EXTENDING DEMO - CONTROL ORGANIZATION MODEL

Modeling an Organization's Viability Norms, Dysfunctions and Resilience Strategies

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Keywords: DEMO, Control, Viability, Dysfunction, Exception handling.

Abstract: In this paper we present part of an extension to the Design and Engineering Methodology for Organizations (DEMO) – a proposal for an ontological model for the generic Control Organization that we argue that exists in every organization. With our proposal, DEMO can now be used to explicitly specify critical properties of an organization – that we call measures – whose value must respect certain restrictions imposed by other properties of the organization – that we call viability norms. We can now also precisely specify, with DEMO, defined resilience strategies that control and eliminate dysfunctions – violations of viability norms.

1 INTRODUCTION

Our initial research efforts had the general purpose of understanding and clarifying what the *function perspective of an organization* should be. As a result of a review that we undertook on how this concept is used in such diverse areas as enterprise engineering, information systems, biology, sociology and philosophy – e.g. (Applegate, McFarlan & McKenney, 1999), (Christensen & Bickhard, 2002) and (Dietz, 2006) – we found that, besides the aspect of *behavior*, also central to the function concept is the *normative* aspect, that is, the existence of certain normally expected values – *norms* – for certain vital properties of a system. In an organization, *deviations* from such norms imply a state of *dysfunction* that can possibly compromise its *viability*. In this paper we present examples from the scenario of a library – introduced in (Dietz, 2006) and extended in our research – as to better accommodate concepts we're proposing. The main activities of the library are *book loaning* and *offer book history courses*. We can define three norms: (1) *min average number of registrants in book history courses 1 week before start is 14*, (2) *min total income per month is 900€* and (3) *max loan declines per week is 30*. A possible dysfunction in the second norm is: *average number of registrants in book history courses is 7 on March 23th 2009*.

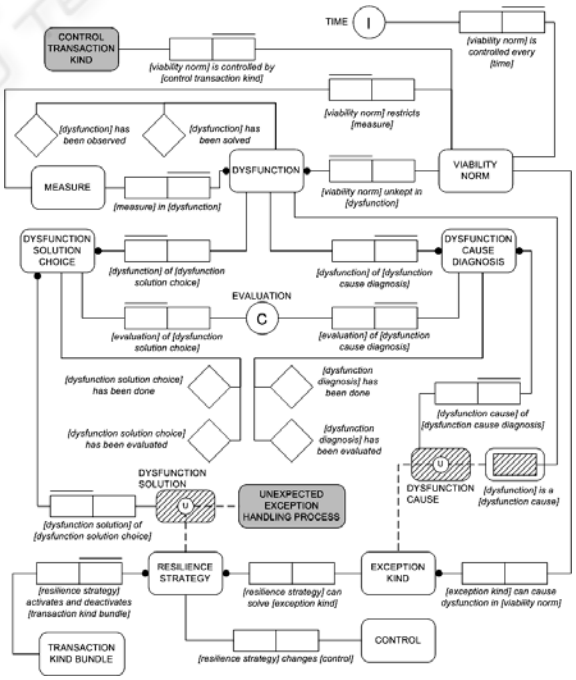

Figure 1: Control Organization's SSD.

Aveiro D., Silva A. and Tribolet J. (2010).
EXTENDING DEMO - CONTROL ORGANIZATION MODEL - Modeling an Organization's Viability Norms, Dysfunctions and Resilience Strategies.
In *Proceedings of the 12th International Conference on Enterprise Information Systems - Information Systems Analysis and Specification*, pages 489-492
DOI: 10.5220/0002908704890492
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This can be a very serious situation because, as a consequence, the library may lose income needed to acquire enough resources and eventually go bankrupt, closing down the business. Dysfunctions will have a *cause* which may be *expected* or *unexpected*. If the cause is expected, certain *resilience strategies* may already exist that can be activated to eliminate or circumvent dysfunctions (Holland, 1996). From several approaches to support Organizational Engineering being proposed, DEMO seems to be one of the most coherent, comprehensive, consistent and concise (Dietz, 2006). It has shown to be useful in a number of applications, from small to large scale organizations – see, for example, (Op' t Land, 2008) (p. 39). Nevertheless, DEMO models have been mostly used to devise blueprints to serve as instruments for discussion of broader scale organizational change or development/change of IT systems (Op' t Land, 2008) (p. 58) and does not, yet, provide modeling constructs and a method for the continuous control (resilience) that we need to exert on organizations to guarantee viability. Contributions of our research – part of which is presented in the next section – extend DEMO, with the devising of concepts and a method that systematically address the referred shortcoming. The reader which is unfamiliar with DEMO is advised to consult (Dietz, 2006) or publications in: www.demo.nl.

2 CONTROL ORGANIZATION

One of the contributions of our research is to apply DEMO to model what we propose to call the Control Organization. The Control Organization's ontological model (COM) is the specification of a generic organization considered to exist included in every organization and responsible for controlling its viability. It clearly and precisely specifies (1) accepted outcomes of organizational behavior so that viability is guaranteed, as well as (2) resilience strategies that can be activated or deactivated, as to eliminate dysfunctions caused by expected exceptions. For auditing reasons and to aid organizational change, we should keep structured information of the state and dynamics of control acts which may be very useful to trace a new previously unexpected exception causing a need for change. We next present one of the main aspect models of the COM, namely the CO's State Model (CO's SM) which is expressed, in World Ontology Specification Languate (WOSL) (Dietz, 2005) in Figure 1, consisting in the CO's State Space Diagram (CO's SSD). WOSL is highly based in the ORM fact oriented modeling language (Halpin, 1998), extending it with the ability of modeling events (result kinds) affecting facts. In practice, the CO's SSD is a default subset of the SSD of every organization. For separation of concerns reasons we model the CO as a "separate" organization, although, in practice, it is included in the controlled organization itself. A similar reasoning applies to the other aspect models of the CO: the CO's CM and the CO's AM, which, for space reasons, are left out of this paper. As a central piece in the CO's SM, we specify object class DYSFUNCTION, of which instances will aggregate all kinds of useful information regarding a certain dysfunction. Special and also fundamental pieces of the CO's SM are object classes MEASURE and VIABILITY NORM.

2.1 Measures and Viability Norms

Norms specify values for properties of the organization system that need to be respected so that viability is maintained. We propose to call such properties as *measures* and norms as *viability norms*, as they specify allowed states for certain measures of an organization which guarantee its viability. We find in (Dietz, 2006) the Object Property List, part of the SM, as a convenient way of specifying fact types that are proper (mathematical) functions, and of which the range is a set of values. The fact types in an OPL are called properties (of object classes). We observe, from the OPL of the library (Dietz, 2006), that certain properties specify restrictions on another property. E.g, we have property *max_copies_in_loan* which specifies the maximum (restriction) number of book copies a certain member of the library is allowed to have in loan (property). This (restriction) property is checked in the action rule that decides on an acceptance or a decline in transaction loan start. It logically follows that, in the SM of a certain organization, certain properties will have to be declared that specify restrictions on certain measures related to its information banks (i.e., to its production and coordination information). Taking the case of the library, one of its production banks is PB01, also named by alias *membership fee payments*. To make sure one is able to cover all expenses of the library, we will need to measure a relevant property of PB01, namely, *total income per month*. As a viability norm, we need to declare a certain necessary minimum income per month. We do this with property *min total income per month*. To detect possible problems in loans, we will also need to measure a relevant property of coordination bank CB04, namely, *loan declines per week*. As a viability norm we need to declare a certain maximum of declines per week. We do this with property *max total loan declines per week*. Object class MEASURE, of the CO's SM, represents the aggregation of all properties

of the main organization's SM which are measures related with information banks. In other words. these are a subset of the properties of an organization which constitute measures that will be repeatedly observed (measured) for control ends. Certain other properties of an organization will impose restrictions on properties that are measures, so that viability is guaranteed. Object class VIABILITY NORM of the CO's SM represents the aggregation of all these restriction properties part of the main organization's SM. Besides knowing which properties of the main organization are measures and viability norms, the CO needs to know explicitly which are the viability norms imposed on each measure. We model this need with the fact type, explained by predicative sentence: *[viability norm] restricts [measure]*. We propose a table to express the above proposed part of the CO's SM, namely the Measures and Viability Norms Table (MVNT) which, for the case of the library, is expressed in Table 1.

Table 1: Measures and Viability Norms Table.

Measure	Viability norm	Scale
total income per month	min total income per month	EURO
loan declines per week	max loan declines per week	NUMBER
average # of registrants in lang. history courses 1 week before start	min average # of registrants in lang. history courses 1 week before start	NUMBER

2.2 Exceptions and Resilience Strategies

We propose object class EXCEPTION KIND, depicted in the CO's SSD, so that we can specify (known) exception kinds. We will need to relate each exception kind with a viability norm which can be in a dysfunction state due to instances of such exception kind. This relation is specified by the fact type: *[exception kind] can cause dysfunction in [viability norm]*. We propose also object class RESILIENCE STRATEGY, so that we can specify resilience strategies that can solve (known) exception kinds. We will need to relate each resilience strategy with the exception(s) that is(are) solved by it. This relation is specified by the fact type: *[resilience strategy] can solve [exception kind]*. We propose another table to express this other part of the CO's SM, namely, the Exceptions and Resilience Strategies Table (ERST). Before presenting the ERST of the library, we need to extend the library scenario with additional information. Let's consider the case that the library regularly sets up courses of book history. Classes need to have a *min average number of registrants 1 week before start* to generate the necessary income for expenses with room renting. As an example of a dysfunction, the starting date of the courses is just 1 week ahead and classes have, on average, only 9 registrants when minimum is 14. Two expected exceptions for this kind of dysfunction are *lack of advertisement of courses* and *general lack of interest in courses*. Three resilience strategies exist as a solution to these exceptions: (1) *distribute course fliers* so that such marketing can bring more registrations in time, (2) *reduce number of classes* where it is necessary to close classes and call students to transfer them to other classes (so that minimum in each class is reached), to change property *number of alternative classes per week* (reduce its value) and also to change viability norm *min total income per month* (reduce its value) as expenses with renting rooms will be reduced and (3) *delay courses start* so that, with current rate of registrations per week, classes can reach accepted minimum for starting. It also happens that, in some years, many students see their loan requests declined as they reached the allowed limit of maximum loans, leading to an abnormal rate of declines in loans. However, this usually happens due to the expected exception of, in exams season, being necessary for the students to loan more books than normally allowed. As it is of interest to the library to earn some more income and history has proven that it is not a risk to temporarily increase maximum allowed loans in this situation, a resilience strategy of increasing this limit for one month (duration of exams season) has been generated and operationalized. The above presented exceptions and resilience strategies are expressed in the ERST of the library, in Table 2, along with the viability norms that can be in dysfunction as a consequence of these exceptions.

Table 2: Exceptions and Resilience Strategies Table.

Viability norm	Exception	Resilience strategy
min average # of registrants in lang. history courses 1 week before start	lack of advertisement of courses	distribute course fliers
	general lack of interest in courses	reduce number of classes
		delay courses start
max loan declines per month	abnormal high rate of loan requests due to exams season	increase value of max_copies_in_loan

3 CONCLUSIONS

In this paper we have presented part of our proposal of the DEMO based ontological model of the control organization (CO). We consider that the CO implicitly exists in every organization and is responsible for exerting control as to eliminate dysfunctions caused by known exceptions occuring in the organization's activity. The State Model of the CO is presented, along with two tables we propose to elicit

useful information related to it: the Measures and Viability Norms Table (MVNT) and the Exceptions and Resilience Strategies Table (ERST). The practical relevance of the first is a quick and summarized glance on which are the critical variables – measures – on which to evaluate an organization's viability and what restrictions – viability norms – apply for them so that one can determine if dysfunctions are happening or not. In many kinds of situations of occurrence of expected exceptions or necessity of change, information of these measures and restrictions on them is essential to assess change impact and eventually establish new values for such restrictions. The practical relevance of the ERST is to provide a comprehensive and summarized view of which exceptions exist that can cause dysfunction on an organization's viability norms and which resilience strategies can be activated to solve such exceptions and eliminate the dysfunction. When an expected exception occurs, the several alternatives that exist to solve it are easily accessible so that the responsible controller can decide on the more adequate choice. For space reasons, we leave out of this paper several relevant parts of our proposal for the CO which can be consulted fully in (Aveiro, 2010) but are referred briefly next. Namely, to express other relevant information specified by the CO's SM, we propose the Control and Responsibilities Table (CRT), useful to clearly express two dimensions of responsibility of control of certain viability norms, namely *who* and *when*. This will be very helpful for auditing ends in quickly and clearly identifying responsibilities in case dysfunctions happen and defined resilience strategies were not activated in the most appropriate manner. We propose also the Resilience Strategy Definition Table, essential to provide a comprehensive view of details of each resilience strategy and, in the context of organizational change, provide, along with the ERST, clues on how to solve new previously unexpected exceptions. This follows the premise from Complex Adaptive Systems (CAS) theory that, to solve new exceptions, "rule pieces" that constitute current resilience strategies that solve similar exceptions may be re-utilized to build new resilience strategies to solve the new exceptions (Holland, 1996). The Dysfunctions Table (DT) provides a summary of current (unsolved) dysfunctions and recent or past (solved) dysfunctions. This will be useful, for example, in diagnosing a recurrent previously unexpected exception. It will also be an instrument for the "controllers of the controllers" so that higher hierarchy in the organization can act if certain dysfunctions are not being appropriately handled in time by their responsible controllers. Finally, the Dysfunctions Diagnosis and Actions Table (DDAT), provides a summary of the history of choices of dysfunction diagnosis and solutions. Together with the DFT and CRT, this table will provide a succinct and thorough trace of relevant control decisions of an organization, so that adequate measures can be taken against irresponsible agents, in a justified and detailed manner. Counting the good and bad choices of diagnosis and resilience strategies is a way to implement another premise from CAS, which is a scoring mechanism which can help on better deciding on which resilience strategies to associate with new (previously unexpected) exceptions or on the design of new resilience strategies.

ACKNOWLEDGEMENTS

Research work that led to results presented in this paper was possible thanks to the financial support of a PhD scholarship (Ref.: SFRH / BD / 13384 / 2003) subsidized by "Fundação para a Ciência e a Tecnologia - Ministério da Ciência, Tecnologia e Ensino Superior" of the Portuguese government and by the European Social Fund.

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