizes and accounts intra-unit transactions. Non-collective intra-household services - like education - can also be considered, as intraunit transactions.

4.3.2.2.6. Illegal Transactions and Crimes

This is an important factor in the SNIA accounts. One of the examples is illegal copying of video- and audiocassettes. As far as illegal transactions should be treated in [SNA92] as legal transactions, provided they are genuine transactions, into which both parties enter voluntarily, this is production, whose data should be imputed.

Theft or violence is an extreme form of externality, in which damage is inflicted on another institutional unit deliberately, and not merely accidentally or casually. These are not treated as transactions, and imputed values are not recorded for them. Illegal receiving of satellite TV broadcasting isn't theft but a crime against property which - according to [SNA] - in no sense ought to be construed as transactions. However, use of an information service doesn't influence the rest of the system, so doesn't cause complications in the accounts. Nevertheless, statistics should measure the phenomena, which exist without respect of their legality or illegality. These factors influence factual use, and so should be measured in SNIA.

4.3.3. Technical Problems

4.3.3.1. Rerouting

A rerouting occurs, when a direct transaction between unit A and C is recorded as taking place indirectly through a third unit B acting as intermediary. As examples the transactions can be mentioned, where transportation is used e.g. mail services. Bookstores are left out of consideration, when net flow is studied.

4.3.3.2. Externalities

Certain information activities, however, carried out by institutional units cause changes in the condition or circumstances of other units without their consent. A local transducer station, foreign and not-interested radio stations (for instance Arabic, Chinese in Hungary) can waste the air-space in other countries. This unintentional import influences the opportunities of the domestic production, it can be viewed as "Polluting with impunity". It is necessary to have a set of accounts which show this phenomenon. It is necessary to make distinction between intentional broadcasting into another country, and unintentional pollution - an intervention into the affairs of another country. The elaboration of and argumentation for international agreements to allocate frequency bands need a careful analysis of SNIA-s of various countries.

Although externalities have been defined, they are not recorded in [SNA92]. Besides, there is no example in [SNA], that externalities would dominate over transactions, which is the case for broadcasting information in SNIA.

4.3.3.3. Imputation refers to attributing an information volume value to an actual flow or introducing purely accounting entries.

4.4. The Indices of Information Household

4.1.4.1.1. General Definition of Services in SNA

According to [SNA92] "Services are not separate entities, over which ownership rights can be established, and they cannot be traded separately from their production. Services are heterogeneous outputs produced to order, and typically consist of changes in the conditions of the consuming units, realized by the activities of producers at the demand of the consumers. By the time their production is completed, they must have been provided to the consumers." The production of services must be confined to activities that are capable of being carried out by one unit for the benefit of another. Otherwise, service industries couldn't develop, and there could be no markets for services. It is also possible for a unit to produce a service for its own consumption, provided that the activity is such, that it could have been carried out by another unit. Among the typical changes, whose presence is characteristic for services [SNA92] mentioned "changes in the mental condition of persons: the producer provides education, information, advice, entertainment or similar services."

4.1.4.1.2. Definition of the concept of services in SNIA

By and large this definition fits to the needs of SNIA. The importance of maintenance of some condition or state should also be underlined along with changes. There are, however, some reservations. Many consider some services to be tradable. Telephone switching services is just one example for it.

"Allowing others to use a mental product under the protection of intellectual property" is also a service. This service stands in the change of mental states of the author and the buyer/user (in the countries with an authors' register the change of states of register and registrars either) concerning a possible copying by the user. Before buying copyright, both sides know, that it is forbidden, and both change their mind after the transaction made. The mental state to be free to do or not to do something is commonly called "right". This state can persist for a long time, and even if not "the state of a given person", but a "state of an indefinite person" can also be traded. This is called "trade with intellectual property".

4.1.4.1.3. Treatment of complex services

There is a number of goods and services, which are contained by standard classifications of commodities and a standard operation is available for definition of their amount. Books, newspapers, phone calls can be mentioned as examples.

However, there is a number of services, which have been defined as large, extended, and not detailed functional classes like "Defense services", "Central government", "Library services". These classes mostly cover a number of well defined, or definable component activities, each or many of which is apt for defining a measurement operation over them, and a transformation procedure into bits, or the definition has even been made. In these cases, component activities were identified or defined and the volumes of component activities were used.

Determination of the services measured

Without explicit enumeration of services the accounts cannot be prepared. The following cases occurred:

- services called as they were called by the supplier,
- services with legal names,
- services under comprehensive statistical categories,
- services under own category-names.

SNA's most basic concepts are "firmly rooted" in economic theory though - for example - the concept of income is not precisely defined in theory. The phenomena that are addressed by SNIA stretch beyond economy. As it was indicated earlier, a twofold approach will be applied: fundamental indices will be defined for the volumes of information due to general transport theory and then the volume of information that can be associated with categories of SNA will be defined either. The indices in the SNIA are designed for a use to describe national information households but can be used for smaller units, either.

4.4.1. Accumulation/Stock

4.4.1.1. Accumulation of Information

4.4.1.1.1. Definition

What concerns non-durable signals, they cannot be stored and so accumulated. Thus volume of *accumulated information* (shortly information accumulation) of an economic unit *i* (corporation, individual etc.) at a time point *t* will be defined as volume of information in or on all copies of all information and non-information goods owned by the unit. Accumulated human knowledge is of primary importance but is not exactly measurable. Volume of accumulated information in a region or country will be defined as sum of accumulated information of all economic units resident on the area of the region or country and denoted by $V(t)$.

4.1.1.1.1. Goods

The above definition by and large contours services in SNIA. I would emphasize that goods persist as physical objects for a definite interval of time. Standard classification of goods in HS and seems to be enough to the proper treatment of all information goods, still some - which usually don't appear as commodities - are to be added.

4.4.1.1.2. Kinds of Accumulation

4.4.1.1.2.1. Assets and Liabilities

[SNA] applies assets and liabilities. As a rule, most information products are also owned/held by the proprietor. Remarkable exceptions may be borrowed books or records, bankable bills, databases used by resellers, value added resellers or gateway services, or in some other sophisticated ways of databanking, and exposed films to be developed. A complete account of "liabilities" and "assets" like this in natural unit terms - as it is done in financial terms - is unrealistic. Hence accumulations/assets will be taken into account at the proprietor and not at the unit which actually uses the assets.

Stocks are generally recorded at one point in time, when inventories are taken, and continuous bookkeeping doesn't exist in this respect.

4.4.1.1.2.2. Proprietors' Groups

Accumulations should be measured by different surveys in the private households ($V_{\text{pop}}(dt)$), government institutions ($V_{\text{govt}}(dt)$) and market units as producers, or trade units ($V_{\text{corp}}(dt)$).

$$V(t) = V_{\text{pop}}(t) + V_{\text{govt}}(t) + V_{\text{corp}}(dt) + V_{\text{nonpr}}(dt) \quad (1)$$

4.4.1.1.2.3. *Classification by Media*

Accumulation can also be divided into groups of

- information goods $V_p(t)$
- durable signals on non-information goods and $V_{ds}(t)$
- human knowledge $V_h(t)$.

$$V(t) = V_p(t) + V_{ds}(t) + V_h(t) \quad (2)$$

Human knowledge plays the definitive role in information phenomena [Die86]. Since von Neumann's pioneering attempt [Neu59], several efforts were made to quantify storage and processing capacity of human brain. Still, we have no exact quantitative data on its volume. Similarly neither statistics nor research studies are available on the amount of durable signals on non-information goods.

4.4.1.1.2.4. *Classification of Accumulation by Source and Purpose*

In SNA, accumulation is divided into groups of

- stocks (inventories, semi-finished products, goods etc)
- fixed capital
- capital finance.

This is to make a distinction between the goods that are durably used for production purposes.

It is clear that a similar distinction would be highly reasonable in SNIA. For instance, collections of libraries and archives belong to the group of fixed information capital. [DSP]'s classification of information for

- living
- entertainment
- work

reflects a similar effort. At the same time, the distinction of capital finance is irrelevant to information phenomena.

Thus, accumulation will be classified as accumulations of

- own assets (capital) $V_{cap}(t)$
- stock of materials and parts (to be consumed in the course of production while embedding or transforming them) $V_{mat}(dt)$
- work in progress $V_{inpr}(t)$.
- own production (mainly intended output) $V_{prod}(t)$
- stocks of trade commodities $V_{comm}(t)$

- waste $V_w(t)$.

$$V(t) = V_{\text{cap}}(t) + V_{\text{mat}}(t) + V_{\text{inpr}}(t) + V_{\text{prod}}(t) + V_{\text{comm}}(t) + V_w(t) \quad (3)$$

(A copy of) an information good is considered to be *waste* if cannot be classified to any of the previous classes.

These stocks altogether might be computed from those of their producers, distributors and users. Hungarian statistical system measures trade stocks of books at some institutions only. No data are available on accumulations of the producers which presumably is a low value and there are no exact regular data on households' accumulation which may be significant. Producers' associations are still weak and the producers don't provide information to the associations.

A transaction may result in adding information to or taking information away from the capital.

A *knowledge capital investment* will be defined as resulting in a positive increment to the capital and a *knowledge capital withdrawal* as resulting in a negative increment from the capital. Annual capital investment ($dV_{+\text{cap}}(dt)$) and withdrawal ($dV_{-\text{cap}}(dt)$) of an economic unit will be defined as the sum of all investments and withdrawals made in the year. Applying this, knowledge capital can be expressed as that in an earlier point of time plus capital investment and withdrawal.

$$V_{\text{cap}}(t+dt) = V_{\text{cap}}(t) + dV_{+\text{cap}}(dt) - dV_{-\text{cap}}(dt) \quad (4)$$

Capital withdrawal can be computed from capital transfer from the unit plus capital consumption (See there!).

$$dV_{-\text{cap}}(dt) = O_{\text{cap}}(dt) + C_{\text{cap}}(dt) \quad (5)$$

Capital investment is equal to investment of own-account capital production plus input investments.

$$dV_{+\text{cap}}(dt) = P_{\text{inv}}(dt) + I_{\text{cap}}(dt) \quad (6)$$

Rented capital information goods are taken into account as a *capital transfer* to the borrower (libraries' and videothekas' services) and back, whose balance is near zero. It could also be accounted as a service of the lender which will then be consumed.

4.4.1.1.2.4.1. Operationalization of the Concept of Capital Goods

There are information goods that are evidently used as capital. Books, records and videocassettes of libraries, software exploited in computer centers, films lent by distributors and databases at database services belong to this category.

There are goods which clearly don't fall into the category of information capital. This can be exemplified by newspapers used only once, receipts, medical recipes etc.

Last but not least, there is a wide zone of goods whose classification is problematic like human knowledge, photos, films, books, records and computer games' software in the households, public non-profit databases, private companies' business files etc.

4.4.1.1.3. Revaluation of Assets

It was mentioned earlier that volume of information of information goods may grow in accordance with the average state of the arts in data capture and recording. That's why stocks should be revaluated in bit terms as well as in value terms. Accordingly, nominal holding gain or loss may appear. The latter occurs if the media becomes obsolete and cannot be used any longer (like with punchcards).

Specific "information density" of the information goods grows at a 5-10 percent annual rate. This makes admissible that stocks left after the production or purchase of the year will not be revaluated. However, stock of the production or purchase in the earlier years should be revaluated.

4.4.1.1.4. Valuation of Information Assets in Value Terms

Valuation of accumulation of information products seems to be an extremely difficult problem. Price of books, maps etc. seem to follow a parabola with going down first but growing again after a period. This may raise the idea that the average prices can be estimated by age classes. Unfortunately, age distribution of the stock is not known, either. Model computations may provide some help.

4.4.1.2. Volume of Information Connected to Assets and Liabilities in [SNA92]

Volume of information connected to classes of assets by the classes of tangible and intangible, financial and non-financial assets is not measurable.

4.4.2. Supply and Acquisition

4.4.2.1. Definition

There are many ways how information goods or non-durable signals are supplied by a unit i to another subject j being the new owner or the consumer. These events were included into transactions.

Gross information supply of a country is the volume of information conveyed by all copies of information goods and services supplied by the resident units in all transactions to another unit in the period between t and $t+dt$ as sales, capital transfer or other purposes. Unusual in the economy forms are widespread in the supply of information goods particularly in the households sector. For example, an 1973 survey

revealed that a surprisingly high percent of books strayed to its owner as a present in Hungary.

Gross information acquisition will be defined as volume of information conveyed by all copies of all information goods and services received by the unit from another unit for purpose of consumption, use, reselling or transport in a transaction.

$$S_i(dt) = \sum S_{ij}(dt) \quad (7)$$

$$A_i(dt) = \sum A_{ij}(dt) \quad (8)$$

5.4.2.2. *Classification of Supply and Acquisition*

Supply and acquisition can be subdivided as

$$S(dt) = O(dt) + S_{cap}(dt) + S_{comm}(dt) + S_{transp}(dt) \quad (9)$$

$$A(dt) = A_{cap}(dt) + A_{comm}(dt) + A_{mat}(dt) + A_{transp}(dt) \quad (10)$$

where $S_{cap}(dt)$ and $A_{cap}(dt)$ are supply and acquisition of capital, $S_{comm}(dt)$ and $A_{comm}(dt)$ that of commercial commodities, $A_{mat}(dt)$ acquisition of goods and services to be consumed as productive consumption (see there!), $O(dt)$ is the output of own production and $S_{transp}(dt)$ and $A_{transp}(dt)$ are volumes of information goods handed over or received as freight by a shipping or forwarding unit.

I call the attention of the reader that output doesn't contain that part of production which has been converted to own-account investment.

4.4.2.3. *Problem Areas*

4.4.2.3.1. *Sales*

In SNA, "sales" contains sales of own production and also that of purchased goods and services, which have been sold in an unchanged form. Thus "sales" belong to "supply".

4.4.3. *Input and Output*

4.4.3.1. *Definitions*

SNA defines the *output of an enterprise* as "the sum of the outputs of the individual establishments of which it is composed. Goods and services may be used for intermediate consumption by receiving establishment, but they may also form part of its gross capital formation. "Output is defined as the economic values of goods and services sold, bartered, used for compensation in kind to be used as intermediary input plus the value of changes in the inventories of goods produced as outputs." Input in

SNA is the consumption of goods and services that are consumed as intermediate or capital consumption.

In SNIA, output and production will be distinguished. The volume of information contained/conveyed by the own-produced information goods, non-durable signals and durable signals on non-information goods of all transactions of type 16-19, 26-29 and 36-39 during the period dt is called *information output of a unit i* and denoted by $O_{ij}(dt)$.

Volume of information contained/conveyed by information goods, non-durable signals and durable signals on non-information goods received from i to consume in information production will be called *information input of a unit j* and will be denoted by $I_{ij}(dt)$ respectively.

An input can be anything what appeared earlier as output, i.e., it should be a good or a service.

Gross information output and gross information input can be defined as sum of information outputs to receivers j and sum of information inputs from sources j . This can be formulated as follows:

$$O_i(dt) = \sum O_{ij}(dt) \quad (11)$$

$$I_i(dt) = \sum I_{ij}(dt) \quad (12)$$

4.4.3.1.1. *Output/Input in the General Transport Theory*

In this approach which is near the [SNA] terminology, "input" is input to/of a production process, which does not contain the goods/services purchased to be transferred in an unmodified form. In general theory of transport processes (GTTP) "input" is the complex of all elements that enter the system, i.e. "acquisition". Similarly supply is called output in GTTP.

In [SNA92] the inputs are recorded and valued at the time at which they enter the process, while completed outputs are recorded and valued when they emerge from the process. The increase in value between the inputs and the outputs measures the gross value added by the production process.

4.4.3.2. *Problem Areas*

4.4.3.2.1. *The Output of Producers of Large Capital Goods or Structures*

The time needed to produce such goods may range several months to several years. This is typical for such products like databases, encyclopedia etc. By definition, the work made won't appear in the output but in works in progress and thus in production.

4.4.3.2.2. *The Output of Wholesalers and Retailers: Who Is a Distributor?*

"Although a distributor actually sells goods, his productive activity is construed to be the provision of services by obtaining and storing goods in a location which is convenient for his customers. The goods themselves are not regarded as being significantly transformed in the process and are therefore not treated as intermediate inputs into the distributor's own processes of production." [SNA91] In consequence, the goods sold do not form part of the output of the distributor whose services are measured by the trade margins he realized."

In accordance with this, distribution will be understood as a commercial activity during which information goods and services are distributed in transactions 18, 28 and 38. This is an apart from terminology in [Por77], [Mach] and others who define teachers, journalists etc. as distributors of information. Nevertheless, these professionals reproduce - that is produce -information. What can be thought distributed, it is knowledge.

Similarly, broadcasting and cable TV services are thought to be productive activities.

At the same time wholesalers and retailers of information goods like a bookshop doesn't produce an information good, their activities aren't information activities, their output and production cannot even be measured in bit terms except internal business and management info, as opposed to their supply. As it has been mentioned the volume of information in or on information goods may grow with the passage of time and there is a general "oblique inflation" as a consequence of technical development. This should be treated as a holding gain.

4.4.3.2.3. *Who is a Carrier of Information?*

Transport and storage of information goods and durable signals aren't considered as information output. Various documents of ITU, ICCR and other international organizations and agreements provide a definition to the notion of "carrier". Telecommunications companies are called common carriers of communications. Nevertheless, a phone company actually does not carry signals from a speaker to another, but, while using the signal made by A, it produces a new copy of it to B. These companies are producers, active agents. Telecommunications is an information activity because it provides information services to its consumers.

There are sophisticated problems with data communications, value added services, and gateway services. They may provide a platform, a user environment, passwords or access to a database. Then neither names of fees are always orientating on replying the question: "Who outputs what?".

4.4.3.2.4. Output of Financial Intermediaries

Which part of output of insurance and financial enterprises should be considered as an information good or service?

For instance, insurance policies are printed forms. However a signed policy isn't just a form any longer, it is a new product, which can be issued by the company only. It is, or is no tradable product. Is it the signature only, which should be accounted as output of insurance companies? If this view is accepted, information output of an insurance company will be found to be limited indeed, but there are vast intra-unit stocks accompanying to insurance institutions. The monetary transactions accompanying to insurance transactions are more voluminous than the information production issued by the company to the consumer. It is not the volume of information what is significant in these cases. The fee one pays for it, isn't the pay for the information on the policy. It is a pay for the policy which - as a unit -entitles its owner to participate in the services of the company. Like with banknotes one buys declaration, promise, obligation with the policy.

4.4.3.2.5. The Outputs of Pension Funds

These funds issue various information on monthly pensions, modification of the pensioners state (rise etc.), resolution on commencing/ending rendering payable the pension.

4.4.3.2.6. Output of Publishing Houses

In the course of traditional technological process, publishing houses produce and use a lot of intermediary goods as authors' manuscript, revised and modified manuscript, accepted manuscript, edited manuscript and camera-ready manuscript. These intermediary products are not registered. Printing offices produce publications in their final form.

4.4.3.2.7. Output of Research and Development.

There are various forms of output in research and development. The manuscripts of articles to appear in scientific journals, research reports bound to grants and the submissions for patents protection are considered as examples of outputs of research activity. Together with this, various intellectual property rights can also arise. As a consequence of electronic mailing and various mailbox, billboard and other services in such systems like DARPA, a greater and greater part of scientific production enters electronic systems. Scientific information is not easily discernible in these systems from other kinds of information. No statistical data are available on the amount of information in these systems.

Classification of the information in electronic systems remains a hard nut. [SNA91] suggests accounting R+D conducted by enterprises as own-account capital formation.

Is it a market output just because it was issued by a market organization? By no means.

Output of exploration - like exploration for raw materials -i.e. exploration documentation and reports is obviously information good.

4.4.3.2.2.8. *Output of Waste*

According to the general definition of waste in the previous chapter, output of waste can be exemplified by broadcastings disturbing other broadcastings making impossible their receiving.

4.4.3.2.2.9. *Output of Oral Communications*

The mind of an employee and his/her knowledge is his/her exclusive property. But then who outputs, consumes and uses information in oral communications made or listened by an employer? In accordance with the civil law, the employer is considered as the unit who outputs information when the employer communicates orally.

Time use statistics record the average time T of "Conversation and chat" spent by data-suppliers i (of number N) in a period dt . The average time spent for conversation and chat by the population is published. During a particular conversation k , a person i in a closed company consisting of n participants outputs communications of duration t_{ki} for $n-1$ partners and himself. Let P the average number of participants in chats and conversations. Volume of information outputted by i during k is and measured in minutes

$$O_{ik}^n = n * t_{ik} \quad (13)$$

Volume of information carried by communications of all speakers i during k is

$$O_k^n = n * \sum t_{ik} = \quad (14)$$

Then:

$$O = \sum n * \sum \sum t_{ik} = T * N * P$$

This leads to the conclusion that published statistics are good for estimating output of oral communications, independently of the number of participants.

5.4.3.2.10. *Output of Churches and Political Parties*

Churches and political parties have outputs like journals, newspapers, brochures, propaganda and advice. Besides they organize meetings, conventions, missa where deliver proper information.

4.4.3.3. Classification of Output

Output and input may consist of information goods and services. Human knowledge (the individual) is not subject to transfer in civilized societies.

4.4.3.3.1. Non-market and Non-marketed Output

"The distinguishing feature of non-market output is that either there are no receipts from sales or receipts are relatively small and do not determine the amounts produced." Practically sales may cover less than a half the costs of production. Such output must be double counted once as market, once as non-market output.

R+D undertaken by non-profit organizations constitutes the production of a collective service in [SNA91]. It is not clear what is to be measured at university professors activities.

4.4.3.3.2. Market output as a substitute for non-market output

The law that obliges central government to provide collective or individual services free or almost free to households, does not oblige the government also to engage in their production with the possible exception of defense, legislation and administration. Thus governments may contract private or non-profit suppliers to provide the service free. These goods and services are market services and goods.

Something similar is present, when central government based upon the number of entitled individuals supports local governments in providing such collective services as primary education. Who provides and what in such actions like. Beneficiaries and users may or may not be the same person.

4.4.4. Information Flow

The information products and services supplied by a supplier i to a recipient j and the supplier j to the recipient i during a period dt will be called the *information turnover* between them and denoted by $T_{ij}(dt)$.

$$T_{ij}(dt) = S_{ij}(dt) + A_{ij}(dt) \quad (16)$$

Gross information flow will be defined as:

$$F_{ij}(dt) = O_{ij}(dt) + I_{ij}(dt) \quad (17)$$

Net information flow is:

$$F_{IA_{ij}}(dt) = IA_{ij}^{in}(dt) + IA_{ij}^{ou}(dt) \quad (18)$$

where $IA_{ij}^{in}(dt)$ is information added of the goods and services used as input at the unit j and $IA_{ij}^{ou}(dt)$ is information added in the output of the unit j .

There are several problem areas with information flows.

Necessity, fairness and financial account of information transfer between government agencies (sometimes transfers in kind between government agencies) is a vital issue in debates on government data systems, privacy, freedom of information and production in government.

It is not only payments (wages, salaries) that flow to the employee but so does information, either. The information acquirable by the employee is valuable, it can be used and misused and it may determine the employee's further carrier. That's why regulations exist which define the rights and obligations of the employee with the information he/she in this quality accessed. But it is not only the information of restricted use or business secret which is valuable, but contacts, personal knowledgeability etc. are, too. There are surveys that indicate that an average clerical worker spent 73 minutes a day for meeting and phoning and an additional 33 minutes reading in the seventies in the US [DSP].

A study of information flow to and from the employee is highly fascinating but in an uncomputerized office is practically infeasible so far.

The study of interemployee communication in computerized offices (electronic mailing, computerized phone calls), however, may give hints to understand these processes, but the whole area is well beyond the opportunities of the official statistics. At the same time the area is subject to legislation and policy making. In an information society, new accounts will be needed but statistics cannot be introduced, because that would violate privacy.

4.4.5. Information Income

Information income of an institutional unit extends to those information goods and services that are available for its consumption.

4.4.6. Exports/Imports

4.4.6.1. Information Exports and Imports

4.4.6.1.1. Definition

Information exports and imports are flows of information goods and services to and from the rest of the world. Volume of information exported/imported is that which is carried on/in all copies of information goods and services whose property was transferred to or received from a non-resident unit.

4.4.6.1.2. Problem Areas

There are several problems which should be faced when applying this general definition.

4.4.6.1.2.1. Broadcasting

Both the production of programs and that of broadcasting are to be taken into account.

Programs are usually recorded on media and these copies are considered as information goods which may be rented for cable TV service bureaus. Direct and continuous on-line supplying a sequence of various programs (programs in broadcast) is a service.

When accounting the programs in broadcast, they should be classified according to the residence of the supplier station (Program). By this, when the central program is adopted by a republican (=U.S. state) station, like Zagreb I, this may be classified in various ways. It should be classified first as use of the imported central (with a residence in Yugoslavia) program if the republican station is just an establishment of the federal organization and should be classified as use of the imported federal program and production by the republican Program if it is independent from the Central Program and is resident in the republic.

If broadcasting is considered, it is not uncommon that broadcasting stations transmit/transfer programs, like Tanger transmired and replayed Voice of America. In principle, two constructions are known. The first is when a broadcasting corporation purchases programs and then broadcasts them. This is typical for commercial broadcasting corporations. The second is, when a "program" purchases broadcasting capacity and then makes its programs distributed, which is typical for national (non-commercial) broadcasting corporations. In both cases location of towers was used in classification.

4.4.6.1.2.2. Consuming Information in Abroad by Resident Units

Foreign consumption of residents is considered import. Foreign experience plays an important role in the development of the countries. Not only technology transfer alone but the information for living, that is "innovation as seen by man on the street" are important factors of social motivation and adaptation. Some elements of the consumption of information by resident individuals in abroad - like students and tourists - can in principle be estimated as well and this will be imputed.

4.4.6.2. The Information Accompanied to Exports and Imports

4.4.7. Production

4.4.7.1. Information Production

4.4.7.1.1. Gross Information Production

4.4.7.1.1.1. Definition

In [SNA92] "*Production in an economic sense* is an activity which produces goods or services which are capable of being delivered, or provided, to other economic units."

According to [SNA92] production as an activity in which a unit consumes inputs to produce outputs. Outputs are specialized as goods and services.

4.4.7.1. The Production Boundary

Production boundary itself may be changed in satellite computations. Generally speaking, the scope of non-market activities may be extended considerably as it is written on p. 4. Chapter XXI [SNA92]." This opportunity will be exploited here.

[SNA92] distinguishes "production of services" and " "other activities" which may be both important and beneficial. The main cutting line is that these activities ("self services") like eating, sleeping" etc. aren't transferable, that is impossible to obtain another unit to perform instead. These are activities which aren't substitutable and cannot be exchanged for others' activities.

Such activities as reading, listening to radio and others can be considered as consuming and using information. These activities should be classified in this class according to SNA. At the same time these are obviously productive activities, even if nobody else can substitute of the reader. These activities are services to maintain human information wealth, knowledge of individuals. If human knowledge wired in the brains of individuals is viewed as a commodity, its maintenance should be viewed as a service. These activities are even substitutable by other activities aiming at building or washing one's mind. Some of these activities can also be made by others.

[SNA92] makes distinction between "general production boundary" and "Production boundary in the System", the latter being more restricted.

Activities that fall within the production boundary of the system may be summarized as:

- the production of all individual or collective goods or services that are supplied to units other than their producers, or intended to be so supplied, including the production of goods or services consumed in the process of producing such goods or services,
- the own-account production of all goods that are retained by their producers for their final consumption or gross capital formation,

The first item almost matches SNA, except "consumed goods and services" were considered instead of "used-up goods and services". The second item will be explained below. No other items will be included.

4.4.7.1.1. Own-account production

Own-account production is a well contourable concept which can be found in the bookkeeping practice of industrialized countries.

For the purposes of SNIA the following approach may be useful.

There is a considerable amount of information goods, like software, which are considered as real own-account production and accounted according to the rules of bookkeeping. These goods are considered as own-account production in SNIA, too.

There is a number of self-services of institutional units as counseling, consulting, meeting, phoning, signing documents to others, commanding, writing letters or mails, memos, payroll and many others. These are generally accounted as general costs or costs of management, divided into labor and material expenses. These activities are seldom considered as true services used up in the process of producing other goods and services even if there are specialized intraorganization units and establishments for these purposes. "Secondary or overhead" information activities will be classified mostly here. These activities will be treated in various classes of goods and services as those of "computer media", "paper-based household documents", "paper-based business and government documents", "mails", "phone-calls" and "business and information services NEC". Creation of these goods and services should also be considered as production, though no official financial accounts are available.

Similarly to this within the households sector, a number of information activities will be acknowledged as an information good or service and their production as "own-account production", though no real accounts are available. Such examples are education ("bringing up children" in time-use studies), supplying TV-show to family members, self-education and training (watching TV in time-use studies).

These activities all will be considered as services or goods, accordingly, and treated as "own-account production of information goods and services", though accounts neither value nor volume are not recorded or available at their producers. These figures will be estimated based upon various indirect ways and then imputed. Imputation cannot distort the national figures, being relatively small.

Accordingly, the volume of information conveyed by all copies of all information goods and services (durable and non-durable signals) and human knowledge of all individuals produced within a period dt will be denoted by $P(dt)$ shortly called gross information production.

Not only the information products and services with completely or to-someone "new" knowledge or ideas or inventions are to be considered as information production. New information cannot be operatively - for economics and statistics - defined. The vast majority of the knowledge consumed is not new at all. As illustrated by the fourth edition of Roget's Thesaurus (published first in 1911 and last in 1990), it is not only new information which is valuable and object of change between economic partners.

It is obvious, too, that the concept of information production should cover those information products either that haven't been included into official statistical industrial classifications, as law drafts and bills, criminal files of the investigation bureaus, payrolls, contracts, private diaries, phone notebooks, etc. though these objects are hardly apt for measuring by official statistics.

4.4.7.1.1.1. Classification of information Goods and Services

4.4.7.1.1.1.1. Classification by Information Bearer/Media

Production of all information goods will be denoted by $P_g(dt)$, that of the services by $P_s(dt)$ and that of the human knowledge by $P_h(dt)$. Since no ideas but products and services are measured these also should be additive:

$$P(dt) = P_g(dt) + P_s(dt) + P_h(dt) \quad (19)$$

4.4.7.1.1.1.2. Classification by Source and Purpose

$$P(dt) = P_{ins}(dt) + O(dt) + V_{prod}(t+dt) - V_{prod}(t) + V_{inpr}(t+dt) - V_{inpr}(t) \quad (20)$$

where $P_{ins}(dt)$ is the production used for own-account investment, $V_{prod}(t)$ and $V_{inpr}(t)$ are the inventories of own produced (and not yet used or sold) goods and goods whose production is in progress, respectively. I remind the reader that output and production in [SNIA] has been defined in a slightly different way from those in [SNA92].

For a supplier i the following equation comes true:

$$P_i(dt) = \sum S_{ij}(dt) - \sum A_{ij}(dt) + C_i(dt) - V_i(t) + V_i(t+dt) \quad (21)$$

Production will be classified into

- commodities
- non-commodities (activities).

In order to create comparability with SNA

- production according to SNA (without households' own consumed services) and
- production with households' own-account services included

will also be defined.

4.4.7.1.2. *Information Added as an Analogy to Value Added*

In SNA, production is a process in which land, labour and capital goods are employed to produce outputs of goods and services by transforming, or consuming inputs of goods and services. In accordance with this to avoid multiplication, the resources consumed in the process of production are subtracted from the output.

Information goods and services as well as other goods and services are made by using resources particularly information resources. For instance, a usual mail may consist of a letter (possibly with a preprinted heading and footing), enclosures (possibly xeroopies, printed matter, photos etc.), an envelope (possibly printed) with the address, and post-stamps. Volume of information in the mail may be computed as volume of all these as a whole. The production indicator of this level was called gross information production.

However, the one who produces the mail - while writing the letter and address - adds information to volume of information contained in the heading, footing, preprinting on the envelope, enclosures and post stamps. His contribution is just the letter and the scripts on the envelope. When the volume of information (conveyed by the goods/services) he consumed for producing the mail will be subtracted, then volume of information added (IA(dt)) can be obtained. Information production can in principle be measured at the level of information added, too.

Vice versa, gross volume of information produced can in principle be measured by adding individual IA volumes of the letter, enclosures, stamps etc.

A long production/use/production technological chain is known at broadcasting where each element of the chain is a user of the product issued by the foregoing and the producer of the product used by its successor. The chain can be simplified as:

authors - typists - typographers - actors, singers - producer of the record - producer of a TV program - broadcasting corporation - set-owner - viewer.

Sometimes the interfaces between succeeding units aren't clearly detectable.

Similarly to SNA the measurement of production/accumulation/ consumption of information can in principle be accomplished at gross accumulated level and at the level of information added.

Information added in production activities at an economic unit *i* can be defined as a good analogy to [SNA92] as:

$$IA_i(dt) = P_i(dt) - C_i^{prod}(dt) \quad (22)$$

where $C_i^{\text{prod}}(\text{dt})$ is the annual productive consumption.

Owing to the lack of data, IA cannot be measured for each good and service, for input is frequently not recorded. While volume of newspapers, magazines and books is well known, the information consumed to produce this output can only be estimated at national level.

Information added can be accumulated, supplied or consumed or may be wasted.

$$IA(\text{dt}) = IA_{\text{cap}}(\text{dt}) + IA_{\text{su}}(\text{dt}) + IA_{\text{prod}}(\text{dt}) + IA_{\text{w}}(\text{dt}) \quad (23)$$

This is a classification of net production by its use.

4.4.7.1.3. Special Cases

4.4.7.1.3.1. Own-account Production of Services in Households

In [SNA92] the value of services produced for own consumption within households is not included in the accounts of the system, whereas the imputed value of goods produced for own consumption is included. The exclusion of own account services is justified on three grounds [SNA91]:

- "Services are consumed as they are produced so that services produced for own consumption could never have been intended for the market." I don't agree with this argumentation. A service can be intended both for the market or own consumption before its supply would be commenced. Just before commencing of the supply, such a decision becomes impossible.
- "The volume of such services is so large that it would be very difficult to impute economically meaningful figure for them." The argument is weak again. The larger the volume is the more its imputation is desirable.
- "Such a large imputation would tilt the balance of the system away from monetary transactions and greatly reduce of the system as a whole for purposes of policy making." Communistic regimes tend to annoy economic and not only economic activities in the households and eliminate all kinds of privacy. Share of economic and information activities by socially non-organized households and families is an important factor. Augusztinovics [Aug83] called the attention that neglecting the household production leads to anomalies like formal growth of GDP while it actually declines. Ignorance also may lead to the real growth of the organized sector. Instead of neglecting non-monetary transactions, statistics should measure share of non-monetary transactions as an important indicator of the society. For instance communistic regimes tend to annoy economic and not only economic activities in the households while eliminate most kinds of privacy.

- "The own-account production of services is a completely self-contained activity with relatively little impact on the rest of the economy." This is not true. When an individual decides to produce an own-account service in his/her household, he also decides not to produce a good which would be taken into account in SNA. By this, he also directly influences volume of production as defined and computed in SNA.

- "The vast majority of domestic and personal services are produced within households for own consumption. There are, therefore, no major markets whose prices can be realistically used to value household services."

This problem is not relevant to information. The very same techniques of estimation can be used for volumes of information conveyed by home and school education. Households when bringing up and educating new generations, produce human knowledge which is dominant in knowledge accumulation. Information exchange in the families is a factor which also cannot be neglected. The production and consumption of household information services will be included in SNIA. Of course, detailed balances we shall have on information production of economically organized sector only.

All these considerations favor that households' information services should be accounted in SNIA.

4.4.7.1.3.2. Production of "Originals" and "Copies"

[SNA92] pays great attention to the production of "intellectual property". "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 the 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 output of the first stage belongs to the originator (author, film-company, program writer etc.) It is treated as a fixed capital asset. Thus the first stage is the production of an intangible fixed asset possibly for sale or possibly for own-account gross fixed capital formation by the originator. ... If the original is sold, when it has been produced, the value of the output of the original is given by the price paid. ... 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 asset in the same way as usually. 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. ... In these cases, the owner is treated as providing services to the licensees that are recorded as part of their intermediate consumption.

In my opinion the [SNA92] treatment in more aspects doesn't cover the facts.

With origination, the originator of such a good attains to rights (copyright, patent rights etc.) and possibly to one or more copies of some information goods. Singers, actors etc. may not come by copies of information goods, but their performance is also

under protection. The rights are not bound to "originals". In case of computer programs, an "original" may be indiscernible from the copies. As a rule, the authors of computer programs write source code and distribute object code but both have "original" and copies. The transfer of an original copy (e.g. that of a manuscript) does not inevitably involve the copyright and vice versa.

In [SNIA] intangible assets weren't defined. The copies, whether original or not, to be used for making copies will be qualified as capital goods. The static rights won't be considered. Transfer of rights is considered as a service, as a result of which the works can be used by the licensee. The volume of service is equal to use of works. The service is consumed as productive consumption by the licensee.

4.4.7.1.3.3. Contribution of Nature

While accounting production, [SNA92] covers the contribution of nature to the creation or transformation of goods and services.

In an analogous way, the natural growth and decline of knowledge of individuals should be considered as production. However, we have no exact means and data for doing so. *Human knowledge* might be made proportional to IQ (which is a known function of age), but it is known that IQ is not directly related to the extent of "lexical" knowledge, it is related rather with the extent of short memory and operation speed than the extent of the long-term memory.

4.4.7.1.3.4. Illegal Production

There are practical difficulties in obtaining data on illegal production. There are two kinds of illegal production:

a/ The production of goods and services whose sale, or distribution, is forbidden by law like pornography or racist publications in several countries;

b/ The production activities which aren't illegal in themselves but which become illegal when carried out by unauthorized producers; e.g. unqualified medical practitioners, jurists or like illegal copying of videocassettes,.

[SNA91] recommends that both kinds of production are included and this is agreed.

4.4.7.1.3.5. Underground Economy

The underground economic activities should be within the production boundary of SNIA. [SNA92] applies the term "concealed production". This is production which was concealed to avoid payment of income, value added and other taxes, copyright fees, social security containments, minimum wages or completing statistical questionnaires.

4.4.7.1.4. Assign Value Terms to SNIA Figures in Natural Units

This is an important aspect, completely undiscovered so far. Practical application of SNIA arises an urgent need towards assigning value terms to SNIA figures. Unit costs influence stocks and flows of information.

4.4.7.2. Assigning Volumes of Information to SNA Production Figures

This can be done without essential difficulties in the corporate sector. In the rest of the sectors there are conceptual problems. This is a major research area which will not be discussed here.

4.4.8. Consumption

4.4.8.1. Information Consumption

4.4.8.1.1. Distinguishing Information Consumption and Use

SNA makes no distinction between "use" and "consumption". Use or consumption is considered as a process with a definite duration. Goods are assumed to be used and consumed at the same period when measured in value terms according to the principles of SNA. Nevertheless, a clear-cut principal distinction can be made when information terms are introduced in SNIA.

Under consumption of a copy of an information good or service its reversible or irreversible physical disappearance (annihilation or transformation) will be understood either as a consequence of repeated usage or building it into some good (like embedding e.g. firmware chips). In SNIA, consumption of a particular good or service is an event which occurs at a definite point of time and which is accounted after it had been completed, which has no direct counterpart in SNA.

Books, records and canned software packages are generally not consumed at one use. Non-durable signals and the information goods that will be built into some other good (in quality of a part or accessory) are to be consumed in a single production cycle. The information goods that are being used for repeated reading or display are consumed in more production cycles. Computer programs, books, files etc. have been being used for several years. The place and situation of consumption defines the consumer. Under volume of information consumed by a unit (shortly termed as information consumption of the unit), the sum of volumes of all copies of information goods and services consumed will be understood.

4.4.8.1.2. Who Consumes Information; Employee or Company or Both of Them?

When studying the case of TV-broadcasting signals, it is doubtlessly the household or individual who consumes them while (with his set) produces a visible for them program. The situation is less simple with the information - as oral and written

communications by business or office partners - consumed at workplace by an employee. Who does consume indeed the phone communication of an external/internal partner to an employee?

This is a fundamental problem, which radically influence the figures of information flow of the society.

The answer obviously depends on the structure of human information processing faculties and the relation between the employee and his employer defined by law.

Employment makes mostly hiring whose analogy is rent among inanimates. Now we can assume that the situation is analogous with renting a car. The information is analogous with gasoline, the renter with the employer and the employee with the car, who is his owner. Who consumes then the gasoline purchased by the renter? It is evidently the intermediate consumption of the rent-a-car company, whose service then will be supplied to the renter. In accordance with this, the following approaches are available:

a/ There are two communications (information services) supplied by the partner, one for the employee, and one for the employer who exists in the mind of its employee.

b/ There is one communication (service supplied) between the employee and his/her partner. Whenever the employee receives a communication, he/she transfers this to the employer, who - from information aspect - resides in a distributed form in the mind of its employees.

c/ There is one communication between the employer and its partner and then the employer - who resides in the mind of its employee - transfers this information to the employee.

d/ The partner supplies a service for the employee who supplies a service to the employer.

e/ The same as d/ but replace "employer" with "employee" and vice versa.

Thus our original question should be reformulated as "Who consumes which information?" and then answered according to version b/ if the assumption above were accepted. Then, this consumption will be considered as consumption by the employee and not that by the company. At the same time, this communication is used twice, once by the employee and second time - in a limited way - by the employer, and so is to be taken into account twice as use. As far as in most countries use and abuse with information is a known legal institution, further uses are subject to regulations.

If this approach is valid, then computerization has much wider consequences than this has so far recognized. Business information flow more and more will avoid employees, they will consume other kinds of information which may lead to an

alienation of institutions and units from their employees. Institutions and legal units will acquire and maintain more physical existence than they did before.

In chapter 4.4.3.2.9. the conclusion has been drawn that time use statistics are good for estimating volume of output of oral communications independently from the number of participations. The very same theorem is true for consumption and use, either.

The account extends to domestic units both for their domestic and foreign consumption of information of domestic and foreign origin.

Consumption of information goods is less problematic.

4.4.8.1.3. Kinds of Information Consumption

As far as the concept of "consumption" does not exactly coincide with that in SNA, subclasses also will differ.

4.4.8.1.3.1. Intermediate and Final Consumption in SNA

4.4.8.1.3.1.1. The Difference between Intermediate and Final Consumption

4.4.8.1.3.1.1.1. Intermediate Consumption

In [SNA] the intermediate consumption of industries consists of non-durable goods and services which are transformed or used up in production within the accounting period. In principle non-durable goods are goods which have an expected lifetime of use less than one year.

Two types of intermediate inputs can be distinguished. The first is that of materials and semi-processed goods. These re-emerge in the process of transformation to happen in the categories of ISIC A to F. The second type of intermediary inputs consists of finished goods which may be used for not only intermediate consumption: books, kinds of office materials, business services etc. These kinds of goods or services are generally entirely consumed. Transformed or consumed these goods must be entirely absorbed by the process of production during the period of accounting.

The intermediate consumption is recorded when the good or service enters the production process. The relevant purchaser's price is that prevailing at the time the intermediate input enters the production process.

4.4.8.1.3.1.1.2. Final Consumption

Final consumption of households is the purchase of new durable and non-durable goods and services reduced by net sales of second hand goods scrapes and wastes. Resident and non-resident households classified into outlays on commodities, other

new goods and services and second hand. Two concepts are employed as final consumption on the domestic market and final consumption of resident households.

The direct purchases that resident households of a given country make in abroad are part of the non-commodity imports of the country and of outlays of the households on other goods and services. Tourists, diplomatic and military personnel, seasonal workers, refugees, guest workers, A business traveler's information import for which company/agency provided.

4.4.8.1.3.1.1.3. Problem Areas: Distinguishing Intermediate Consumption of Information from Final Consumption

4.4.8.1.3.1.1.3.1. Benefits and Allotments to Employees

"Certain goods and services used up during the course of production do not enter directly into the process of production itself but are consumed by employees who are themselves working on that process." Is this intermediate consumption or remuneration in kind? When the goods and services are consumed by the employees at their own discretion and in their own time, their provision must be treated as remuneration in kind in [SNA91]. When employees are obliged to use the goods or services, this should be considered as intermediate consumption.

4.4.8.1.3.1.1.3.2. Working Tools

Goods and benefits acquired to the employees classified as payments i.e. final consumption in SNA, but the working tools employees are contractually obliged to purchase is intermediary consumption.

No adjustments are to be made for the fact that much expenditure by individuals such as an expenditure on the journey to work contain an element akin to business expenses. On the other hand, travel entertainment and similar expenses which are incurred by employees in connection with the business of their employer and for which they are reimbursed should be classified as outlays on intermediate consumption.

4.4.8.1.3.1.1.3.3. Distinguishing Intermediate Consumption from Fixed Capital Formation

Making tools and small items of equipment is shown as intermediate consumption though some of these outlays should be recorded as capital formation.

A part of repair and maintain activities, the outlays which lengthen the expected lifetime of a fixed asset or increase productivity or profitability. The maintenance and repair of a capital good which is already in use in production must be treated as *intermediate consumption*. Outlays on the repair and maintenance to keep fixed assets in proper working condition are classified as intermediate consumption.

Major renovations, reconstructions or enlargements, which both enhance their productive capacity and prolong their working time, should be handled as *gross fixed capital formation*.

Research, development and exploration should be treated as capital goods, but is treated as intermediate for practical reasons.

The used goods distributed are not recorded as intermediate consumption.

The goods purchased by government agencies for purposes of stocks of strategic material are excluded from intermediate consumption.

Durable goods acquired primarily for military purposes belong to intermediate consumption except durable goods purchased primarily for civil defense which is capital formation.

When a government service provides goods and services directly to persons the items acquired from industries or private non-profit services which are used in these activities should always be included in the intermediate consumption.

When industries or non-profit bodies supply services or goods to individuals directly which are paid for entirely or in part by the government service considerations should be taken for the degree to which government service organizes and controls the provision of the item and the extent to which the individual can choose the unit. If the individual is not free, then the government is the purchaser of the service. If the individual is free, the government's contribution is a transfer.

In SNA a sharp distinction is done between commodities (imported, produced or secondhand) and other goods and services in intermediate consumption due to evaluation problems.

4.4.8.1.3.2. Classification of Information Consumption in SNIA

4.4.8.1.3.2.1. The Traditional Distinction Between Intermediate and Final Consumption May Become Obsolete in an Information Society

SNA's ideology rests upon the idea that society can and should be divided to the sphere of production and the sphere of final consumption.

In an information society, wherever people are involved in information production mostly and this is done as home activity as well as office work, in a world of global business, when business and private life doesn't separate any longer in a rigid way, this distinction becomes artificial and misleading. To the contrary, governments should have the vision of a transitional dual society and a new information society without clear drawn boundaries between organized and non-organized spheres of society. In

these circumstances households' consumption cannot be considered any longer as final consumption. The distinction between intermediate consumption, capital formation and capital consumption remains relevant.

4.4.8.1.3.2.2. If the Distinction Were Made, the Boundaries Should Be Set in a New Way

When information is considered as a good, or a service, bringing up children is a significant productive activity of the parents which must not be considered as final consumption. Rubin [Rub87] accepted this view when computing GDP of the U.S. primary information economy. His computations gave a 150 billion \$ amount for the U.S. in 1980 as a contribution of families with home education to GDP.

The societies can and will say the last word in the question of classification. For example in the Eastern European countries, where people frequently refuse undertaking more than one child, it is frequently heard that the state should cover the expenses of bringing the children up. In an alienated society like this, people view at these self-services so as if they were external services and by doing so bringing up children became truly an external service indeed supplied for the state/nation, which will not be (and really isn't) supplied if not covered (by the state).

Also most government activities must not be viewed as final consumption. Ministries, agencies, departments and courts output information goods and services. Their consumption is vital for economy and should be qualified as intermediate consumption.

4.4.8.1.3.3. Classifications of consumption

These factors necessitate to classify information consumption by more ways.

Classification by the physical process to happen during consumption is as

- embedding,
- transformation,
- annihilation;

by subject of consumption by

- households,
- government,
- corporations,
- non-profit organizations; and

by purpose of consumption as

- productive/unproductive consumption,
- useful/useless consumption,

by *object of consumption*

- consumption of capital,
- consumption of non-capital goods and services.

4.4.8.1.3.3.1. Embedding, Transformation and Annihilation.

An information good can be consumed so that it will not exist any more in its kind, i.e. it is "transformed" *sensu lato*. A ROM-chip built into a computer or a photo glued into an album may be the examples of a similar action called embedding ($C_{em}(dt)$). However, the chip and the photo can be taken out of the incorporating good again and sold as a second-hand good.

An information good can also be consumed by its physical annihilation ($C_{ann}(dt)$), when a book is teared or a newspaper is lit and committed to the flames. Pièces of exposed but undeveloped photographic paper turn to photoes when developed. This called transformation *s.s.* ($C_{tr}(dt)$).

The latter cases are called real consumption.

$$C(dt) = C_{em}(dt) + C_{ann}(dt) + C_{tr}(dt) \quad (24)$$

4.4.8.1.3.3.2. Productive/improductive Consumption

When a (copy of a) new information product (good or non-durable/durable signal) will be formed as a result of consuming (a copy of) an information good or service, this will be classified as productive consumption opposed to unproductive consumption. Embedding and transformation of information goods are kinds of productive consumption.

$$C(dt) = C_{imp}(dt) + C_{prod}(dt) \quad (25)$$

An important case of productive consumption is when the information good or service is consumed in order to produce human knowledge. Obviously education and training belong to this category. Productive consumption bound to production of human knowledge is not easily contourable. Entertainment and amusement cannot mechanically be qualified as non-productive. Fundamental human situational and behavioral patterns are many times acquired during free-time programs.

In accordance with the general definition above, consumption by governments is mostly not unproductive consumption in SNIA. Contribution of governments in form of legislation, authoritative activities etc. is an essential contribution to society as well as economy. Failure of countries with ill construed government and state proves that a rigid separation of government from economy is harmful and doesn't reflect the processes present in the society.

Which is relevant indeed, it is use/consumption by households and consumption/use by government, i.e. sectoral distribution of consumption.

$$C(dt) = C_{\text{hous}}(dt) + C_{\text{corp}}(dt) + C_{\text{govt}}(dt) + C_{\text{nonpr}}(dt) \quad (26)$$

4.4.8.1.3.3. Useful/useless Consumption

Sometimes a copy of an information good or service is consumed without using it. When radio signals arrive at the antenna of a set which is switched off, the signals produce heat but aren't used. Also the parts of a copy of a newspaper with text that remains unread are not used. These exemplify useless information consumption ($C_{\text{usl}}(dt)$).

$$C(dt) = C_{\text{usl}}(dt) + C_{\text{use}}(dt) \quad (27)$$

5.4.8.1.3.4. Problem Areas

The problem areas in SNA contour the problem areas of SNIA.

Owners of databases are obliged to undertake periodically updating which are not intended to bring about a change in its performance. Databases are also regularly extended. While the former should be classified as repair or maintenance the latter is fixed capital formation.

The issue of consumption of office information by employees has been discussed in the foregoing paragraphs.

5.4.8.2. Volume of Information Accompanied to Consumption

The set of all goods and services consumed (as consumption was defined in [SNA92]) might in principle be considered and the volume of information of all goods and services under this heading could be estimated.

5.4.9. Use

5.4.9.1. Information Use

4.4.9.1.1. Definition

Use of information goods and services (shortly information use) is understood as occurrence of a physical access to them for their copying for recording, modifying or for any other purpose. Reading is considered an appropriate form of access. Volume of

information used ($U_i(dt)$) in an economic unit i is the volume of information carried by all copies of information goods and services used, also considering the number of uses. Volume of information used in the country is the sum of all information used by the resident economic units. Human use mostly takes the form of "reading", "sensing" or "perceiving". Use of information goods will be shortly referred to as "information use".

In Chapter 5.4.8.1.2. we dealt with the problem of "information consumption by employees" and decided that employees consume information. Their use of information goods and services should be accounted twice, once as an employee, and once as a private person.

4.4.9.1.1.1. Use of Human Knowledge

This definition makes some difficulty when applying to use of human information (i.e. human knowledge). It's obvious that human knowledge can be used by the individual and by other individuals or machines. The use of the individual's knowledge by himself is permanent and isn't subject to a discrete number of accesses. That's why this human information use can be measured in bit*time units rather than in bits alone. This problem can be resolved considering operating frequency of the brain which is at about 100 millisecc. This is ten---hundred times slower than the operation of individual neurons. The order of magnitude of the number of neurons is about 10^{14} . As far as number of neurons and particularly storage capacity of brain aren't known exactly, all the estimates are of highly hypothetic character and should be treated with precaution and for limited purposes..

4.4.9.1.2. Kinds of Use

4.4.9.1.2.1. Productive/improductive Use

When an information product (good, durable or non-durable signal) is used in a production process whose output is a product or service (commodity or activity), this is called productive use whose opposite is unproductive use. The amount of original information created can be obtained from gross production by subtracting the volume of information used productively.

4.4.9.1.2.2. Human and Machine Use

Both humans and machines are able to use information in the sense as this has been defined earlier. The events/processes when use is made by humans can be discerned from those when it is made by machines. Relation of human and machine information use should be an important long-range social indicator of an information society. Obviously, in technically advanced societies the function of information use is more and more provided by machines.

4.4.9.1.2.3. Capital Use

The use of information goods that are qualified as capital goods and that of human knowledge (by humans and machines) will be called capital use.

5. Accounting

5.1. Rules of accounting

SNIA should be based on the principle of double entry. Each flow ought to be recorded twice, once as a resource, and once as a use. Today statistics don't provide data for doing so. Transactions are not registered by both parties on accrual basis. Mostly supplier provides aggregated figures of production/ accumulation sometimes on transactions to change accumulation. No figures for use are provided. No hierarchic system can be built up. Balances are not made by economic units.

No information volume of money transfer at transactions will be recorded, which escort the monetary transactions. From point of view of information it should be desirable to view information carried by money at buyer, as information taken out of the accumulation and used for output.

Each transaction of this type should be normally recorded twice by the two transactors involved.

The accounts of the nation are not kept as those of a business unit by recording all flows incurring in a given period.

5.2. Imputation

Due to the uncertainties with human knowledge and non-digital products, the figures in SNIA, except those about digital products will not be as solid, as those in the SNA. Many times estimates or guesstimates will be used. These are called imputations into the system.

5.3. Consolidation

The transactions which occur between units belonging to the same sector are to be eliminated when sector level tables are made. Output, once measured at the establishment level is not modified, whatever the level of aggregation is.

5.4. Kinds of accounts

The following accounts will be defined:

Current accounts for
 production (VI.)
 primary distribution of income (VII.)

secondary distribution of income (VII.)
use of income (VIII.)

Accumulation accounts for
changes in assets and liabilities
changes in net worth (IX.)

5.4.1. Current accounts

Resources produced are put on the right side and consumed goods and services on the left side at current accounts. Balance sheets are represented with liabilities and net worth (the difference between assets and liabilities) on the right side and assets on the left.

5.4.1.1. Production accounts

Productive consumption was applied instead of intermediate consumption and obligatory supply of data and free information instead of taxes less subsidies on products, which are their analogons.

5.4.1.2. Primary distribution of income accounts

In place of *wages* and salaries and *employers' social contributions*, *transfers to employees* will be taken into account. Use of office information by employees will be considered as transfers to employees.

Taxes on products will be replaced by *obligatory supply of data* to domestic and foreign units.

Subsidies are substituted with *free information*.

5.4.1.3. Secondary distribution of income

SNA traditionally distinguishes primary and secondary distribution of income. It is questionable whether this distinction is reasonable for information accounts. Even the term "distribution" may assume and in Hungarian "elosztás" does assume a distributor who primarily and secondarily distributes money - and information.

Technically it is not necessary either in SNA to define a redistribution to explain the phenomena with taxes, social contributions and capital transfers.

In SNIA obligatory supply of data, free information and capital transfer in form of heritage and present belong to these categories. Public information like public TV broadcasting cannot be seen as a redistribution of information, because it evidently produces information and doesn't distribute it.

Free courses for the unemployed and handicapped might be accounted here

5.4.1.4. *The use of income accounts*

Productive consumption expenditure will be applied instead of Final consumption expenditure for many items, as it has been mentioned in chapter 4.4.8.1.3.2. Adjustment for the change in net equity of households on pension funds is meaningless and as such was deleted.

5.4.2 *The capital accounts*

5.4.2.1. *The changes in net worth*

Some terms of capital accounts of [SNA92] are hardly interpretable in SNIA. Intangible assets - as it was mentioned in chapter 5.1.1.2.1. – are not subject to SNIA. The account of non-produced information goods and services extends to open frequencies allocated to the country. To extend the frequency bands available to the country is an obvious way to add to net worth.

5.4.3 *Supply and use tables, input-output tables*

These tables will be adopted first in the SNIA.

6. *Projection of political issues onto the SNIA*

Several political issues can be formulated in terms of the SNIA, as Table 8. illustrates.

Table 8. A projection of a few political/regulation issues onto SNIA

<i>Industry</i>	<i>Stocks</i>	<i>Exports</i>	<i>Imports</i>	<i>Production</i>	<i>Use</i>
Mass communication	Availability	Ethnic minorities in foreign countries, overspilling, access to frequencies	Protection of domestic producers and culture, difficulties in financing	Freedom of press, public vs. commercial stations, monopoly, right to influence, advertisements	Access to foreign programs, information capital/waste
Education		Stipends to foreign students, support to the members of the nation living in minorities	Foreign support to domestic ethnic minorities, stipends for domestic undergraduates	Scope of responsibility of the state, obligatory courses, independence of the schools, formation of national elite	Supports to talented and handicapped, equal opportunity in rural regions
Research and		Brain drain,	Provide necessary	Incention of	Patent protection

development		support domestic innovation	high-tech to armed forces, stipends for domestic graduates, support adopting foreign innovation	innovation, selection of progressive areas, patents info system	
Statistics	Exploitation of official statistical data	Monopoly of official statistics to inform international organizations, distribution of statistical information in abroad, export of methodology	Access to international databases, participation in international projects, import of methodology	Monolithic or oligopolistic statistical service, balance among central government and independence, public service or science, statistical self governance, sovereignty of the country	Data of individuals, privacy, freedom of information, interface with the private sector, intraagency flow of information
Central government	Exploitation of administrative databases, access to government data, classification, interface with the private sector, public information goods	Access to databases of international governmental and non-governmental organizations, standards	Access to domestic governmental and non-governmental databases by foreign clients	Public information goods and institutions	Interagency flow of information, "One-window" system