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Gabriel ILIESCU

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SOCIO-LOGICAL VARIABILE, INTERFERENCES BASED ON ORDER RELATION AND SUSTAINABLE DEVELOPMENT

Gabriel ILIESCU[1]

Abstract

The overall purpose of this article is to highlight that behind the sociological discourse are different formal logic substrates. One of these is given by order relations. It is about inferences based on these relations. One of the particular purposes was to produce these inferences. They capture as many fragments of social reality under a double aspect: static and dynamic. One second purpose was to compare the variable, understood as in predicate logic syntactical sense with sociological variable. While variables in the mentioned inferences belong to the language of predicate logic, in fact they stay for sociological variables. We displayed that however is a difference it is possible a correspondence between the two senses of concept of variable. So that the inferences can be abbreviated by the variable in the meaning of predicate logic syntax, instead of variable in sociological sense. Inference schemes thus obtained are useful to control thinking on those social fragments that have been selected.

Keywords:

socio-logical variable; fragment of social reality; synchrony; diachrony; inference; order relation.

[1] Ph.D.Lecturer, Spiru Haret" University, Faculty of Legal, Political and Administrative Science, Bucharest, e-mail: gabi.iliescu@yahoo.com.

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1. Sustainable development versus waste

The idea of sustainable development occurs at the crossing between green parties and the economic development trends between the years 1882 – 1970. The first are concerned to protect the environment(Giddens, Anthony (2014):940).

Others seem oriented towards exhaust its resources.

The Rome Club conducted a study entitled *Limits of Growth*. According to it, the trends of economic growth between the years 1882 – 1970 cannot be long lasting, i.e. until 2100(Giddens, Anthony (2014):941).

On the one hand the report concluded that such a economic and demographic growth must be limited, even severe. Its limitation has a double source, both natural and social. This is because it is not compatible with the finiteness of the resources. On the other hand, another report, in 1981, entitled *Catastrophe or new society,* of the same club, resumes the idea that current trends cannot continue. In connection with this is used the term catastrophe. Moreover, the same report added that developing countries cannot go through the same path like the developed ones. Nor it is desirable, because of the eror commited by them in the use of environmental resources. A new model of society is proposed. The outlook is optimistic because it is based on the reuse and the recovery of the resources

Then, United Nations achieved in 1987 a report entitled *Our common future*. This is known as the Brundtland report. Here is proposed concept sustainable development. It is about using the renewable resources to some directions such as: *economic growth, the protection of animal species and biodiversity, and to maintaining clean air, water and land* (Giddens, Anthony (2014):941).

2. Problem formulation

This concept can be approached from different viewpoints. We choose to approach it from standpoint of sociology and logic. Both the concept mentioned in particular and the sociological discourse generally, contain variables, their values and order relationship between these ones, rendered by the words: smaller, (<), bigger (>), equal (=).

Their presence is not always explicit. Comparing populations of two different countries, we say that population P_0 is smaller then, for example P_1. One of the three order relations appears explicitly. But comparing the values of population in the same country into two distinct time points, P_{t0} and P_{t1} we could see that there is an increase. That means the value of P_{t0} is smaller than P_{t1}. In turn, the idea of maintaining may have as a substrate a constant value. Which means that in t_0 and t_1 the value of the variable is the same.

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Thus the order relation can be extended over diachronic perspective. Without being explicit in language, it is still present.

In the context of sustainable development, the considered variables are of sociological kind. But the order relation is established between variables in the meaning of predicate logic syntax. In this context evolves the following question. If the sociological and statistic variable differs from that in predicate logic syntax one, then inferences based on order relation that contain the variable in predicate logic syntax sense, may express social reality fragment in its specified sense? The whole approach is based on the affirmative answer to this question.

3.Variable in syntactic-logic sens and in sociological-statistic sens

3.1. Variable in predicate logic syntax

First we introduce the concept of variable in syntactic logical sense. For a precise correlation between the two meanings of variable, we introduce an extended part of the syntax of predicate logic (PL). That is:

1. a subset of alphabets inside the predicate logic alphabet (PLA)
2. rules of well forming for the: terms (T1, T2, T3); atomic formulas (A1, A2).

1. Some of the alphabets of predicate logic alphabets (Popa, C. (2002):79)are as follows:

A_{CI} {a, b, c, a_1,…}, individual constant alphabet; A_{VI} {x, y, z, x_1,..y_1,..}, individual variable alphabet; A_f {f, g, h, f_1, ..}, function symbols alphabet; A_P {P, Q, R, P_1,...} predicate symbols alphabet; $A_=$ {=}, equality symbol alphabet.

2. Rules of well forming refer in the first place to the *terms* and the next ones:

T1. Individual constants are terms: a, b, c, etc. They may mean *John, Bucharest, Danube*, ...proper names;

T2. Individual variables are terms: *x, y, z,* etc. In their turn these ones may mean: *something, somebody* (Popa, C. (2002):79)

f, g, h can stay both for natural language words such as: *son..., capital..., age..., studies...*, for mathematical operations such as *sum, difference, and for variable and indicators* in statistics. In te most general sense they stand for *functions* (Hedman, S.(2004):53), more explicitly told, *functional dependences*. These ones stay for *definite descriptions* by which are assigned some characteristics to some individuals alleged to be unique (Hurley,

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P.(2006):441) Functional signs have a feature called *arity (*Hedman, Sh.(2006):53). In the sequence of signs $f(t_1,\ldots, t_n)$, f has the arity n.

T3. If f, g, h belong to A_f and the arity of f is equal to n ($\delta(f) = n$) and $t_1, \ldots t_n$are terms then $f(t_1, \ldots t_n)$ is a term.

Some authors present three rules for terms (Popa, C.Other ones compress the first two rules into one. Rezult only two rules for terms. T3 becomes T2 (Popa, C. (2002):79).

Examples for $\delta(f) = 1$. The form of the term is: $f(t)$. we agree that t is exemplified by *a* that means *Romania* and *f* means *capital*. Therefore $f(a)$ means *Romanian capital*. We reassign *f* by *radical* mathematical operator. Instead of *a*, we introduce just the number *144*. Thus, $f(144)$ means *radical from 144*. We rise the arity of *f* to 2. Add *the year 2016* as refering to *Romanian capital*. Add convention that *c* stands for *year 2016*. The term we obtain will be $f(a, c)$. Reassign the functional symbol *f* by summ between $a_1 = 2$, $a_2 = 3$. Hence for the term will be $f(a_1, a_2)$.

An other resignification contains components from statistics. So, for *f* is reassigned *gross domestic product*. Inside the n arity of *f* we have t_1 and t_2 that stand for $b_1 = SUA$ and $b_2 = anul\ 1998$. As a sequel, $f(b_1, b_2)$ means *USA GDP in 1998*.

We close the list and specifiy that *well forming rules for* terms are T1, T2, T3 and only them. And the term is a sequence of signs obtained from A_{CI}, A_{VI}, A_f, by applying of the *T-rules* a finite number of times.

Then the well forming rules refer to the *atomic formula.*

$P(t_1, \ldots t_n)$ *is a first kind of atom. P* symbolizes natural language words, namely *properties* or *relations*. They also have an arity. *Properties* have the *a*rity 1. *The relations* have the arity at least equal to 2. Follows the first well forming rule:

A1. If*P* belongs to A_P and the *arity of P* is equal to $n(\delta(P) = n)$ and $t_1, \ldots t_n$,are terms then $P(t_1, \ldots t_n)$ is a *predicate atom.*

*$\delta(P) = 1$. Consider a single term let it be *t*. the atomic formula is $P(t)$. We agree that P means *poet*. Therefore $P(x)$ means *x is a poet*.

*$\delta(P) = 2$. Add to the previous example a second term t_2. The form of the atomic formula is $P(t_1, t_2)$. Reassign P by *taller than*. Therefore $P(x, y)$ means *x is taller than y*.

*$\delta(P) = 3$. Add a third term t_3. The form of the atom formula becomes $P(t_1, t_2, t_3)$. Reassign *P* by *being among* or by *reading*. Therefore, $P(x, y, z)$ may mean *x is among y and z* or *x reads y for z*.

*$\delta(P) = 4$. Add a fourth term t_4. The form of the atomic formula becomes $P(t_1, t_2, t_3, t_4)$. Reassign *P* by *to read* with the arity extended by *to love more than*. Therefore $P(x, y, z, s)$ may mean *x reads y to z at the moment s* or*x*

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loves y more than z loves s (Leblanc, Hugues and Wisdom, A. William, (1993):110)

$t_1 = t_2$ *is the second type of atomic formula.* As regards the previous type of atomic formula, the sign „=" is a predicate of arity 2. Formulation of the well forming rule we are considering is:

A2. If "=" belongs to $A_=$ andt_1, t_2 are terms then $t_1 = t_2$ is an *predicate atomic formula.*

The rules of well forming formula for the predicate atomic formula are A1, A2 and only them.

Predicate atom is a sequence of signs obtained from A_{Cl}, A_{VI}, A_{β}, A_P, $A_=$by a finite number of times application of *A-rules.*

This atomic formula is such noted because expresses the idea of identity. „is" in this case may be replaced by „is identical with"(Gensler, J. Harry, (2010):206)

One can distinguish several direction for using this atoms: the referent of a term is identical to another one, and the identical ones can be even the persons or things(Hurley, P, (210):450) for the expression containing words as: „only", „the only", "No one...except", "All except" referring to individuals; for the superlatives, maximal or minimal values; statements expressing numbers; definite descriptions (Gensler, J. Harry,(2010):206). Some authors indicate „exactly" however it is obvious by this are translated the numbers. On the one hand, the sign for identity is distinguished of ordinary predicate symbols if they describe monadic predicates. On the other hand this is treated in the context of higher than 1 predicates.

Among other things, an interesting property of this is that if $a = b$ and one of them, say *a* has the property *F*, *F(a)*, from hence we deduce, by replacing equivalents rule, that b also has the same property, *F(b)*. The rule itself is based on the fact that identical are interchangeable.

Some authors join by disjunction both types of atomic formula in a single common definition of this formula. In the Romanian literature on this theme, sometimes the definition recourses only to the well forming rules of the two types of atoms. If the definition precedes these rules or succeeds them, this is a less important issue.

We can distinguish a few directions to use this kind of atoms: the referent of a term is identical with the referent of another one; for the expressions containing words like: „only". „the only", „no....except...", „all..except", all of these about individuals, for superlative, and numerical statements, and also for definite descriptions.

We reconsider the above term in some several interpretations:

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*$f(a)$ with the same significance. Furthermore we agree that b means Bucharest. As such $t_1 = t_2$ is in the particular form $f(a) = b$. That menas *Romanin's capital is the same as Bucharest*.

* $f(144)$ with the same significance. Introduce a second term, *number 12*. As such $t_1 = t_2$ is in the particular form $f(144) = 12$. Its significance is obvious: *root of 144 is equal to 12*.

*$f(a, c)$ and b keeping their significance. That is why $t_1 = t_2$ is in the particular form $f(a, c) = b$. Its significance is: *the Romanin's capital in 2016 is the same as Bucharest*.

*$f(a_1, a_2)$ with its arithmetic significance. Add to this, that $a_3$stands for 5. As such $t_1 = t_2$ is in the particular form $f(a_1, a_2) = a_3$. Its arithmetic significance is: *arithmetic sum of 2 and 3 is equal to 5*.

* $f(b_1, b_2)$ from above with the same significance of *US Gros Domestic Product in 1998*. Add that b3 means the numeric expression of GDP: 28313 $.

As such $t_1 = t_2$ can be specified as follows: $f(b_1, b_2)= b_3$. Its arithmetic significance is: *US GDP in 1998 is equal to* 28313 $.

Table1. Significance of the atomic formula of the type $t_1 = t_2$

$t_1 = t_2$	f(a) = b	the Romanin's capital is the same as Bucharest.
	f(144) = 12	root of 144 is equal to 12.
	f(a, c) = b	the Romanin's capital in 2016 is the same as Bucharest.
	$f(a_1, a_2) = a_3$	arithmetic sum of 2 and 3 is equal to 5.
	$f(b_1, b_2) = b_3$	US GDP in 1998 is equal to 28313 $.

3.2. The variable in statistics and in sociology

We begin with variable in statistical sense We leave for the second part of this section, the reference to the sociological sense

By introducing this kind of variable, we will symbolize it in the already displayed language in the previous section. Thus it will be outlooked to what extend the two types of variables correspond each other.

Now following a list of elements composing the variable and the statistic date.

**notional part* (Danciu Aniela Raluca, Niculescu Aron, Gruiescu Mihaela, (2007):21) or shorter *the notion (*Isaic-Maniu, Alexandru, Mitruţ, Constantin, Voineagu, Vergil,(2004):31)that defines the content. An example

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is: *The interest rate on housing loans in roni.* We propose a suggestive symbolism for the natural language terms that compose it: *p%int_rate_hous_loan.*

identification elements in time and space*, as an example: *august, 2007, in Romania*.** We introduce the sequence of signs: *august2007.*

** numerical value(*Isaic-Maniu, Alexandru, Mitruţ, Constantin, Voineagu, Vergil,(2004):31) 10, 4%

Applying the notion to the identification elements, we get the natural form of expression for the *characteristic* or *statistic variable.* We assign it a symbolisation, resulting from partial forgoing encoding:

**The interest rate on housing loans in roni in august 2007, in Romania.*

**p%int_rate_hous_loan(aug2007, rom)*

Adding the numerical part we get the statistic date:

** The interest rate on housing loans in roni in august 2007, in Romania is equal to 10, 4%.*

**p%int_rate_hous_loan(aug2007, rom) = 10, 4%*

Statistical variable coresponds to the term of type $f(t_1, ... t_n)$ where n arity of *f*, $\delta(f) = 2$. So the term is $f(t_1, t_2)$ is equal to 2 As t_1 is for the time and t (Danciu A ,R, Niculescu, A, Gruiescu M, *(2012):*21.) for space, a suggestive symbolism is by *t* and *s*. The term $f(t_1, t_2)$ becomes *f(t, s)*. Simplified version of the atom is: *f(t, s) = m*.

The indicator is a neiboring notion exemplified by:

** Romania Gros Domestic Product in 2005 was equal to 287186 roni.*

Statisticians note in addition to the content of the indicator, its method of calculus and also the numerical expression embodied in time and space. Content indicator in this case, without containing the method or the calculation methodology is the same as the previous notional situation and here is the same order as the one above:

*Gros Domestic Product.*Introduce direct full symbolic form:

**GDP (rom, 2005) = 287186 roni*

The last example has the next form: *f(s, t) = n*.

Sociology refers to variable in connection with relation of cauzality-correlation.

Correlation means an exact relationship, repeated between the sets of values of two variables. But between the two variables might be not causality. Which means that we could not infer causation from correlation. The idea of variable is met in sociological research, in the field of experimental method.

Allan G. Johnson addresses the concept of variable in a separate article, pointing out the measurability of the variable(Jonhnson, G. Allan,

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(2007):384).Thus is considered only one particular case of variable, even if quantitative variable are very extended.

Some Romanian authors repeat this idea. It is shown the presence of the control group beside the experimental one (Mihăilescu, I.,(2003):37). Changing the value is a minimal base to talk about variable. In some cases the sociological vocabulary that defines the variable is borrowed from statistics. In the sense that what is modified is a characteristic or a treat (Grosu, Nicolae, (2000):14) Or, about the treat or characteristic as a synonymous of the variable speak the statistics. Based on these, we can build sentences, containing as basic elements the pairs: variable-number and variable- variable.

3.3. Comparison between the two types of variables

Two elementary notions in statistics, in exactly this order, are: *characteristic* or *variable* and *statistic data*. The difference between the two ones suggests a comparison with their correspondent in predicate logic syntax.

Notional part as a part of statistic variable corresponds to *funcţionalsymbol f* from predicate logic syntax.

The identification elements of the statistic variable correspond to the arity δ of functional symbol *f*, respective δ(f), that is a string of *n* ordered terms $t_1,\ldots,t_n$.

By applying the notional part to identification elements we compose the *statistical variable*. By applying the functional symbol *f* to the string of terms $t_1,\ldots,t_n$ we compose *functional term* $f(t_1, \ldots t_n)$ of predicate logic syntax. As a conclusion, *the characteristic* or the statistical variable correspond to the type of term $f(t_1, \ldots t_n)$, but more synthetical said, to a term *t*.

Statistical variable has as an equivalent a *value. The equivalences,* ormore general said, *the order relation* between the two ones are *statistical data*. The functional term is equivalent to a denoted. The relation between the two terms is the *identityatom*.

The statistics data correspond to *identity atoms*, having the general form $t_1 = t_2$. The connection between the two stems from the fact that, for example t_1 may be of the form $f(t_1, \ldots t_n)$. As a sequel, $t_1 = t_2$ it takes the particular form $f(t_1, \ldots t_n) = t_m$.

So, the statistic variable or the feature is a part in the structure of statistic date as the term $f(t_1, \ldots t_n)$ is only a part in the structure of the atom $t_1 = t_2$. From this follows that we can treat in advance a part of the statistic date, discussing about *statistic variable* such as, treating about an atom, we implicitly talk about one of its terms. As a result, the relation between statistic variable and the logical one could be as follows:

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Table2. Summary of the correspondence between
the sociological-statistic sense of the variable and the logical one

Sociology-Statistics……..	Logic
Noţional parta …….	Functional symbol, f
Identificational elements …….	Arity of the functional symbol $\delta = n$, $\{t_1,\ldots,t_n\}$, more explicit, variables x, y, z, $x_1,\ldots, z_n$ or obiectual constants: a, b, c, $a_1,\ldots, c_m$.
Statistic Variabile	Functional term, $f(t_1,\ldots,t_n)$
Numerical value	Denotation of the functional termen
Statistic data	Identity atom: $t_1 = t_2, f(t_1,\ldots, t_n) = t_m$

Therefore, statistical variable has the same level of complexity with definite descriptions *$f(t_1, \ldots t_n)$* but not with the variables în logic syntax sens. Identification elements, concretely exemplified, the ones who applied the notional part to, correspond to the *constants*. The same identification elements, given in general, unspecified form correspond to the *variables* from logical syntax.

4. Inferences based on the order relationship between socio-logical variables

A partial aim of this section is to capture such a fragment of social reality which has the features: complete and minimal. According to this features the fragment contains three different order relations, preferably, each of them one time. These are as many premises, from which concluded similar relationships.

So the focus moves from the elements of the relation - the variables and their values – towards the relations between them. Temporarily, retain only the relations and neglect the elements they connect. Obtain such a fragment by cartesian product on the already shown set with itself three times. For this, introduce a variable to each order relation: R_i, R_j, R_k. Their value ranges are identical: $D_{Ri} \equiv D_{Rj} \equiv D_{Rk} \equiv \{<, >, =\}$. Cartesian product mentioned is:$\{R_i, R_j, R_k\} \times \{R_i, R_j, R_k\} \times \{R_i, R_j, R_k\}$, i.e. $\{<, >, =\} \times \{<, >, =\} \times \{<, >, =\}$. Follows 27 triples consisting in order relations . These are as many sets of premises and as many inference schemes based on order relation. Inside of them temporary neglect the connected elements:

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Table3.27 Inferential pre schemes, without connected elements

1		27
…R_i…		…R_i…
…R_j…		…R_j…
…R_k…		…R_k…
…-…		…-…

Substituting R_i, R_j, R_k by their values $<, >, =$, obtain a more detailed picture of the twenty seven inferentional pre schemes, yet without connected elements:

Table 4.27 Inferentional preschemes, specifying the relations

1	2	3	4	5	6	7	8	9
=	=	=	=	=	=	=	=	=
=	=	=	<	<	<	>	>	>
≡	≤	≥	≡	≤	≥	≡	≤	≥
-	-	-	-	-	-	-	-	-

10	11	12	13	14	15	16	17	18
<	<	<	<	<	<	<	<	<
=	=	=	<	<	<	>	>	>
≡	≤	≥	≡	≤	≥	≡	≤	≥
-	-	-	-	-	-	-	-	-

19	20	21	22	23	24	25	26	27
>	>	>	>	>	>	>	>	>
=	=	=	<	<	<	>	>	>
≡	≤	≥	≡	≤	≥	≡	≤	≥
-	-	-	-	-	-	-	-	-

And now we can introduce the connected elements. We use two criteria: *syntactical structure* and *temporal perspective*. *Syntactical structure* covers two components: a) variable – number (v-n); b) variable- variable (v-v). *Temporal perspective* refers to a) synchrony (S); b) diachrony (D); c) syncronic-diacronic i.e. a mixed perspective (M). we choose a first criterion thesyntactical structure. We subordinate to this, the *temporal perspective*. Based on this hierarchy of criteria we can generate a first sequence of reasoning preschemes:

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1. variable – number composition which we assign a first inferentional protoscheme, 1.v-n, from which follows by substitutions, the two next pre schemes;

1.1. variable – number composition with a synchronic perspective, 1.v-n S, by substitution α_0/x; α_1/y;ν_0/n; ν_1/m;

1.2. variable – number composition, with diachronic perspective (1.v-n D, by substitution α_0/x_{t0}; α_1/x_{t1}; ν_0/n; ν_1/m;

2. variable – number composition, mixed (2. v-n M);

Table 5.variable-number synchronic-diachronic composition and mixed one

	1. v-n		2. v-n
	α_0 R_i ν_0 α_1 R_j ν_1 $\underline{\nu_0\ R_k \nu_1}$ α_0 - α_1		
1.1. v-n S		1.2. v-n D	2. v-n M
α_0/x; α_1/y; ν_0/n; ν_1/m x R_i n y R_j m $\underline{n\ R_k\ m}$ x – y		α_0/x_{t0}; α_1/x_{t1} ν_0/n; ν_1/m x_{t0} R_i n x_{t1} R_j m $\underline{x_{t0}\ R_k\ x_{t1}}$ x_{t0} - x_{t1}	
1, …, 27		1, …, 27	

Then, in the general scheme 1.1.v-n.S, apply on relations R_i,R_j, R_k the twenty seven substitutions, previewed in *Table 4*. Thus, obtain a variant of the *Table 1.1.*with 27 inference schemes containing distinct variables and numbers and that capture synchronic perspectiv. Abbreviating, we get 27 inference schemes of the type 1 v-n.S.

Similarly, in the general scheme 1.2.v-n D, substitute using the *Table 4*. It follows a second variant of the *Table 1.1* with 27 inference schemes containig a single variable with different numerical values, for different time points, i.e. 1. v – n.D. An exceptions is the mixed perspective, 2. v-n M, containing an increased number of schemes.

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Table 6. Inference schemes with variable-number premises, synchronic-dyachronic and mixed perspective

1. v-n						2. v-n		
1. v-n S			1. v-n D			M		
1	..	27	1		27	1	….	
x R_i n	..	x R_i n	x_{t0} R_i n		x_{t0} R_i n			
y R_j m	..	y R_j m	x_{t1} R_j m		x_{t1} R_j m			
$\underline{n\ R_k\ m}$	..	$\underline{n\ R_k\ m}$	$\underline{x_{t0}\ R_k\ x_{t1}}$		$\underline{x_{t0}\ R_k\ x_{t1}}$			
x – y	..	x – y	x_{t0} - x_{t1}		x_{t0} - x_{t1}			

Starting from the criterion *variable – variable* we can generate a second *reasoning pre scheme*:

1. variable – variable composition which we assign a first inferentional protoschema, 1.v-v, from which follows by substitutions, the two next pre schemes;

1.1. variable – variable composition with a synchronic perspective, 1.v-v D, by substitution α_0/x; α_1/y; α_2/z; α_3/s;

1.2. variable – variable composition, with diachronyc perspective (1.v-v D, by substitution α_0/x_{t0}; α_1/x_{t1}; ν_0/n; ν_1/m;

2. variable – variable composition, mixed (2. v-v M) by substitution α_0/x_{t0};α_1/x_{t1};β_0/y_{t0}; β_1/y_{t1};

Table 7. Variable- variable composition, synchronico-dyachronic and mixed perspective

	1. v-v		2. v-n
	α_0 $R_i\alpha_1$ α_1 $R_j\alpha_2$ α_2 $R_k\alpha_3$ α_0 -α_3		α_0 $R_i\alpha_1$ β_0 $R_j\beta_1$ $\underline{\alpha_0\ R_k\beta_0}$ α_1 -β_1
1.1. v-v.S	1.2. v-v.D		M
α_0/x; α_1/y; α_2/z; α_3/s x R_i y y R_j z $\underline{z\ R_k\ s}$ x – y 1, …, 27	α_0/x_{t0}; α_1/x_{t1}; ν_0/n; ν_1/m x_{t0} R_i x_{t1} x_{t1} R_j x_{t2} $\underline{x_{t2}\ R_k\ x_{t3}}$ x_{t0} - x_{t3} 1, …, 27		α_0/x_{t0};α_1/x_{t1};β_0/y_{t0}; β_1/y_{t1} x_{t0} R_i x_{t1} y_{t0} R_j y_{t1} $\underline{x_{t0}\ R_k\ y_{t0}}$ x_{t1} - y_{t1} 1, …27

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In all of the three general schemes 1.v-v.S, 1.2.v-v.D, şi în 2.v-v.M are applied on the variables R_i,R_j, R_k the 27 de substitutions, previewed in *Table 4*. Thus obtain 27 inference schemes for each of the three perspectives: synchronic, diachronic and mixed as shown in the Table 8 below.

Table 8. Inference schemes containing variable-number composition and synchronico-dyachronic and mixed perspectives

1. v-v						2. v-v		
1. v-v S			1. v-v D			2. v-v M		
1	..	27	1		27	1	..	27
$x\ R_i\ y$	..	$x\ R_i\ y$	$x_{t0}\ R_i\ x_{t1}$		$x_{t0}\ R_i\ x_{t1}$	$x_{t0}\ R_i\ x_{t1}$		$x_{t0}\ R_i\ x_{t1}$
$y\ R_j\ z$	..	$y\ R_j\ z$	$x_{t1}\ R_j\ x_{t2}$		$x_{t1}\ R_j\ x_{t2}$	$y_{t0}\ R_j\ y_{t1}$		$y_{t0}\ R_j\ y_{t1}$
$\underline{z\ R_k\ s}$	..	$\underline{z\ R_k\ s}$	$\underline{x_{t2}\ R_k\ x_{t3}}$		$\underline{x_{t2}\ R_k\ x_{t3}}$	$\underline{x_{t0}\ R_k\ y_{t0}}$		$\underline{x_{t0}\ R_k\ y_{t0}}$
$x - y$	..	$x - y$	$x_{t0} - x_{t3}$		$x_{t0} - x_{t3}$	$x_{t1} - y_{t1}$		$x_{t1} - y_{t1}$

In all these cases we felt that we deal with three *sociological* perspectives of thought, based on *sociological* variables. Or, what is certain is they are variables in logic syntax sense. In this context one might ask whether such schemes, interpreted by sociological variables, can lead from true premises to necessarily true conclusions.

5. Applications

Follows to illustrate the variables of some above inferences with variables in sociological sens that are directley or indirectley subordonated to sustainable development.Introduce the next table that quantifies transnationalization of several industrial branches, from oil and mineral branch and ending with electronics. We already introduced in the table encoding for branches from r_1 to r_7, and for the two years, 1993 and 1997 and from t_0 to t_1 for the dyachronic perspective

Table 9 Transnationalizing economic branches index for the first 100 transnational companies
(Moisuc, Constantin (coordonator), Pistol, Luminiţa şi Gurgu, Elena (2005):200)

Industrial branches	*Index of transnationalization*	
	t_0. 1993	*t_1. 1997*
Total de ramuri din care	47	51
r_1. Oil and minerals	54	51
r_2. Food and drink	61	61
r_3. Construction	72	68

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r_4. Metals	45	59
r_5. Chemicals and pharmaceuticals	41	59
r_6. Cars	60	40
r_7. electronics	42	49

Select from this table triplets of premises for possible inferences. Apply the announced ranking criteria. For the first we build *variable-number*, then *variable - variable* premises. Then, split each of them in synchronic and dyachronic constructions. Select for example, the branch r_5. *Chemicals and pharmaceuticals* and r_7.*Electronics*.

5.1. Inferences based on variable-number and synchronic perspective

Starting from here we express a few premises:

1. Transnationalizing index for Chemicals and pharmaceuticals, in 1993 is equal t to 41.
2. Transnationalzing index for *electronics*, in 1993 is equal to 42.
3. 41 is lower than 42.
4. Index of transnationalization for *chemicals and pharmaceuticals* in 1993 is lower than index for *electronics* in the same time point.

Introduce convention designation. In *Table 9* already introduced individual constants for the economic branches and temporal constants for the two years. Add that *f* is functional symbol for transnationalisation index.

Initial inference is symbolized in *Table 10* below, left. Add other two inferences directly in symbolic form. All three have premises of variable-number type. Temporal perspective is a synchronic one.

Table10. Inferences based on variable – number structure and synchronic perspective

1. $f(r_{5_{t0}}) = n_0$	5. $f(r_{7_{t0}}) = n_1$	9. $f(r_{4_{t0}}) = n_2$
2. $f(r_{7_{t0}}) = n_1$	6. $f(r_{4_{t0}}) = n_2$	10. $f(r_{3_{t0}}) = n_3$
3. $n_0 < n_1$	7. $n_1 < n_2$	11. $n_2 < n_3$
4. $f(r_{5_{t0}}) < f(r_{7_{t0}})$	8. $f(r_{7_{t0}}) < f(r_{4_{t0}})$	12. $f(r_{4_{t0}}) < f(r_{3_{t0}})$

Conclusion 4 shows that transnationalization index of the *chemicals and pharmaceuticals* branch, r_5 is lower than the one of the *electronics,* r_7. Similarly, the conclusions 8 and 12 expres the same order relation between transnationalistion indexes of two economic branches. Natural language

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interpretation is clear from already given conventions. The conclusions are composed only of the variable- variable pair. Temporal perspective is synchronic. Rewrite these conclusions as premises of the following inference.

5.2. Inference composed of variable- variable premises, synchronic perspective

The conclusions 4, 8 and 12 from table 10 are retained as premises for the next inference. In the initial table of the 27 pre schemes, the inference in *Table 11* is ranked in 14.

Table 11. Inferences with variable- variable premises, synchronic perspective, derived from the conclusions of the previous inferences

14	
4. $f(r_{5_{t0}}) < f(r_{7_{t0}})$	$41 < 42$
8. $f(r_{7_{t0}}) < f(r_{4_{t0}})$	$42 < 45$
12.$f(r_{4_{t0}}) < f(r_{3_{t0}})$	$45 < 72$
13. $f(r_{5_{t0}}) < f(r_{3_{t0}})$	$41 < 72$

5.3. Inference composed of variable-number premises, diachronic perspective

For the dyachronic perspective we qoute again part of the dynamics of world's population table.(Aur, I. Nicu, Andrei, Mădălina & Gherasim, C., Cezar, (2004):32.*)*

Table 12. World population after 1900

Year	Milions of inhabitants
t_0 1900	m_0 1600
t_1 1955	m_1 2751
t_2 1990	m_2 5295
t_3 1999	m_3 6000
.....	.....

Introduce new convention scoring. Thus, the years have already been coded by symbols from t_0, to t_3, number of millions of inhabitants by other symbols from m_0, to m_3. Introduce a new term denoting *the world in time point* t_i: w_{ti}, in which $i = \{0,..., 3\}$. As a sequel, symbolize the sentence *in1900 world's population is equal 1600 million inhabitants,* thus $g(w_{t0}) = m_0$.

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Table 13. Inferences based on variable-number, dyachronic perspective

1. $g(w_{t0}) = m_0$	5. $g(w_{t1}) = m_1$	9. $g(w_{t2}) = m_2$
2. $g(w_{t1}) = m_1$	6. $g(w_{t2}) = m_2$	10. $g(w_{t3}) = m_3$
3. $m_0 < m_1$	7. $m_1 < m_2$	11. $m_2 < m_3$
4. $g(w_{t0}) < g(w_{t1})$	8. $g(w_{t1}) < g(w_{t2})$	12. $g(w_{t2}) < g(w_{t3})$

5.4. Inferences based on variable-variable composition , and dyachronic perspective

Select the conclusions 4, 8, şi 12. We compose din ele un al patrulea raţionament în care structura premiselor este de tip variabilă-variabilă iar perspectiva temporală este diacronică.

Table 14. Inferences based on variable-variable, and dyachronic perspective

4. $g(w_{t0}) < g(w_{t1})$
8. $g(w_{t1}) < g(w_{t2})$
12. $g(w_{t2}) < g(w_{t3})$
13. $g(w_{t0}) < g(w_{t3})$

5.5. Inferences based on variable-variable premises, and mixed perspective

For this kind of inference we return to the *Table 9*. Their specific is mixing the synchronic with dyachronic. The first two premises describe each variable diachrony over a time interval t_0 – t_1. The third premise is synchronous. We compare the two variables in previous premises in the time t_0. The conclusion is also synchronous. We the same two compare variables in the last moment t_1.

We can find information for such an inference in the same table of the transnationalisation indexes. The first two premises describe diachrony of the transnationalisation index for the branches r_2 *Food and drink* and r_4. *Metals*. The diachronic premise refers to the relation between the two indexes in t_0. The conclusion relates the same two indexes in t_1. In the preschemes table, previous relied, this inference ranks 8. It is instantiated only with three groups of numerical values.

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Table 15. Inferences based on variable-variable, and mixed perspective, non-valid

8	a	b	c
$f(r2_{t0}) = f(r2_{t1})$	61 = 61	61 = 61	61 = 61
$f(r3_{t0}) > f(r3_{t1})$	72 > 68	72 > 61	72 > 60
$\underline{f(r2_{t0}) < f(r3_{t0})}$	$\underline{61 < 72}$	$\underline{61 < 72}$	$\underline{61 < 72}$
$f(r2_{t1})$? $f(r3_{t1})$	61 < 68	61 = 61	61 > 60

Few observations are necessary in this inference. On the one hand, inside the initial grid with 27 pre schemes, 8 is invalid. Which means that the truth of this succession of order relations in the premises: =, >, < does not necessary entail a certain order relation between the transnationalisation indices of the two branches r_2 and r_3 in the conclusion. On the other hand, given these numbers, their synchrony in t_1 could not be other than this 61 < 68 (a). Inside the limits of the succession of the relations of 8: =, >, <, decreasing in the second premise can be done also in this way: $f(r3_{t1}) = 61$, so $f(r3_{t1})$ may be smaller than 68. The conclusion 61 = 61 mai seem trivial. But it tells that $f(r2_{t1}) = f(r3_{t1})$ (b). Possibly, can reach to $f(r3_{t1}) = 60$, i.e. just $f(r3_{t1})$ < 61, say. This meaning that *61 >60*, but especially, that $f(r2_{t1}) > f(r3_{t1})$.

Alternatives b and c for the conclusion a in column 8, show the reality that *index of transnationalization for the branch food and drinks is smaller than the one for construction* is only one of the possible realities. Also possible would be some dates of the premises that would support equality or the opposite order relation between the two indices in the conclusions b and c, as mentioned.

Maybe it should not be uniportant that the same reasoning in rank 8, in table with reasonments *v-n, D* is valid, while in Tables *v-v, S* and in v-n, S is invalid.

Conclusions

The main concern was to play some of facts and processes that are subordinated to the concept of sustainable development, through the relationship of order. They were grouped as premises of reasoning centered on the theme of sustainable development.

Sociologic and statistic variables can be approximated as variables in the sense of predicate logic syntax. Exemplifying them through the sociological content we can get from true premises to true conclusions. If it

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is not happening this way, it is not to blame the interpretation, but the order relations in the premises. That we have ilustrated in *Table 15* in reasonment 8.

It can be argued that in *tables* as 10 and 13 containing numbers instead of numeric variables, the conclusion is obvious. But one could counterague in at least two ways. First, the so called evidence of a conclusion is in fact founded on a reasonment used by human mind. The simplicity if this reasonment is why thinking runs it very fast. Most likely, mind does perceive its use of such an inferentional tool. Then, in case of reasonment 8 in table 15, it is the numerical obviousness the one that requires the conclusion. Despite the compelling arthimetic, the conclusion is not valid. Finally, reasonments with obvious but also corect conclusions are taken from logic, not from a no man's land. Invocating obviousness may be equated with a beating of ownership of logic over that tool.

Thus, at least some of the sociological concepts can be treated rigorously and intersubjectiv controllable. But, no matter how rigorously intersubjectiv controle would be, the controlled ones are statistical data, indices etc, related to global settings of the economy or, of the planet. As such, this control on thinking is necessary but not enough. It does not do the future not to be loaded by such risks as: water pollution (Giddens, A, (123): 945-947), air pollution, waste recycling, soil degradation and desertification, global warming, genetically modified foods (Giddens, A, (123): 945-947). Prevention of these can do such that economic growth and finiteness of the resources be mutually compatible. In this context, both analytical thinking and preventive action have their necessary role.

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