Increasing the Accuracy of the Information Load Annual Growth Evaluation on the Internet of Things

Igor Zhukov [1] [0000-0002-9785-0233], Nickolay Pechurin [1] [0000-000-1727-7455], Lyudmila Kondratova [2] [0000-0002-9170-4198], Maksim Iavich [4] [0000-0002-3109-7971] and Kalyy Yerzhanov [4] [0000-0003-3166-3715]

[1] National Aviation University, Kyiv, Ukraine
[2] National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute", Kyiv, Ukraine
[4] Scientific Cyber Security Association, Tbilisi, Georgia
[4] Yessenov University, Aktau, Kazakhstan
zhuia@ukr.net, nkpech@i.ua, kaly7524@gmail.com

Abstract. The paper is devoted to the problem of assessing the primary information load on the Internet of things, i.e. assessing the amount of information that enters the network directly from things that are and are only generators of information (issues of information consumption by "things" are beyond the scope of this article). Having advanced the postulate that the amount of information emanating from a thing, is proportional to the product of its mass (thing) by its specific orderliness, it is concluded that it is possible to use a model similar to the V.V. Leontyev model of interindustry balance. In the proposed network (graph) model, balancing is performed not according to the volumes of generated things, like Leontyev's, but according to "volumes of the generated order". The proposed balance model will make it possible to more accurately predict the development of the Internet of things than this can be done, for example, using time series.

Keywords: Internet of Things, Information Load, Balance.

1 Introduction

The successful resolution of the vivid problem of computer engineering and sciences, the creation of global systems of artificial intelligence, is impossible without constructing a reliable picture of the state and prospects for the development of their (systems) infrastructure, which is a global cyber-physical system (network), often referred to as the Internet of Things [1]. One of the indicators characterizing the state of the Internet of things is the total amount of primary information generated over a fixed period of time and entering the network. That search for the source of relevant data to evaluate the (primary) load on the Internet of Things, led the authors to the following considerations about the possible ways of evaluation of this indicator. The amount of information generated by an individual thing is determined by the degree of its (dis) ordering (Boltzmann, Shannon et al), and its total volume is also determined by the number of these things. But these two parameters form the basis for assessing an indicator completely alien to the problems of artificial intelligence and the Internet of Things - an indicator of the welfare (prosperity, efficiency, proximity to the “first world” etc) of the state achieved during the year, which, as usual, is macroeconomic indicators such as GDP, GDP for PPP, GNP, IPP etc). The concept of gross domestic product, introduced in 1934 by Simon Kuznets (the annual market value of consumed, exported and accumulated goods (and services)) has since been successfully used to evaluate and compare the economic power of countries. This indicator could be used directly to solve the problem of determining the total amount of primary information generated over a fixed period of time (here - for a year) and transmitted through the sensors to the network. However, by default, the modern understanding of this term is that GDP is not only goods (carriers of the material world, i.e. things that are the subject of our interest), but also services. Kuznets GDP only indirectly represents the country's capacity for the production of things - goods (and therefore, primary information for the Internet of things): it is rather not the result of the production of things (ordering the world under the Moon - the construction of buildings, bridges and ships), but the process of ordering it. GDP is the mass of the annual water flow of the Dnieper (Volga), the result of streamlining is silt in the floodplain, and the service disappears without a trace in the Black (Caspian) Sea. First of all, a sensor (microprocessor) is put on a thing, not a service. In general, if we consider only a thing on which you can establish the primary (or terminal — which side to look at — the last mile / li / lee / verst / kilometer) Internet of Things device, then Kuznets GDP hides the true picture [2].

Another circumstance associated with classical GDP should be mentioned. Having made the natural assumption that the price of a thing (one of the arguments of GDP etc), as an object of the material world and goods, is rigidly related to the degree of its order (things), we conclude that the significance of a thing as a generator of primary information of a network of things, in GDP taken into account by its market price, is an increasing function of the degree of ordering of things. It is ordering that must give rise to the true price of a thing, and, therefore, indirectly the amount of information associated with it. However, in practice, a ton of coal (a thing that has a certain fixed value) has different prices, if you count in Donetsk or Rotterdam. The article is devoted to the problem of estimating, on the basis of GDP in value (money) terms, the primary information load on the Internet of things, i.e. estimating the amount of information received, through terminal software and hardware devices, to the network directly from things that are and only are information generators. The issues of information consumption by “things” are beyond the scope of this opus. The selected indicator is an indicator carefully monitored by international research organizations, it contains indirect data on the intensity of primary information flows [3,4].

The first step in formalizing a task is to accept the principle of its decomposition. If the development of a global (world) computer network of things is predicted, then it is proposed to decompose it into more than two hundred interconnected subscribers, the economies of states that produce the corresponding volumes of things. If the development of a regional network is forecasted, for example, at the state level, then one of the possible ways of decomposition is to decompose it into interconnected sectors of the economy, acting as subscribers-sources of information flows to the computer network of things, as is done in the classical V.V. Leontyev model of inter-branch balance.

The usual period for issuing statistical information (on GDP, PPP GDP, GNP, IPP and the like) by global and regional monitoring organizations is one year, so in this article the unit of measurement of the intensity of information flows [10-12] is [information units] / year.

Assumption. The source of primary information for / in the computer network of things are things themselves, i.e. material objects ordered to a certain extent. In other words, the postulate is advanced: the amount of information coming from a thing, taken into account by the GDP indicator, is proportional to the product of its (thing) mass by the degree of ordering of a unit of mass, i.e. specific ordering.

Then the intensity of the general information flow is composed of the flow from existing (operated) things and from things that are added during the year and the latter is represented by GDP. GDP in value terms contains only aggregated, indirect information about the intensity of the real physical flow of produced things.

The task is to find a method for estimating, on the basis of a macroeconomic indicator of GDP, the intensities of the physical flows of manufactured things, respectively ordered for the subsequent calculation of the intensities of the primary (input for the network, the “first mile”) information flows of the computer network of things – the Internet of Things [13-16].

The use of GDP of PPP, GNP and other indicators that additional distort the essence of things is not considered in this opus.

2. Approaches and issues using GDP intensities to estimate the increment of the primary data flows

The initial prerequisite when using the GDP indicator to assess the intensity of information flows is this: the (sought) intensity of the primary information flow appears to be an increasing (non-decreasing) function of GDP.

There are a number of approaches to using GDP to solve the problem of estimating the annual increase in the information load on the Internet of Things.

The first, obvious approach to solving the problem is to directly use the values of GDP in the formation of the time series for forecasting.

Along with the known shortcomings of universal forecasting algorithms based on time series, we have a relatively short time series due to the novelty of such an object of study as the Internet of Things [5].

Another mistake that arises when solving our problem of estimating by the values of GDP arises due to the convolution, in classical GDP in value terms, of two components: the annual volume of goods produced, i.e. things for sale, and the annual volume of services (in the context of this article is noise).

Another approach is to use only a part of the GDP indicator, namely, the intensity of production of goods: the additive nature of the convolution allows us to identify the component of GDP associated with the production of things (GDP in the physical dimension).

The carriers of information coming into the network of things from end users' terminal devices per unit of time are the "things" themselves, i.e. the material objects provided by the I / O devices, which can be played by various software and hardware, in particular, the executable devices. and (intelligent) sensors [6].

Therefore, the next approach to assessing the initial information load is to evaluate the intensities of the flows of precisely “things”, on the basis of which data are obtained on the intensity of information flows coming from each of the sources (network subscribers). In addition, as in the approaches discussed above, it is also necessary to establish a (functional) relationship between the intensities of the flows of each type of thing and the corresponding information flows.

This method is difficult to apply directly because of the complexity of the relevant multi-product model and the lack of a monitoring system.

The circumstance that generates another approach to the use of the GDP indicator for assessing the increment in the intensities of primary information flows is that the values of GDP for a particular subject (GDP_i) are not independent, their values are affected by the nature of the relationship of the subscribers. In particular, these interconnections can be determined by the technological aspects of the production of things, if the subscriber is a (macro) economic subject, then these interconnections can be formalized on the basis of the inter-industry balance model of V. Leontyev [7].

In fairness, it should be noted that GDP is not the only traceable indicator on the basis of which the intensity of primary information flows of the Internet of Things can be estimated.

An alternative may be the level of "produced" greenhouse gases, but scientists here have to rush in order to forestall the young northern researcher, who, if she has recently achieved her goal, will reduce this figure to nothing.

3. Statement of the problem for building a model for estimating the annual increase in the information load on the Internet of Things with increased accuracy

Assuming that the amount of generated information is a non-decreasing function of GDP, we come to the corollary that the increment in information flows generated by the state is greater, the higher the level of its well-being. The generally accepted notion of the contribution of states to national and global welfare (progress) is illustrated either by the number of things that appeared in the current year (in recent years), measured by the volume of GDP produced in the same year (in recent years), or per capita GDP or derivatives of these indicators such as GDP PPP, GNP, IPP and the like, where GDP refers to the amount of gross value added created by all resident producers in the economy of a given country, plus any taxes on products and minus any subsidies, not included in the cost of production.

By default, such a design describes the real balance of the achievements of countries in the (material) development of the world.

Definition. Country OZ = state OZ = world territorial community OZ (hereinafter - OZ).

Definition. Up to the provisions of existing international law, OZ's own material resource is understood to mean the material world observed in a cone with a center in the center of the Earth and generating rays passing through an administrative border or a border including exclusive economic zones, OZ.

Assumption. During the astronomical year (the period with which the GDP indicator used in the article and the like is associated) the mass and ordering of one's own material OZ resource in a natural way, i.e. without the direct participation of a person, it does not change: a ton of oil recovered by an Azerbaijani is not replaced by a corresponding underground natural influx from Iran; a ton of graphite in a cloud from the vicinity of the Uzh river does not fall on the cranberries of Belarusian marshes; the ozone layer is fixed all year and lies within the above-described cone; a mass-order resource received from the Sun is located over and in Sahara for a whole year, not being mixed by dust storms in the EU states.

In an attempt to break the silence for many years, the authors dare, in the spirit of Karl Marx, as well as Friedrich Engels ("question everything!"), To doubt that the balance of achievements of the countries (and, accordingly, each citizen of the country) in the material development of the world (and therefore the loading of the Internet of Things), measured using the above indicators (the degree of ordering of the latter) really reflects the changes in the material world in the direction of its ordering that are carried out by a specific country (citizen of the country). Doubts, for example, are the assertion (see estimates of GDP and similar indicators in [3]) that in 2018 the Swiss produced products (GDP - face value per capita = $ 80,690 USD) twice as much as a German (GDP - face value per capita population = 44 549 US dollars), and that, in turn, is four times as many Russians (10 608 US dollars). Taking into account the circumstances of inclusion of the services provided in the GDP (through the use of IPP etc) does not reduce the intrusive contrast of the picture of the achievements of world territorial communities in the development of the material world (guidance of the world material order of things). The technology is incomprehensible (we will leave the considerations of current, in the sense of the present, socioeconomists outside our vision), according to which the Swiss, having received a cubic meter (weakly, but not to the zero degree) of ordered propane-butane, will disorder part of it in order to order the remainder so that "amount of order "in this remaining part of the initial number of carbon, hydrogen, etc. atoms - see the table of Dmitriy Mendeleev, so (strikingly, according to the estimation by GDP) differed from the received" amount of order ". It is possible to restore order on a fixed subset B of the set (atoms) A only by disordering the set I - the complement of B to A. In the example of the Swiss "hard workers" (producers of GDP), the observed striking differences were explained (and are explained) by the striking difference in the efficiency of the (Swiss) technology of the redistribution of order between the atoms of the gas cubic meter mentioned above. Introducing, for simplification, the concept of specific ordering as the strength (power) of bonds assigned to one atom (or unit mass of matter), we have a possible estimate of order strength (quantity) on the set A as the product of the number (mass) of atoms of the set A and the force (power) of bonds assigned to one atom (or unit of mass), i.e. specific ordering on the set B. Similarly, a possible estimate of the order strength (quantity) on the set I can be estimated as the product D of the number (mass) of atoms of the set I by the specific ordering on the set I. The T / D ratio can serve as an indicator of (technological) development - in 2018, for the Swiss, this indicator is 8 times higher than it is for the hard worker - Russian. Puzzling is the fact that over time the Swiss manages to produce twice as much "order" than the German (of the order in the Tissot more than in Siemens?).

The ultimate goal of constructing this model is to provide an a posteriori opportunity to verify the adequacy of the existing model of interstate balancing (orderliness of the material world), built on macroeconomic indicators, where things are considered as goods with value, and ordering is the addition of (added) value - see works already mentioned, not in vain, the unforgettable and eternal Karl Marx.

The task is to synthesize a model of balance of (state) achievements based on the usual, at least for the domestic population, criteria: the degree of ordering of the things of the material world in which they live (and for some time they hope, with the permission of the Almighty, to continue) the authors of this article. At the same time, it is supposed to evaluate its applicability for solving the problem of estimating the increment of the primary information load on the Internet of things with increased accuracy.

4. The problem solution in building a model for assessing the annual increase in the information load on the Internet of Things with increased accuracy

Definition. A thing is called a physical object, in most cases equipped with a (intelligent) sensor [6] and connected, with the help of the latter, to a computer network of things. A thing generates a primary information stream (a stream of the first verst) of the corresponding intensity, measured by the amount of information generated per unit of time (a kind of bitrate). The C_2H_5OH molecule is a thing at the micro level; here her model is an oxygen atom bound in a single whole, two of carbon and six of hydrogen.

Assumption. The minimum (degenerate, atomic) thing here will be considered the atom, as represented by Democritus, and somewhat later, two thousand years, used by Dmitry Mendeleev (electron, positron, neutron and others like them are not considered in this article, although it is intuitively felt that there will be no fundamental differences in this detail). Those who wish can use newer models such as Higgs particles instead of the democritic term.

Statement. In the material (Earth) world of countries, the law of conservation of “mass of order” is valid (similar to the law of conservation of matter and energy), where by mass of order we mean the product: [mass of one thing] • [degree of order associated with one thing] • [number of things], i.e. at the atomic-molecular level - something similar to the entropy indicators of Ludwig Boltzmann's companions (if he really had the latter).

In other words, [mass of order] = [degree of order associated with one thing, i.e. specific degree of order, specific ordering] • [mass of one thing] • [number of things] = [specific ordering of things] • [mass of one thing] • [number of things].

At the molecular level of consideration, an example of one thing is the C_2H_5OH molecule: [mass of one thing] - the total mass of atoms forming this molecule [degree of order associated with one thing, i.e. specific degree of order, specific ordering] can be measured by the degree of "approximation" of the binary relation existing in the molecule (binary valence bonds between atoms, see the structure of the molecule) R to the linear order relation L or to the lattice. This proximity can be very approximately estimated by the ratio of the total possible number of distinguishable bonds to the number of bonds forming a linear order, i.e. transitive fault power R; I must say that this measure is a function of only the number of atoms that make up the molecule, and does not characterize the degree of ordering of the molecule itself, however, using this (naive) measure greatly simplifies the task of assessing the degree of specific ordering of a thing, similar to how the use of the logarithmic function greatly simplifies the procedures estimation of entropy, allowing the effective application of the famous constant of $1{,}3806488(13)\cdot 10^{23}$ Joule /K.

At the macroeconomic level, the order mass index is currently measured as the product of the mass of matter and its value (cost), i.e. represents the material component of GDP: [mass of order] = [degree of order associated with one thing] • [mass of one thing] • [number of things] or, to simplify macroeconomic monitoring and calculations, [mass of order] = [degree of order associated with a unit of mass of things] • [mass of things].

Let us dwell in more detail on the introduced mass order index (see also the use of the Boltzmann constant in calculating the entropy of the thermodynamic state S = k * W, where W is the number of corresponding microstates), associating it with indicators of the theory of relations.

Let there be a set M of 5 things {a, b, c, d, e}, in which an arbitrary element a can be (or not) in relation to element b, and the combination of these elementary relations forms a (binary) relation on M. The total possible elementary relationship is 52 = 25. Putting order on M includes the following steps.

1) Partitioning M into a subset of things-products of ordering TP and a subset of things-the results of disordering DE, i.e. things - sources (energy) for ordering.

2) Checking the sufficiency of the resource (the presence of elementary relations) to establish order, ideally linear, on TP. In fact, this is the presence of one and only one route, which includes all the TP elements once, where the existence of a direct path from a to b is equivalent to the fact that a is in elementary relation with b. In this case, elementary connections between DE elements can be used, and their use is the resource (energy) consumption from DE. A negative test result indicates that the available resource of mass of the order is insufficient for the complete ordering of TP (i.e., it is impossible to convert TP into a final product (product)).

3) Streamlining TP. Here you can use different ways of ordering, for example. - algorithms, presented in due time by Donald Ervinovich Knut, of arithmetic or logical multiplication of matrixes of elementary routes. If an elementary route from DE entered the route, then this order element is excluded from D, thereby decreasing the

ordering index D. If the route does not include elements from DE at all, then this is evidence that “the subject of the transformation of nature” (Swiss hard worker in our example) actually does not produce anything, but only reproduces the resulting order (not production-ordering, but a transaction).

The described allusions of ordering with the constructions of the theory of matrices and relations are (unnecessarily) cumbersome, complicate the understanding of the idea of constructing a model of balance in the generation of the material world (things), and therefore, for simplicity, the quantity of order is not associated with a system of atoms (things), but with each individual atom (thing) by attributing a thing to the degree of its (thing) inclusion in an ordered system, which, at a certain level of abstraction, is called the final product. The concept of the valency of an atom in chemistry, the valency (degree) of a vertex in graph theory - this is an indicator of the degree of “inclusion” of a thing (atom or vertex of a graph) in an ordered system.

Assumption. The increment in the intensity of the primary information flow is determined solely by the increment in the number of newly created (produced over a selected period of time) things; the set of distinguishable entities creating (producing) things is given.

The mentioned subjects, with the number n, are the subscribers of the created network of things (intelligent sensors of the first verst).

Thus, the essence of the problem is to find a way to more accurately assess the intensity (bitrate) of flows generated by things produced by the entire population of subscribers, a group of subscribers (for example, countries - manufacturers of things), as well as individual devices.

The unit for measuring the intensity of production - a source of information load on the network, adopted a conventional unit - US dollars. Thus, there are n producers of gross product, each of which (manufacturers) generates streams of primary information entering the network (determines the information load on the network).

As already mentioned, a method for treating chronic illness of forecasting based on time series is proposed, based on the construction of a dynamic algebraic (single-product stream) model that takes into account the interconnection of parameters on the basis of which the time series is built. At the same time, we expect greater accuracy in estimating the bitrate than when taking into account relationships by using various “autocorrelation” methods (AR, MA, ARMA etc) and, possibly, methods of the MGUA type (for the latter, at least, in terms of the “accuracy of the estimated bitrate” / labor input ”) [8].

By the way, considerations of what exactly is semi-voluntaristic, for example, economists and exchange experts from Rotterdam will forgive us (politicizing), setting the price of a thing when measuring the volume of manufactured goods in terms of GDP (PPP GDP) can significantly reduce the accuracy of estimating bitrate (for now, within the scope of this article), out of brackets.

For each i-th subscriber, we introduce S_i, T_i, D_i - values proportional to the intensity of the flows of things actually generated, accumulated during the observation period, used by the i-th subscriber in the production process, respectively.

By the way, if we assume that the system obeys the balance condition according to V.V. Leontyev $E \cdot X_E^T - A \cdot X_E^T - R^T = 0$ [9], where the technological matrix A takes into account the scattered part of the flows of things consumed during the production process within the i-th industry (i-th subscriber in our context), then Ti is associated with R_T, D_i - with elements of the main diagonal A.

5. A model for assessing the annual increase in the information load on the Internet of Things with increased accuracy

Balance condition α. In a balanced system, the law of conservation of matter is fulfilled; the authors could not resist the temptation to once again enjoy, hopefully, together with the reader, his presentation in the style of Mikhail Lomonosov in his letter to Leonard Paul Euler: "... all changes in nature occurring, the essence of the state is that how much what one body will be taken away, so much will be added to another, so if where some matter disappears, it will multiply in another place ... "

In our case, this is a system of $X_{iS,i} + \sum_{j=1, j\neq i}^{n} X_{ji} = X_{i,iD} + X_{i,iT} + \sum_{j=1, j\neq i}^{n} X_{ij}, \ i = \overline{1,n}$.

Here $X_{nS,n}$ is a value proportional to the intensity of the flow of things generated by the subscriber itself n. If the country's economy is the subscriber, then $X_{nS,\ n}$ is a value proportional to the intensity of the flow of natural resources (mineral and biological) extracted (per year), labor resources can also act as a carrier (generator) of information (sorry for the association with the word "thing" but you won't throw a word out of a song!). $X_{n,\ nD}$ is a value proportional to the intensity of the flow of things used by subscriber n in the production process. If the economy of the country is the subscriber, then $X_{n,\ nD}$ is a value proportional to the intensity of the flow of consumed resources — own and borrowed; this may include, for example, a hundred tons of the mass of (chemical) SO_3 radicals and H_2SO_4 molecules scattered in the ambient air from the Chemical Technology Plant No. 512 on the left bank of Kiev in 1991 (the information source [4] does not provide statistics on this facility today because of the untimely the demise of the latter). As a rule, this is the value of the "destroyed" (dissipated) resource for energy production (in turn, spent on the production of things); and this part of "things" ceases to be associated with a particular subscriber. Nevertheless, further, within the framework of the article, we will assume that the mass represented by the variable $X_{n,\ nD}$ does not leave the limits of the economy that generated it (see the assumption above). $X_{n,\ nT}$ is a value proportional to the intensity of the flow of things accumulated by subscriber n during the observation period. If the country's economy is the subscriber, then $X_{n,\ nT}$ is a value proportional to the intensity of the flow of things produced during the year (actually, national wealth).

Balance Condition of β. The assumption is made that there is a direct linear dependence of the amount of information generated by the i-th subscriber and entering the network per unit of time on the intensity of the flow of things; of course, the thing itself is only a carrier of a terminal device (an intelligent sensor [6]) - actually the generator of primary information of the first verst): $C_{ij} \cdot X_{ij} = B_{ij}, \ i, \ j = \overline{1,n}, \ j \neq i$

For $S_i, T_i, D_i \; (i=\overline{1,n})$ $C_{iS,i} \cdot X_{iS,i} = S_{iS,i}$; $C_{i,iT} \cdot X_{i,iT} = T_{i,iT}$;
$C_{i,iD} \cdot X_{i,iD} = D_{i,iD}, \; i=\overline{1,n}$.

Here the coefficient coefficient of C_{ij} is the specific ordering of the flow of things, estimated value of X_{ij}: the more streamlined the unit of flow of things, the greater the magnitude C_{ij}. If the subscriber is the country's economy, then C_{ij} is the price attributed to (unit) of X_{ij}.

Balance condition of γ. This type of balance is the (macro) economic expression of the law of conservation of energy. There is performed the balance of information flows values: $C_{i,iT} \cdot X_{i,iT} + \sum_{j=1, j\neq i}^{n} C_{ij} \cdot X_{ij} = G_i, \; i=\overline{1,n}$

or in matrix form: CX = G.

Balance condition of δ. There are satisfied the natural conditions of non-negativity for the variables:

$$X_{ij} \geq 0, \; i, \; j=\overline{1,n}, \; j \neq i \, ,$$
$$X_{iS,i} \geq 0 \, , \; X_{i,iT} \geq 0 \, , \; X_{i,iD} \geq 0 \, , \; i=\overline{1,n}$$
$$C_{ij} \geq 0, \; i, \; j=\overline{1,n}, \; j \neq i \, ,$$
$$C_{iS,i} \geq 0 \, , \; C_{i,iT} \geq 0 \, , \; C_{i,iD} \geq 0 \, , \; S_{iS,i} \geq 0 \, , \; T_{i,iT} \geq 0 \, , \; D_{i,iD} \geq 0 \, , \; i=\overline{1,n} \, ,$$
$$B_{ij} \geq 0, \; G_i \geq 0, \; i, \; j=\overline{1,n}, \; j \neq i$$

Features of model constructions. The constructions of γ – the essence of a system of nonlinear equations with the additional restriction of non-negativity of δ. Here (n(n-1) + 3n) = n(n+2)) variables of X; as many it is C and B; the variables of S, T, D, G are on n. Total equations it is (n (block a) + n(n+2) (block b) + n (block c) = n(n+4)).

The generated model describes the interconnections of the Internet of things subscribers, however, it has no pragmatic meaning (estimating of X) and therefore requires an external supplement.

The first step here is to eliminate the component of GDP, which is to a small degree related to X, which is the “volume of services” component. The adoption of assumptions that GDP is an additive function of the volume of goods and services produced, as well as the ratio of the volume of goods produced to the volume of services rendered, is a constant for the planning period, allows you to use and trust, at least within the scope of this article, the values presented, for example ., in [3,4].

As follows from the foregoing, by S, T, D, G we understand the “material” parts of GDP as truly generating information flows of the first verst. The obvious, possibly compromising highly intelligent manufacturers, naming the remaining part of the "imaginary" part of the GDP - by chance. Manufacturers of high-value “ideas” [1], that is, high-tech and even more so-high-value intellectual property products, probably do not require protection of ways of setting prices for their products, although …

Suppose that the efficiency of production technologies of things (processing of resources, streamlining of matter coming from outside and inside, adding value to matter) are constants: C_{ij} = const.

Then we have a homogeneous SLAE with a matrix of structure coefficients as shown above.

If the subscribers of the Internet of things are territorial associations (state economies), it is natural to assume that the “mass of the state” (literally!) Does not change over time or changes slightly (of course, in the context of the picture of changes in this indicator in many economies of other states , and not in relation to the "mass" of the state itself), or the mass of the substance forming (possibly only potentially) its (state) "thing value" changes insignificantly, i.e. under the assumption $C_{ij} = 1$ ($i, j = \overline{1, n}$) $\sum_{j=1, j \neq i}^{n} X_{ji} = \sum_{j=1, j \neq i}^{n} X_{ij}, i = \overline{1, n}$.

Having made the (natural) assumption that the material component of GDP is the resources ordered by various technologies from the sources that have these resources, we come to the identification of the possibility of using multi-product flow models in the network, the nodes of which represent economic entities that have the technologies for organizing resources.

Let us introduce the assumption that subject i has the only type of source in the technological chain (-s), of resource; he builds his strategy for managing them in such a way as to ensure a cycle in the graph (network) starting at i such that the sum of the weights of the arcs included in this cycle is maximal (here the weight of the arc i, j represents the amount of produced things related to the supply of the source resource from subject i to subject j).

The predicted values of the components of GDP obtained by analyzing this model are the ones required to determine the correct resource allocation strategy for creating the appropriate Internet of Things infrastructure. The model parameters are built on the basis of data received from monitoring systems, and the essence of the determinate values obtained, as we see it, as the expected value of the corresponding estimated values. Thus for the estimation of the expected value the selection of values of constituents of GDP is used, length of that is related to the depth of prognostication.

In case of the use middle on the values given in the system of monitoring, with subsequent application of algorithms of type of algorithm of Floyd, there is the known risk of "error middle".

The case of the use of supposition is possible, that weight of arcs are casual sizes, conformable to the different laws of probability distribution.

If dates are stochastic, we come to the conclusion, that here distortion of results is also possible for the parameters, related to the subjects, possessing "eventual", in economic sense, technologies (by subjects at the end of technological chainless): similar to foregoing, "error of middle", arising up at calculations on networks.

The point is that external addition of this model can be limit on the level of future GDP for some subjects of economy, caused, for example, by their unwillingness to exceed some set level of height of GDP (for example – in a 3% a year).

This circumstance is expressed, in particular, by the considerable increase of stake of high-frequency constituent in the spectrum of corresponding function of distribution, and consequently, using of mean value for forming of elements offered to using as a model, can result into the bias error in the estimation of actual value GDP (or making GDP).

On other words, a macroeconomic situation is such presently, that the known assumptions accepted for simplification of model for multiphase service system of type of supposition about independence of L. Kleinrok [8], accepting is impossible from a nascent systematic error.

A model was approved on the example of balancing, in the sense accepted in this article, five state associations which have greatest resources.

An analysis of this special model showed that such is not, generating the informative stream of the first mile, stream of things on the network of the subscribers incorporated in the computer network of things, that the condition of material (thing) balance (type of inter-branch V. Leontiev in natural expression) was executed.

The model offered in the article was also applied for balancing taking into account mass ordering (resource) acting Sun.

As a result of her research (with the use of accessible to the authors of data) drawn conclusion that the energy (mass ordering) got from sunny batteries can not be examined as "got from proceeded in energy sources", not only that is why, the power resource of a Sun limits.

Technological matrix in equalization of balance such, that balancing roots do not exist: disordering at creation of the technologies, presented by this matrix , the arrived at organization exceeds, presently.

6. Conclusion

Money mode GDP may be used to estimate year information flow growing to Internet of things with carefulness. More exact, then money mode GDP scale of year information flow growing to Internet of things, will be year mass order growing: GDP produces systematic mistake under year information flow growing to Internet of things estimation. Account, in the offered (by a stream) model, connections at the "production of order" increases exactness of evaluation of annual increment of the informative loading on the internet of things. The faze by faze changes of efficiency of primary resource, estimated by classic Karl Marcs addition of cost, for the aims (at least) of evaluation of annual increment of the informative loading on the internet of things, it is necessary to replace the increase of degree of efficiency. And exactly the degree of efficiency of thing determines her price in the conditions of the balanced system. The simple network model gives acceptable results at the evaluation of annual increment of the informative loading on the internet of things only on condition of absence of subjects, a production of things volume is related that to the functions of distribution with a wide spectrum. At presence of the indicated productive things

subjects, it is necessary to use (more difficult) the stochastic network models of multifood streams and corresponding methods of their analysis.
An increase of the informative loading on the internet of things from a concrete subject also is the certificate of successes of the last in strengthening own welfare: than anymore he generates to information on the first mile, the anymore prophetic a subject put (certainly, due to the disordering subsets of other things) in order. An existent estimation of successes of subjects is on business of strengthening of own material welfare measureable the degree of efficiency of accessible great number of things, on the basis of GDP in a money term, is not objective: making GDP generate equalizations of balance, not having non-trivial decisions (and we have no nontrivial appropriate flow task solving).

References

1. Kevin Ashton. That ‘Internet of Things’ Thing. In the real world, things matter more than ideas, RFID Journal (June, 22,2009).
2. The Last Mile Became to First, First Mile, 2017, vol. 4 (2017), pp. 10-17.
3. The World Factbook / Central Intelligence Agency. Retreived from www.cia.gov.
4. State Statistics Service of Ukraine. Retreived from www.ukrstat.gov.ua.
5. Pankratova N.D., Kondratova L.P., 2019. System strategy for guaranteed complex engineering system functioning in real operating conditions. Problems of Control and Informatics. 1. pp.1-11 (in Russian).
6. Voitovich I.D. Intellectual sensors, Ukraine. Science and culture, 2009, vol. 35, pp. 106-111 (in Ukrainian).
7. Zhukov I.A., Pechurin N.K., Kondratova L.P., Pechurin S.N., 2016. The allocation of resources in the computing cluster for UAVs Problems of informatization and management. vol. 3 (55). pp.1-5 (in Russian).
8. Zhukov I.A. Implementation of integral telecommunication environment for harmonized air traffic control with scalable flight display systems, Aviation, 2010, №14(4), pp.117-122.
9. Zhukov I. A., Pechurin N. K., Kondratova L.P., Pechurina O.O., Method of evaluation of intensity of the primary information flows, generated by computer network network components. Science-Based Technologies. 2018, vol.3 (39). pp. 308-313. (in Ukrainian).
10. Mazin Al Hadidi, Jamil S. Al-Azzeh, R. Odarchenko, S. Gnatyuk, A. Abakumova, Adaptive Regulation of Radiated Power Radio Transmitting Devices in Modern Cellular Network Depending on Climatic Conditions, Contemporary Engineering Sciences, Vol. 9, № 10, pp. 473-485, 2016.
11. Mazin Al Hadidi, J. Samih Al-Azzeh, O. Tkalich, R. Odarchenko, S. Gnatyuk, Yu. Khokhlachova. ZigBee, Bluetooth and Wi-Fi Complex Wireless Networks Performance Increasing, International Journal on Communications Antenna and Propagation, Vol. 7, № 1, pp. 48-56, 2017.
12. O. Solomentsev, M. Zaliskyi, R. Odarchenko, S. Gnatyuk, Research of energy characteristics of QAM modulation techniques for modern broadband radio systems, Proceedings of the 2016 IEEE International Conference on Electronics and Information Technology (EIT), Odesa, Ukraine, May 23-27, 2016, pp. 14-20.
13. Fedushko S., Benova E. Semantic analysis for information and communication threats detection of online service users. The 10th International Conference on Emerging Ubiquitous Systems and Pervasive Networks (EUSPN 2019) November 4-7, 2019,

Coimbra, Portugal. Procedia Computer Science, Volume 160, 2019, Pages 254-259. https://doi.org/10.1016/j.procs.2019.09.465

14. Fedushko S., Davidekova M. Analytical service for processing behavioral, psychological and communicative features in the online communication. The International Workshop on Digitalization and Servitization within Factory-Free Economy (D&SwFFE 2019) November 4-7, 2019, Coimbra, Portugal. Procedia Computer Science. Volume 160, 2019, Pages 509-514. https://doi.org/10.1016/j.procs.2019.11.056
15. Fedushko S., Michal Gregus ml., Ustyianovych T. Medical card data imputation and patient psychological and behavioral profile construction. The 9th International Conference on Current and Future Trends of Information and Communication Technologies in Healthcare (ICTH 2019) November 4-7, 2019, Coimbra, PortugalProcedia Computer Science. Volume 160, 2019, Pages 354-361. https://doi.org/10.1016/j.procs.2019.11.080
16. Fedushko S., Syerov Y., Kolos S. Hashtag as a Way of Archiving and Distributing Information on the Internet. CEUR Workshop Proceedings. 2019. Vol. 2386: Workshop Proceedings of the 8th International Conference on "Mathematics. Information Technologies. Education 2019. P. 274–286. http://ceur-ws.org/Vol-2386/paper20.pdf