Employees balance and stability as key points in organizational performance

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Abstract. System analyzes deal with interrelationships between different variables that keep the system in balance. Morin [1], in his analysis of complex thinking, states that the system is viewed as a complex unit in which the “whole” is not reduced to the "sum" of its parts; the system becomes an ambiguous term because it consists of several variables that interact with unforeseen results; and is situated at a transdisciplinary level, because it is impossible for an area to have a complete reading of its complexity. It was also mentioned that the concept of the open system best describes complexity by stating that “the laws of the organization are not equilibrium, but an imbalance that is restored or compensated for by stabilized dynamics”. This idea originated from the field of Thermodynamics and the 2nd Law, in which the imbalance that it maintains allows the system for an apparent balance. This fragile, steady-state has something of a paradox, since the structures remain the same, but their constituents are changeable. The concept

of open system undoes the door to a theory of evolution that can only derive from the interactions between system and ecosystem and can be conceived as the transition from the system to a metasystem. It is within this systemic approach that we focus our analysis, considering the ambiguity, multidisciplinary and complexity inherent in the regulation of any system.

Keywords: Balance, Stability, Organizational Performance, Entropy, Logic Programming, Knowledge Representation and Reasoning, Artificial Neural Networks, Levels of Trust and Sustainability.

1 Introduction

Balance and *Stability* are key points for organizational performance. These two states maintain the system balance in a status quo, which means that the system does not change. The change process is related to instability. It is associated with the process that supports changes in an organizational environment. Analysis of system performance in a stable or changing state can be assessed based on efficiency. This conception leads to an evaluation of system performance and optimizes the results. In an organizational system, two main areas work together to achieve maximum system performance - the technical and the behavioral. These two interconnected areas affect performance, which means that they are complementary and interdependent. For this reason, the maximum performance (results) is a complex topic, since there are many possible combinations in technical and behavioral dimensions. If the technical dimension is stable, its changes will occur in the medium and long term. However, the behavioral dimension is much more unstable because behaviors and attitudes can change at any time in any social environment. The main reason for this instability lies in behavioral variables that influence the system balance, such as motivation, cooperation, emotions and feelings in the relationship of people, i.e. in their individual and collective dimension, and the structural behavioral variables of the system regulation, such as Power, Leadership and Justice [2]. When looking for these changes, our analysis focuses on those variables that can affect system balance and therefore overall system performance. In organizational performance analyzes it was found that performance in the organizational environment depends on two main activities that are interrelated, the organizational and coordination process [3]. These two activities are interrelated, complementary and contradictory at the same time. The former deals with the division of labor, which requires a breakdown of activities, making the tasks that people may perform easier and more specific. The more intensive the division process, the more difficult the coordination process becomes. The coordination must integrate the various parts that result from the organizational process, in relation to the structure in which areas, departments, functions and tasks have to be set up. The main task of coordination is the integration of technical and behavioral areas. When the first deals with technologies and systems organized in a particular environment, the second relates to people's behavior and attitudes. Both have to do to perform better. In the behavioral dimension, cooperation is one of the main supports of coordination in an organizational environment in order to achieve a better accomplishment of people by themselves, i.e., engagement is one of

the most important challenges in optimizing the skills and performance of a person Individuals and their team. Since engagement has a personal and a collective dimension, we need to understand how these two dimensions work together to maintain people's satisfaction (in an organizational setting) [4]. *Balance and stability* refer to the understanding *of the phenomenon of improving organizational sustainability*, considering the inputs used and the achievable results. When the focus is on the process of improving *work effectiveness*, one of the dimensions that affect the process depends on the interaction among people and their behavior in the organizational environment, as well as their impact on the process of achieving improved outcomes. People, while a piece of the engine to improve efficiency at the organizational level act in order to support the enterprise sustainability. In 1973, David McClelland in his article *"Testing for Competence Rather than Intelligence"* [5] challenged this paradigm by arguing that academic aptitude and literacy could not consistently anticipate a person's good performance. He argued that there was a *set of competencies* that played an important role on the *organizational setting* which were centered on a set of abilities that supported the *professional capacity for success*, such as *empathy*, *self-discipline*, and *initiative*. These were *good predictors for the leaders' performance* in the conduction of their teams. This is the attitude that lies behind this work, which develops through the stretches, i.e., following the introduction, the fundamentals adopted in the article are set, namely the use of *Logic Programming* for *Knowledge Representation and Reasoning*, whose sceneries are understood as a process of energy devaluation [6, 7]. Next, a case study on organizational efficiency will be presented and evaluated, considering the emotions and feelings of employees. It uses an eclectic mix of characteristics that indicates the extent of *group identity*, *methods*, *collective self-esteem*, *gratitude* and *prosocialness* predicates, i.e., how employees respond to specific questionnaires that, once translated into logical programs, and taken in isolation, form the company's knowledge base [8-12]. Then conclusions are drawn and future work is outlined.

2 Fundamentals

2.1 A Thermodynamic Approach to Knowledge Representation and Reasoning

The problem-solving methodology presented in this article is based on *Thermodynamics* and aims to describe the practices of *Knowledge Representation and Reasoning* (*KRR*) as a process of energy degradation [6, 13, 14]. In order to explain the basic rules of the proposed approach, the *First* and *Second Law of Thermodynamics* are considered, attending that one's system moves from state to state over time. The former one, also known as the *Energy Saving Law*, states that the total energy of an isolated system is constant, i.e., cannot change over time. This means that energy can be converted, but cannot be generated or destroyed. The latter deals with *Entropy*, a property that quantifies the orderly state of a system and its evolution. These characteristics fit the proposed vision of *KRR* practices, as this has to be understood as a process of energy degradation. Indeed, it is believed that a data element is in an entropic state, the energy of

which can be decomposed and used in sense of degradation, but never used in the sense of destruction, viz.

- *exergy*, sometimes called available energy or more precisely available work, is that part of the energy that can be arbitrarily used by a system after a transfer operation, or in other words, giving a measure of its entropy. In Fig. 2 (section 4.1) it is given by the gray colored areas;
- *vagueness*, i.e., the corresponding *energy values* that *may or may not have been consumed*. In Fig. 2 are given by the gray colored areas with spheres; and
- *anergy*, that stands for an *energetic potential* that was not yet consumed, being therefore available, i.e., *all of energy that is not exergy*. In Fig.2 it is given by the given by the gray colored areas with asterisks [6, 13,14].

On the other hand, there are many approaches to *KRR* using the epitome of *Logic Programming* (*LP*), namely in the areas of *Model Theory* and *Proof Theory*. In this article, the *Proof Theoretical* methodology for problem solving was adopted and expressed as an extension of the *LP* language [7]. Under this setting a *LP* will be grounded on a finite set of clauses in the form, viz.

$$
\begin{aligned}
&\{\\
&\quad \neg\, p \leftarrow not\ p, not\ exception_p\\
&\quad p \leftarrow p_1, \cdots, p_n, not\ q_1, \cdots, not\ q_m\\
&\quad ?\,(p_1, \cdots, p_n, not\ q_1, \cdots, not\ q_m)\ \ (n, m \geq 0)\\
&\quad exception_{p_1},\ \cdots\ , exception_{p_j}\ \ (0 \leq j \leq k),\quad being\ k\ an\ integer\ number\\
&\}
\end{aligned}
$$

Program 1. The Archetype of a Logic Program

The first clause denotes predicate's closure, "," designates "*logical and*", while "*?*" is a domain atom denoting "*falsity*", the p_i, q_j, and p are classical ground literals, i.e., either positive atoms or atoms preceded by the classical negation sign $\neg$ [7]. Indeed, $\neg$ stands for a strong declaration that speaks for itself, while *not* denotes *negation-by-failure*, i.e., a failure in proving a certain statement since it was not declared in an explicit way. According to this way of thinking, a set of *abducibles* are present in every program [15]. In this work are given in the form of exceptions to the extensions of the predicates that make the program, i.e., clauses of the form, viz.

$$exception_{p_1},\ \cdots\ , exception_{p_j}\ \ (0 \leq j \leq k),\quad being\ k\ an\ integer\ number$$

that denote data, information or knowledge that cannot be ruled out. On the other hand, clauses of the type, viz.

$$?\,(p_1, \cdots, p_n, not\ q_1, \cdots, not\ q_m)\ \ (n, m \geq 0)$$

are invariants that make it possible to specify the context under which the universe of discourse should be understood [13, 14].

2.2 Artificial Neural Networks

Artificial Neural Networks (*ANNs*) are computing tools inspired by studies of the human brain and nervous system. In fact, they are mathematical models that simulate such systems as are understood today. *ANNs* were first introduced in 1943 [16], and significant developments occurred until 1969 (e.g., the emergence of single-layer perceptron [17]). However, some limitations (e.g., the fact that a single-layer perceptron cannot solve the *XOR* problem) led to a decline in interest in *ANNs* between 1969 and 1986. The above-mentioned disadvantages were remedied in the 1980s and research on *ANNs* again increased the emergence of the back-propagation algorithm in 1986 [18] and the posterior stimulation through the development of numerous fast gradient-based variants (e.g., *RPROP*) [19]. One of the main characteristics of *ANNs* is their ability to learn. In fact, it is important to note that *ANNs* are not traditional computer programs. You learn from examples through a process called training, in which *ANNs* organize themselves to adjust an internal set of parameters (i.e. weights) that are used to collect the information contained in the data [20]. Compared to traditional methods, *ANNs* treat inaccurate and / or incomplete data, give approximate results, and are less prone to outliers. In addition, it is not necessary to accept restrictions or to know the relationships between variables from the outset. *Multi-Layer Perceptron* (*MLP*) is one of the most widespread *ANN* architectures in which neurons are layered and only forward connections exist [20]. The *MLP* design is typically trial and error using an upward approach, starting with an initial architecture that is adjusted to minimize the internal error (e.g., *Mean Square Error*) [20, 21].

3 Methods

This study was carried out at a company in northern Portugal. A total of 72 workers participated in this study. The ages of the participants ranged from 22 to 68 years (average age 46.3 years), with 42% women and 48% men. The questionnaire consists of three sections, the first of which contains general questions (e.g. age, gender, academic qualifications, place of residence), while the second contains information on *Group Identity*, *Methods*, *Collective Self-Esteem*, *Gratitude* and *Prosocialness*. Finally, in the third section, workers are asked to express their opinion about the *Organizational Performance* of the company. The *WEKA* software was used to implement *ANNs* as stated above while maintaining the standard software parameters [22]. To ensure statistical significance of the results, 20 tests were carried out in all situations. In each simulation, the database was randomly divided into two mutually exclusive partitions, i.e., the training and test sets.

4 Case Study

4.1 A Thermodynamic Approach to Data Acquisition and Processing

In order to collect information about organizational efficiency of the company the respondents were asked to tick the option(s) that reflects their opinions regarding each statement. The answer options were confined to the following scale, *viz*.

strongly agree (4), agree (3), disagree (2), strongly disagree (1), disagree (2),

agree (3), strongly agree (4)

The statements under consideration were organized into three groups, namely *Group Identity Related Statements – Five Items* (*GIRS – 5*), *Methods Related Statements – Three Items* (*MRS – 3*), *Collective Self-Esteem Related Statements – Four Items* (*CSERS – 4*), *Gratitude Related Statements – Three Items* (*GRS – 3*) and *Prosocialness Related Statements – Four Items* (*PRS – 4*) [8-12]. The former one comprises the statements, viz.

S1 – One's Working Group Identity is very high;
S2 – One's Working Group Identity is high;
S3 – One's Working Group Identity is low;
S4 – Our Working Group stands for our Family; and
S5 – Would you enjoy to switch to another Working Group.

The group related with *Methods* encompasses the statements, viz.

S6 – Our organizations methods are adjusted to our level of results;
S7 – No improvement can be made; and
S8 – We always look for best practices in my organization.

The *Collective Self-Esteem* group includes the statements, viz.

S9 – Overall, my social groups are considered good by others;
S10 – I am a cooperative participant in the social groups I belong to;
S11 – In general, others respect the social groups that I am a member of; and
S12 – In general, belonging to social groups is an important part of my self-image.

Regarding *Gratitude* group, it comprehends the statements, viz.

S13 – I have so much in life to be thankful for;
S14 – If I had to list everything that I felt grateful for, it would be a very long list; and
Q15 – Long amounts of time can go by before I feel grateful to something or someone.

Finally, the group of statements concerning *Prosocialness* involves the statements, viz.

S16 – I am pleased to help my colleagues in their activities;
S17 – I am emphatic with those who are in need;
D18 – I am willing to make my knowledge and abilities available to others; and

S19– I easily share with friends any good opportunity that comes to me.

The answers of the respondent #1 to *Group Identity Related Statements – Five Items* (*GIRS – 5*) are presented in Table 1. For example, the answer to S1 was strongly agree (4) → agree (3), i.e., respondent #1 indicated that he/she strongly agree (4) with statement S1, but does not reject the possibility that the answer could be agree (3) in certain situations. It shows a trend in the development of the his/her opinion with a variation in entropy, i.e., in this case there is a deterioration in the respondent's opinion once the entropy increased. Otherwise, the answer of respondent #1 to S3, disagree (2) → agree (3), shows a trend in his/her opinion with a decrease in entropy, i.e., there is an increase in respondent's opinion. For S4 and S5 the answers were strongly disagree (1) and agree (3), respectively, a fact that speaks for itself, while for S2 no options were indicated that indicate a vague situation, i.e., the value of the energy consumed is unknown, although it is known that it is in the bandwidth is the interval 0 ... 1.

In order to quantify the qualitative information and make the process intelligible, complete calculation details for *GIRS – 5* are provided. Fig. 2 describes such responses regarding the different forms of energy, i.e., *exergy*, *vagueness* and *anergy*. Bearing in mind the fact that the markings on the axis correspond to one of the possible scaling options, the respondent's opinion behaves better when the entropy decreases, which is the case with S3, as shown in Table 2 for the Best/Worst Case Scenarios (BCS/WCS).

Table 1. Respondent # 1 answers to *GIRS – 5*.

Statements	*Scale*							
	increasing trend →				*decreasing trend* →			
	(4)	(3)	(2)	(1)	(2)	(3)	(4)	*vagueness*
S1	×	×						
S2								×
S3					×	×		
S4						×		
S5				×				

Leading to **Leading to**

Fig. 2

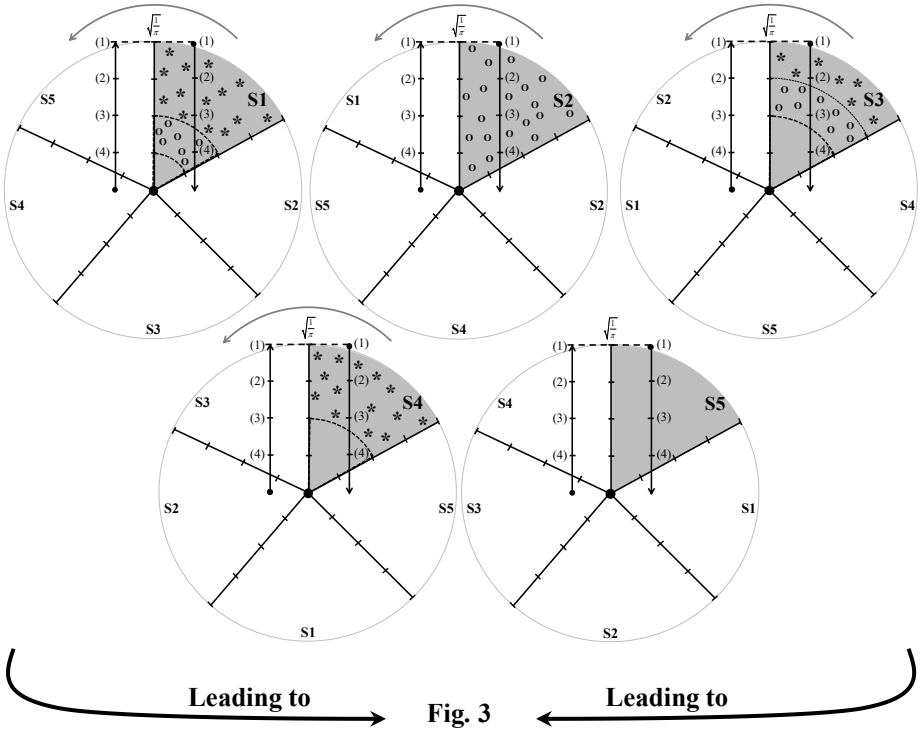

Fig 2. Estimate energy consumption for each statement sentence in relation to respondent # 1's answers to the *GIRS – 5*. The gray areas, gray areas with spheres and gray areas with asterisks stand for exergy, vagueness and anergy, respectively.

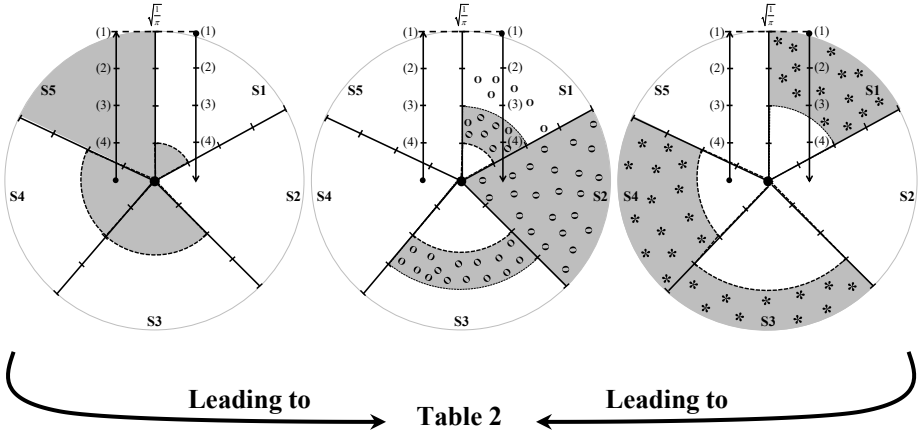

Fig. 3. A global view of the energy consumed by respondent #1 when answering to *GIRS – 5*. The gray areas, gray areas with spheres and gray areas with asterisks stand for exergy, vagueness and anergy, respectively.

Table 2. *Assessment of the respondent's #1 answers to GIRS – 5 for the Best and Worst scenarios.*

Statements	*Best Case Scenario (BCS)*	*Worst Case Scenario (WCS)*
S1	$exergy_{S_1} = \frac{1}{5}\pi r^2\Big]_0^{\frac{1}{4}\sqrt{\frac{1}{\pi}}} = \left(\frac{1}{5}\pi\left(\left(\frac{1}{4}\sqrt{\frac{1}{\pi}}\right)^2 - 0\right)\right) = 0.01$	$exergy_{S_1} = \frac{1}{5}\pi r^2\Big]_0^{\frac{2}{4}\sqrt{\frac{1}{\pi}}} = 0.05$
	$vagueness_{S_1} = \frac{1}{5}\pi r^2\Big]_{\frac{1}{4}\sqrt{\frac{1}{\pi}}}^{\frac{2}{4}\sqrt{\frac{1}{\pi}}} = 0.04$	$vagueness_{S_1} = \frac{1}{5}\pi r^2\Big]_{\frac{2}{4}\sqrt{\frac{1}{\pi}}}^{\frac{2}{4}\sqrt{\frac{1}{\pi}}} = 0$
	$anergy_{S_1} = \frac{1}{5}\pi r^2\Big]_{\frac{1}{4}\sqrt{\frac{1}{\pi}}}^{\sqrt{\frac{1}{\pi}}} = 0.19$	$anergy_{S_1} = \frac{1}{5}\pi r^2\Big]_{\frac{2}{4}\sqrt{\frac{1}{\pi}}}^{\sqrt{\frac{1}{\pi}}} = 0.15$
S2	$exergy_{S_2} = \frac{1}{5}\pi r^2\Big]_0^0 = 0$	$exergy_{S_2} = \frac{1}{5}\pi r^2\Big]_0^{\sqrt{\frac{1}{\pi}}} = 0.2$
	$vagueness_{S_2} = \frac{1}{5}\pi r^2\Big]_0^{\sqrt{\frac{1}{\pi}}} = 0.2$	$vagueness_{S_2} = \frac{1}{5}\pi r^2\Big]_{\sqrt{\frac{1}{\pi}}}^{\sqrt{\frac{1}{\pi}}} = 0$
	$anergy_{S_2} = \frac{1}{5}\pi r^2\Big]_{\sqrt{\frac{1}{\pi}}}^{\sqrt{\frac{1}{\pi}}} = 0$	$anergy_{S_2} = \frac{1}{5}\pi r^2\Big]_{\sqrt{\frac{1}{\pi}}}^{\sqrt{\frac{1}{\pi}}} = 0$
S3	$exergy_{S_3} = -\frac{1}{5}\pi r^2\Big]_{\frac{2}{4}\sqrt{\frac{1}{\pi}}}^{0} = 0.05$	$exergy_{S_3} = -\frac{1}{5}\pi r^2\Big]_{\frac{3}{4}\sqrt{\frac{1}{\pi}}}^{0} = 0.11$
	$vagueness_{S_3} = -\frac{1}{5}\pi r^2\Big]_{\frac{3}{4}\sqrt{\frac{1}{\pi}}}^{\frac{2}{4}\sqrt{\frac{1}{\pi}}} = 0.06$	$vagueness_{S_3} = -\frac{1}{5}\pi r^2\Big]_{\frac{3}{4}\sqrt{\frac{1}{\pi}}}^{\frac{3}{4}\sqrt{\frac{1}{\pi}}} = 0$
	$anergy_{S_3} = -\frac{1}{5}\pi r^2\Big]_{\sqrt{\frac{1}{\pi}}}^{\frac{3}{4}\sqrt{\frac{1}{\pi}}} = 0.09$	$anergy_{S_3} = -\frac{1}{5}\pi r^2\Big]_{\sqrt{\frac{1}{\pi}}}^{\frac{3}{4}\sqrt{\frac{1}{\pi}}} = 0.09$
S4	$exergy_{S_4} = -\frac{1}{5}\pi r^2\Big]_{\frac{2}{4}\sqrt{\frac{1}{\pi}}}^{0} = 0.05$	$exergy_{S_4} = -\frac{1}{5}\pi r^2\Big]_{\frac{2}{4}\sqrt{\frac{1}{\pi}}}^{0} = 0.05$
	$vagueness_{S_4} = -\frac{1}{5}\pi r^2\Big]_{\frac{2}{4}\sqrt{\frac{1}{\pi}}}^{\frac{2}{4}\sqrt{\frac{1}{\pi}}} = 0$	$vagueness_{S_4} = -\frac{1}{5}\pi r^2\Big]_{\frac{2}{4}\sqrt{\frac{1}{\pi}}}^{\frac{2}{4}\sqrt{\frac{1}{\pi}}} = 0$
	$anergy_{S_4} = -\frac{1}{5}\pi r^2\Big]_{\sqrt{\frac{1}{\pi}}}^{\frac{2}{4}\sqrt{\frac{1}{\pi}}} = 0.15$	$anergy_{S_4} = -\frac{1}{5}\pi r^2\Big]_{\sqrt{\frac{1}{\pi}}}^{\frac{2}{4}\sqrt{\frac{1}{\pi}}} = 0.15$

S5	$exergy_{S_5} = \frac{1}{5}\pi r^2\Big]_0^{\sqrt{\frac{1}{\pi}}} = 0.20$	$exergy_{Q_5} = \frac{1}{5}\pi r^2\Big]_0^{\sqrt{\frac{1}{\pi}}} = 0.20$
	$vagueness_{S_5} = \frac{1}{5}\pi r^2\Big]_{\sqrt{\frac{1}{\pi}}}^{\sqrt{\frac{1}{\pi}}} = 0$	$vagueness_{S_5} = \frac{1}{5}\pi r^2\Big]_{\sqrt{\frac{1}{\pi}}}^{\sqrt{\frac{1}{\pi}}} = 0$
	$anergy_{S_5} = \frac{1}{5}\pi r^2\Big]_{\sqrt{\frac{1}{\pi}}}^{\sqrt{\frac{1}{\pi}}} = 0$	$anergy_{S_5} = \frac{1}{5}\pi r^2\Big]_{\sqrt{\frac{1}{\pi}}}^{\sqrt{\frac{1}{\pi}}} = 0$

Leading to **Table 3** **Leading to**

The data collected above may now be structured in terms of the extent of predicate ***g****roup* ***i****dentity* ***r****elated* ***s****tatements* (*girs – 5*) in the form, *viz*.

$$girs - 5: \boldsymbol{EX}ergy, \boldsymbol{VA}gueness, \boldsymbol{O}rganizational's\ \boldsymbol{P}erformance,$$
$$\boldsymbol{Q}uality\text{-}\boldsymbol{o}f\text{-}\boldsymbol{I}nformation \rightarrow \{True, False\}$$

a construct that speaks for itself, whose extent and formal description follows (Table 3 and Program 2).

Table 3. The extent of the *girs – 5*'*s* predicate built on the respondent # 1 answers to *GIRS – 5*.

Questionnaire	Ex BCS	VA BCS	OP BCS	QoI BCS	EX WCS	VA WCS	OP WCS	QoI WCS
GIRS – 5	0.31	0.30	0.95	0.69	0.61	0	0.79	0.39

{

$$\neg\, girs - 5\ (EX,\ VA, OP,\ QoI) \leftarrow not\ girs - 5\ (EX,\ VA, OP,\ QoI),$$
$$not\ exception_{girs-5}\ (EX,\ VA, OP,\ QoI)$$

$$girs - 5\ (0.31,\ 0.30,\ 0.95,\ 0.69).$$

}

Program 2. The extent of the *girs – 5* predicate for the *Best* case scenario.

The evaluation of *Organizational's Performance* (*OP*) and *Quality of Information (QoI)* for the different items that make the *girs* – 5 extent is now given in the form, *viz*.

- OP is figured out using $OP = \sqrt{1 - ES^2}$ (Fig. 4), where ES stands for the exergy's that may have been consumed, a value that ranges in the interval 0…1. In the *Best* case scenario, $ES = exergy$, while in the *Worst* case scenario, $ES = exergy + vagueness$).

  $OP_{BCS} = \sqrt{1 - (0.31)^2} = 0.95$

  $OP_{WCS} = \sqrt{1 - (0.31 + 0.30)^2} = 0.79$

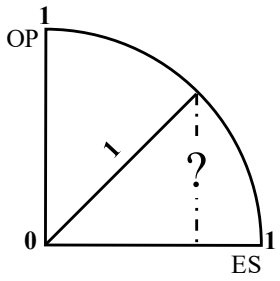

Fig. 4. *OP* evaluation.

- QoI is evaluated in the form $QoI = 1 - ES/Interval\ length(= 1)$.

  $QoI_{BCS} = 1 - 0.31 = 0.69$

  $QoI_{WCS} = 1 - (0.31 + 0.30) = 0.39$

To complement Table 1, Table 4 shows the respondent #1 answers to *MRS – 3*, *CSERS – 4*, *GRS – 3* and *PRS – 4*.

Table 4. Answers of respondent # 1 to the *MRS – 3*, *CSERS – 4*, *GRS – 3* and *PRS – 4*.

Questionnaires	Statements	*Scale*							
		increasing trend →				← *decreasing trend*			
		(4)	(3)	(2)	(1)	(2)	(3)	(4)	*vagueness*
MRS – 3	S6						×		
	S7	×	×						
	S8					×			
CSERS – 4	S9		×	×					
	S10				×				
	S11								×
	S12						×	×	
GRS – 3	S13						×		
	S14	×	×						
	S15						×		

PRS – 4	S16							×
	S17			×	×			
	S18	×	×					
	S19					×		

Leading to **Table 5** **Leading to**

Table 5. The *girs – 5*, *mrs – 3*, *csers – 4*, *grs – 3* and *prs – 4* predicates' scopes obtained according to the respondent # 1 answers to the *GIRS – 5*, *MRS – 3*, *CSERS – 4*, *GRS – 3* and *PRS – 4*.

Questionnaires	Exergy BCS	Vague BCS	OP BCS	QoI BCS	Exergy WCS	Vague WCS	OP WCS	QoI WCS
GIRS – 5	0.31	0.30	0.95	0.69	0.61	0	0.79	0.39
MRS – 3	0.29	0.06	0.96	0.71	0.35	0	0.94	0.65
CSERS – 4	0.33	0.38	0.94	0.67	0.71	0	0.70	0.29
GRS – 3	0.19	0.06	0.98	0.81	0.25	0	0.97	0.75
PRS – 4	0.22	0.41	0.97	0.78	0.63	0	0.78	0.37

4.1 Evaluation of Respondents' Opinion – A Computational Logic Approach

The Formal Framework. Computational Logic is the use of computers to establish facts in a logical formalism. The topic dates from the 19th century and tries to understand the nature of mathematical thinking. In this subsection a mathematical-logical program is presented, with the help of which one's perception of the individuals or assemblies with respect to a particular subject is evaluated and how the organization as a whole is assessed, i.e., it measures the impact of the individuals' psychosocial threats on the organization through logical reasoning (*Program #3*, further down). Indeed, contextual programming is not new, but an unusual field that can help find or work out data. In addition, as often the Artificial Intelligence and Machine Learning is currently widely practiced, there is no way to ask the computer why this was the case. It is known how to teach an algorithm to identify a horse in a photo, but you cannot ask why it is a horse. This was the main reason why the system of information or knowledge representation and reasoning was changed. The focus is not on knowing the absolute value of a variable, but on quantifying the associated evolutionary process that has resulted in a certain variable taking on a certain value. Indeed, this framework provides the basis for training an *ANN* to assess the Levels of Trust (*LoT*)) and Sustainability (*LoS*) of *Program # 3* with respect to *Organizational Performance* (*OP*).

```
{

/* The sentence below states that the extent of predicate girs – 5 are made on the
clauses that are explicitly stated plus the ones that cannot be discarded */
```

$\neg\, girs-5\,(EX,\ AN,\ OP,\ QoI) \leftarrow not\ girs-5\,(EX,\ AN,\ OP,\ QoI),$

$not\ exception_{girs-5}(EX,\ AN,\ OP,\ QoI).$

/ The sentence below denotes a girs – 5 axiom*/*

$girs-5\ (0.31,\ 0.30,\ 0.95,\ 0.69).$

*/*The sentence below states that the extent of predicate* $mrs-3$ *is made on the clauses that are explicitly stated plus the ones that cannot be discarded*/*

$\neg\, mrs-3\,(EX,\ AN,\ OP,\ QoI) \leftarrow not\ mrs-3\,(EX,\ AN,\ OP,\ QoI),$

$not\ exception_{mrs-3}(EX,\ AN,\ OP,\ QoI).$

/ The sentence below denotes a mrs – 3 axiom*/*

$mrs-3\ (0.29,\ 0.06,\ 0.96,\ 0.71).$

*/*The sentence below states that the extent of predicate csers – 4 is made on the clauses that are explicitly stated plus the ones that cannot be discarded*/*

$\neg\, csers-4\,(EX,\ AN,\ OP,\ QoI) \leftarrow not\ csers-4\,(EX,\ AN,\ OP,\ QoI),$

$not\ exception_{csers-4}(EX,\ AN,\ OP,\ QoI).$

/ The sentence below denotes a csers – 4 axiom*/*

$csers-4\ (0.33,\ 0.38,\ 0.94,\ 0.67).$

*/*The sentence below states that the extent of predicate* $grs-3$ *is made on the clauses that are explicitly stated plus the ones that cannot be discarded*/*

$\neg\, grs-3\,(EX,\ AN,\ OP,\ QoI) \leftarrow not\ grs-3\,(EX,\ AN,\ OP,\ QoI),$

$not\ exception_{grs-3}(EX,\ AN,\ OP,\ QoI)$.

/ The sentence below denotes a grs – 3 axiom*/*

$mrs-3\ (0.29,\ 0.06,\ 0.96,\ 0.71).$

*/*The sentence below states that the extent of predicate prs – 4 is made on the clauses that are explicitly stated plus the ones that cannot be discarded*/*

$$\neg\, prs-4\,(EX,\ AN,\ OP,\ QoI) \leftarrow not\ ps-4\,(EX,\ AN,\ OP,\ QoI),$$

$$not\ exception_{prs-4}(EX,\ AN,\ OP,\ QoI) \quad .$$

/ The sentence below denotes a prs – 4 axiom*/*

$$prs-4\,(0.22,\ 0.41,\ 0.97,\ 0.78).$$

}

Program 3. *The make-up of the LP or Knowledge Base to establish respondent`S # 1 estimation about Organizational Performance in the Best Case Scenario.*

where $\neg$ denotes *strong negation* and *not negation-by-failure*.

Artificial Neural Network Training and Testing Procedures. It is now possible to consider the data sets to train and test an *ANN* [21, 23] (Fig. 5), viz.

- The input in the form of the respondents' opinions about *Group Identity* (extent of predicate *girs – 5*), *Methods* (extent of predicate *mrs – 3*), *Collective Self-Esteem* (extent of predicate *csers – 4*), *Gratitude* (extent of predicate *grs – 3*) and *Prosocialness* (extent of predicate *prs – 4*); and
- The output in terms of an evaluation of *Program #3 Levels of Trust* (*LoT*) and *Sustainability* (*LoS*) to assess *Organizational Performance*, values that range in the interval 0…1.

In present work a cohort of 72 workers was enrolled, and the training set was gotten by clarifying the theorem, viz.

$$\forall\,(EX_1,\ VA_1,\ OP_1,\ QoI_1,\ \cdots,\ EX_5,\ VA_5,\ OP_5,\ QoI_5),$$

$$\left(girs\text{–}5\left(EX_1,\ VA_1,\ OP_1,\ QoI_1\right),\ \cdots,\ prs\text{–}4\left(EX_5,\ VA_5,\ OP_5,\ QoI_5\right)\right)$$

in every possible way, i.e., generate all different possible sequences that combine the terms or clauses of the extents of predicates *girs – 5*, *mrs – 3*, *csers – 4*, *grs – 3* and *prs – 4*, viz.

$$\left\{\left\{girs\text{–}5\left(EX_1,\ VA_1,\ OP_1,\ QoI_1\right),\ mrs\text{–}3\left(EX_2,\ VA_2,\ OP_2,\ QoI_2\right),\cdots\right.\right.$$

$$\left.\left.\cdots,\ prs\text{–}4\,(EX_5,\ VA_5,\ OP_5,\ QoI_5)\right\},\cdots\right\} \approx$$

$$\approx \left\{\left\{girs\text{–}5\,(0.31,\ 0.30,\ 0.95,\ 0.69),\ mrs\text{–}3\,(0.29,\ 0.06,\ 0.96,\ 0.71),\ \cdots\right.\right.$$

$$\cdots,\ prs\text{–}4\ (0.22,\ 0.41,\ 0.97,\ 0.78)\},\ \cdots\}$$

With regard to *LoT* and *LoS*, they may be weighed in the mold, viz.

$$\left\{\{\left(OP_{girs\text{–}5}+SP_{mrs\text{–}3}+OP_{csers\text{–}4}+OP_{grs\text{–}3}+OP_{prs\text{–}4}\right)/5\},\ \cdots\right\}_{LoT} \approx$$

$$\approx \left\{\{(0.95+0.96+0.94+0.98+0.97)/5=0.96\},\ \cdots\right\}_{LoT}$$

and, *viz*.

$$\left\{\{\left(QoI_{girs\text{–}5}+QoI_{mrs\text{–}3}+QoI_{csers\text{–}4}+QoI_{grs\text{–}3}+QoI_{prs\text{–}4}\right)/5\},\ \cdots\right\}_{LoS} \approx$$

$$\approx \left\{\{(0.69+0.71+0.67+0.81+0.78)/5=0.73\},\ \cdots\right\}_{LoS}$$

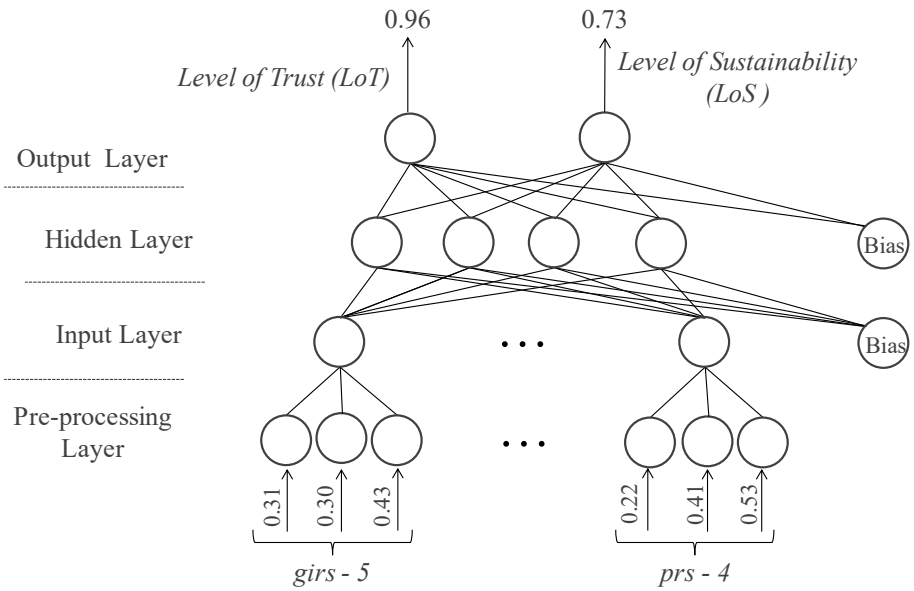

Fig. 5. An abstract view of the topology of the *ANN* to assess *Program # 3 Levels of Trust* and *Sustainability*.

5 Conclusions and Future Work

The analysis of a real model abandons the theoretical assumptions and focuses on reality to construct these factors. In searching for this path, systemic analysis introduces organizing principles that make it possible to understand reality in terms of the systems' stability/instability and their complexity, rendering one to understand what is a Real

Organization Model. Any organization may be seen in terms of the structural components that determine its performance, namely Information, Make-up (Consolidation/Division/Unification), and Entropy [1]. Information is a structuring component of the organizational system. It is the information available that structures the organism. It is through the exchange of Information that it is accessed the Information's Meaning. Meaning is the source of the transaction between the different actors that make up the organizational system. We are dealing with the visible part of the information. However, the information in the transmission process is embedded in the meaning that is transmitted. Information that is transmitted and transacted is often incomplete, contradictory, nebulous, non-existent. Meaning in uncertain environments is becoming increasingly uncertain. We are working on the Invisible Dimension of Information. The organizing process is the second structuring element of any system, i.e., in any organizational system there are two components of such a process; one, the division of labor, the other, coordination/unification [3]. Any organizing process has these two components that structure the visible part of the organizing process, like structure, number of levels, activities and tasks. However, the process of unifying has an invisible dimension, which is based on the Involvement and participation of the different actors that make up the system. These are influenced by characteristics such as Sharing, Motivation, Cooperation, among others. Understanding and weighing these actors was the goal of this work. Future work will focus on topics such as personality, including the impact of different cultures. Perception and its impact on decision-making; employee's values; emotions, including emotional intelligence, emotional work and the effects of positive and negative impact on decision-making and creativity; and motivation, including the impact of rewards and goals and their impact on management, including the structural behavioral variables of the system regulation, such as Power, Leadership and Justice.

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