

Using Activity Diagrams and DEMO to Capture Relevant Measures in an Organizational Control

A Case Study on Remote Assistance Service

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Keywords: Activity Theory, DEMO, GOD, Collaborative Work, Dynamic Work, Enterprise Ontology.

Abstract: This paper makes a proposal how to find dysfunctions in the operation of an organization. For that it uses relevant work done in DEMO (Dynamic Essential Modelling of Organizations approach) and as a novelty it introduces some of the Activity Theory concepts such as the contradiction concept.

The DEMO method to construct an organization's control is named GOD (Generation, Operationalization & Discontinuation). The GOD method aims at the diagnosis of the organization's dysfunction, i.e., deviations from what is the expected operation, and also prepares the organization for an adequate response to such dysfunctions, so that it can continue to work. Dysfunctions are found by the declaration of control rules (i.e., norms) of some organization measures and monitoring feasible values for that rules. For example a measure could be the "income per month" of the organization, a norm could be "min income per month" and viability value could be "higher than 5000 Euros".

Notwithstanding the existing of GOD, it is not clear how to choose the proper measures, norms and the control values and how to relate them with operation of organization. To solve this challenge we propose to use Activity Theory concepts such as contradictions to propose a method to choose and monitor useful measures, norms and viability values. We will use the proposed solution via a real case study of a service (e.g., www.True-Kare.com) that allows someone to provide a remote assistance to another person by using a mobile phone.

1 OUTLINE

Current DEMO (Dietz, 2006) organization's control research models, such as GOD (Aveiro, 2010) are focused on the development of a DEMO extension that defines the exception handling function perspective of an organization, based in a continuous updated model of organization reality (Aveiro et al., 2010).

This research considers how can we introduce the Activity Theory's contradictions (Engeström and Sannino, 2010) (Engeström et al., 1997) in GOD, so that relevant organization's dysfunction can be caught taking into consideration the address the following characteristics of human activities: concurrent; interleaved; ambiguity and multiplicity (i.e. perform activities in a diversity of ways).

This proposal is a contribution specifically linked to GOD. Our research effort is to introduce in GOD

the Activity Theory's contradictions to improve the finding of organization measures that should be monitored to find the organization's dysfunctions.

Contradiction is a relevant Activity Theory concept (Engeström et al., 1997). Contradiction can be regarded as structural tensions over time within the organization (i.e., elements of an activity) and between activities that generate problems, failures and conflicts that result in break down, but at the same time become the capacity of an activity to develop it-self.

The purpose of GOD is to manage the allowed states for certain norms of an organization, which guarantee its viability. The organization's control model keeps a record of all norms of an organization and corresponding measured values so that the organization works in the proper way.

The observation of the norms' values is made by DEMO transactions that serve as control role. When

the observation of a transaction norm is faced with an unaccepted norm's value, we call it a dysfunction in that norm. As a cause of such dysfunction there is a need to diagnose an exception and a way to solve the dysfunction (i.e. resilience strategy). It is not always possible to solve dysfunctions. In that case the organization has to start an Organizational Engineering Process (OEP) to find the new exception happening and generate and operationalize the necessary organization artefacts to solve the dysfunction caused by it.

It appears that at present, there is a lack of a methodology that addresses how to choose the norms and how to find an exception. Traditionally several researchers have addressed these exception issues, and they recognize that organizations have keep on solving them continuously. The traditional solutions keep information about exceptions and how to solve them. This avoids the expenditure of an added effort in handling the continuous treatment of the same kind of exceptions (Antunes and Mourão, 2011) (Aveiro, 2010).

This document is structured as follows: Section 2 and 3 presents the theoretical foundations of our work. Section 4 presents the proposed method. Section 5 presents a case study that is used to validate the solution. Lastly, section 6 approaches the problems encountered, conclusions and future work.

2 ORGANIZATION CONTROL

DEMO methodology (Dietz, 2006) provides a description of an organization through an ontological model, which emphasizes the description of the core business. DEMO is based on Ψ theory (Dietz, 2006) that states that people, via their social exchanges, are bound in commitments relating to actions to be taken and approve on the results of these actions (Dietz, 2003).

DEMO comprises ontology acts, which are defined as acts in which new original things are effect. There are two kinds of acts, production acts and coordination acts. By performing coordination acts, people establish mutual commitments about production acts. The Production acts contribute to achieve the organization's purpose.

In DEMO the coordination and production acts are related to each other by means of the pattern referred as transaction. A transaction is organized in three phases: (i) in the Order-phase, an actor (i.e. initiator) makes a product request to other actor (i.e. executor) and the executor actor makes a

commitment that will deliver the requested product; (ii) in the Execution-phase the executor makes the product and, (iii) in the Result-phase the executor actor presents the initiator actor with the product manufactured and the initiator accept the product. Each phase represents a number of communicative acts or interactions between actors. An organization can be described as a collection of transactions linked together in different phases.

2.1 GOD Organization Control

Aveiro developed GOD, a DEMO organizational control model that manages the aspects of organization changes, as a result of treatment of exceptions. To this end, Aveiro proposed the use of a resilience strategy and microgenesis as a mechanism to deal with new kind of exceptions. In short, Aveiro proposes that organizations should explicitly design and deploy their organization's control with mechanism of resilience and microgenesis dynamics.

Figure 1 presents the control object's fact diagram that is part of state diagram of DEMO control model of an organization proposed by Aveiro.

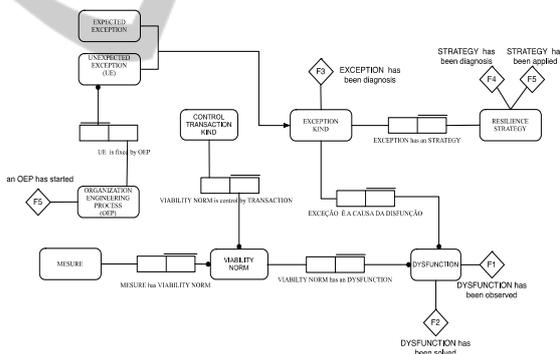


Figure 1: GOD Control Object Facts (Aveiro 2010).

It describes the conceptual model of allowable state space and can be used to capture the history of organization change. State model defines the main relations between objects and relevant facts that should be recorded in an organization such as: a dysfunction was observed (F1) and a dysfunction was fixed (F2). The F3 is a fact that records the discovering of the exceptions that causes the dysfunction. The solution of a dysfunction consists in discovering the right strategy (F4) that should be used to resolve the exception and finally applying the strategy (F5). When it is not possible to identify the type of the exception, it is considered that we are

dealing with an unexpected exception (i.e., a new one) and an organization engineering process has to be started (F6) as part of microgenesis dynamics.

3 ACTIVITY THEORY AND CONTRADICTION CONCEPT

Activity Theory describes people’s work in organizations as a social, cooperative and collective task (Kaptelinin and Nardi, 2012). The collective activity is linked to the shared object (purpose) of the activity and the subjects (i.e., person or group) performing it, of which the community members (i.e. person) are not often conscious. The concept of the object of the activity is grounded under the activity concept in the sense that there is no activity without an object and that individual work can be merged into collective activity through the use of communication and coordination instruments.

An activity produces outcomes and is performed through a division of work composed of actions, which are performed through operations. Actions are temporary, have a clearly defined beginning and an end and are linked to specific targets or goals. Operations are performed in an automatic, unconscious fashion and some times are not clearly related to goals. Operations depend on the conditions in which actions are performed (e.g., if someone needs to make a call he or she can use a phone or can use an email, depending on what the person has disposable in that moment).

Engeström, departed from the theoretical basis of Activity theory, proposes a triangular activity diagram that includes various components. An example of activity diagram is present in Figure 2.

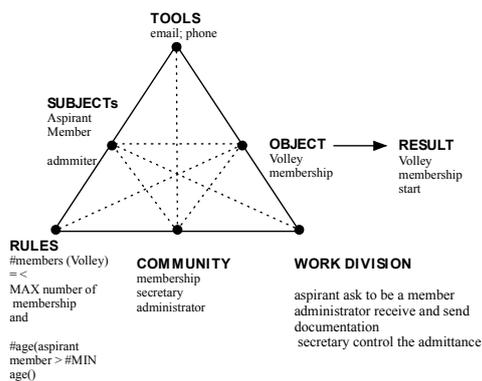


Figure 2: Activity Diagram of Volley Tennis club.

This diagrams describes the activity of a person in order to become a member of a tennis club named

Volley as described in Dietz book (Dietz, 2006) pages (15-32).

The Triangular Activity Diagram suggests the possibility of multiple relationships within the triangular structure activity and between activities, linked in a system. However, the main task is always to understand the entire context rather than their separate connections, since work cannot be understood or analysed outside the context in which it occurs.

3.1 Contradictions

According to the Activity theory, contradictions should be provided as tensions or imbalances manifested by failures, problems or errors. We can detect the manifestation of contradiction by analysing the people’s work and speech in an organization (Engeström and Sannino, 2011), expressed in the actions and operations performed by a person within an activity.

Contradictions can be analysed from an isolated element or between the elements that constitute the triangular activity diagram or from the relations between elements of an activity.

It can be typified as being the first, second, third and fourth type (Figure 3).

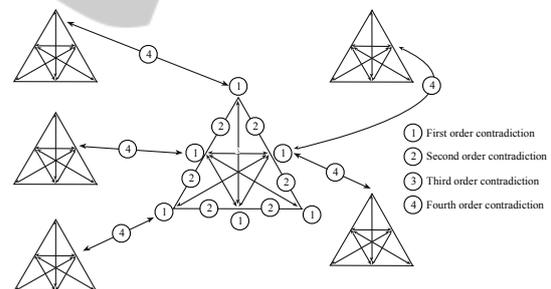


Figure 3: Types of activity contradictions.

The **first order contradictions** correspond to problems found in an internal element of a given activity. It occurs when one can isolate the manifestation of the occurred contradiction, diagnosing that it is due to a particular element of the Activity.

The **second order contradictions** occur because the problem cannot be isolated and are related to the interaction between two or more elements of the activity. They are between the corners of the triangle and occur between the components of the activity system.

The **third order contradictions** arise when conflicts can limit the development of the current

activity in relation to a hypothetical activity, which is culturally more developed.

Finally, the *fourth order contradictions* occur between the central activity system and the surrounding activity systems on the systems network and emerge from interaction of the central activity with peripheral activities. Most of the tensions occur in this situation, where usually a given activity is dependent on a result constructed by another.

Table 2 presents examples of contradiction that can be found when analysing activity diagram described in Figure 2.

Table 1: Kinds of contradictions.

ORDER	EXAMPLE
1° ORDER	When the member aspirant has some doubts about the use of volley club service and the price that he is going to pay or if he use the volley club to practice some sports or to other purpose such as business networking.
2° ORDER	When admitter has difficult to use the email tool to send or receive information from / to the member aspirant.
3° ORDER	When they want to change the service, for example to support volley training to younger members.
4° ORDER	If for example the activity that manager the volley field decide to change the king of field used it can impact with the member. Some may decide to leave and new ones can joint.

4 RESEARCH METHODOLOGY AND PROPOSED SOLUTION

The research methodology used in this work is Design Research (Hevner et al., 2004), which we consider to involve: (i) construction and (ii) evaluation. We understand construction as a process marked by creativity, since it presupposes the creation of new artefacts, based on realization and implementation models of an organization. We comprehend evaluation as a continuous process of testing the usefulness of the artefact. For that we use qualitative and quantitative methods as a way to measure the effectiveness and impact of the artefact preferably in real life case studies.

From the viewpoint of ontological, realization and implementation models of an organization, we

follow the proposal made by Dietz (Dietz, 2006) (e.g. mainly theorem of the organization and the distinction axiom in the Ψ theory) where the ontological model keeps apart all realization and implementation issues.

However the realization and implementation are bound to the ontological model. The realization starts with the business aspects of an organization (i.e., the ontological model) and comprises the detailed integration, through the layered nesting, of information and document necessities to operation of organization (Dietz, 2006).

According to our proposal, from the implementation of an organization we can analyse activity's contradictions as a basis to find useful measures, viability norms and dysfunctions. Our position is that the organization implementation is a result of an engineering process that can be analysed as a system of activities. This system can be used to understand technology (i.e., people, rules, division of work and tools) that is part of organization implementation. For that we propose a DEMO model to capture the essential structure of activities from the ontological organization model.

To achieve that we redefine the concept of activity, as *“an activity is the minimum unit for understanding the context of people’s work practices in an organization. In an activity, people act on an object, with competence and authority. The object is transformed so as to attain a result of production, which is designated activity output”*.

The construct model of the proposed solution is stated in figure 4.

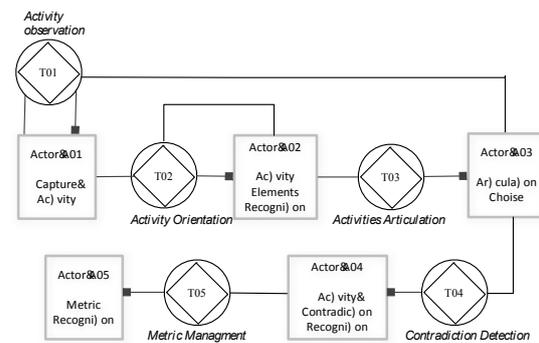


Figure 4: Proposed solution.

The model is composed of five transactions: T01 to T05 and the corresponding actors: A01 to A05. The actor role A01 has the responsibility to recognize all the transactions of the organization and map each activity. We start from the definition of an activity. This is a working unit with one objective: People involved organize their way of working in order to

achieve the goal of the activity.

The actor A01 has the responsibility to capture activities. Even though there are several methods, none is sufficiently clear in the way that activities can be obtained. Therefore we propose transaction T01, as a novel way to apprehend activities from an ontological model of an organization. We take advantage of some overlapping concepts between the DEMO and Activity theory that helps to delimit the identification of scope of organization activities through DEMO Model. The main idea is to use DEMO to find useful activities, being clear that Activity Theory was not a DEMO substitute.

The actor A02 has the responsibility to capture detail of each activity, i.e. he/she identifies the elements of an activity, such as: actions, operations, subject, tools and business and social rules. This task is an iterative one. It continuously tries to capture missing or changing elements. The actions aim at the planned goals, and required resources must be taking into account in the environment as well as their affordances and constraints. These physical executions of actions are named operations, and they must be comprehended by the conditions given at the moment of execution.

We use The DEMO concepts of phase and steps to help us to capture and structure activity actions and operations. We proposed that an activity has three main phases that correspond to the three phases of a transaction (Order-phase, Execution-phase and Deliver-phase). Each phase has a unique step with a well-defined goal. We link each goal action to step; therefore, the goal of an action is to fulfil the step. The operations represent the task that we do to achieve the action.

The actor A03 has the responsibility of identifying relationships between activities, notably it defines the different types of articulations considered to relate the activities. To connect the activities we contemplated two types of interconnections that represent two types of relationships between activities. They are: (i) a sequential relation and an (ii) inclusion relation. When activities have a sequential relationship, it means that the result of an activity is the object of another activity. In this case there is a temporal relationship between the first and the second activity and the second can only happen after the first produces its result.

4.1 Introduction Contradictions in the Organization Control Model

The introduction of activity in organizational

control is done through contradictions discovered in transaction T04. The result of the contradictions discovery leads to identify the metrics that should be monitored, as well as the feasibility of these rules. This work is done by transaction T05 and executed by actor A05.

The Activity's contradictions will be discovered by analysing its set of elements. We propose the use of three sets of relations between the following elements of a single activity: subject/tools, subject/object and norms/object. Each set will be associated to a metric mentioned below:

- (1) Metric between subject and tools. These metric measures the contradictions that express the misalignment between tools and subjects to access the object of activity. It also express the support of execution of actions and operations (for example, what is the tool that is used to access the updated list of the organization's products, and what people think it is his problems);
- (2) Metric between subject and object. It measures misalignment between the subject and the object of an activity by counting the cancellation of coordination acts. It is computed by calculating the cancellation of promise acts and the cancellation of delivery acts;
- (3) Metric between norms and subject, will measure the feasibility of achieving the result of the activity. This metric is the type usually associated to the business objectives (e.g. total revenue per month minimum activity will be 5,000 Euros).

Figure 5 presents the proposed the new Organization Object Fact Diagram for organizational control. This model integrates the contradiction measures into organizational control.

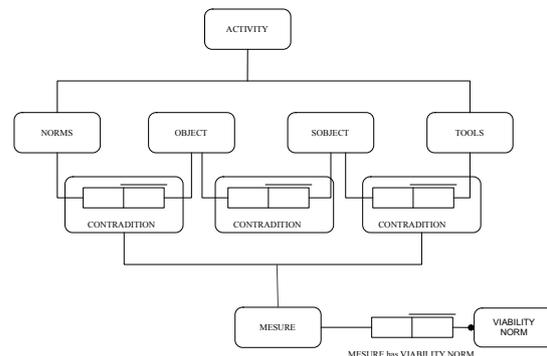


Figure 5: Introduction contradiction in control model.

5 APPLYING SOLUTION TO TRUE-KARE

We exemplify our method by using it in the analysis of a service named True-Kare. The main purpose of the True-Kare service is to facilitate the support given by the family or institutions to the elder person with some level of dependency. The service has two main steps: (i) the purchase of mobile equipment and, (ii) the service subscription, after the purchase of the equipment. To purchase the equipment a customer has to fill out a purchase form in the True-Kare portal, and provide personal information, such as the equipment delivery address and billing information. When the customer receives the equipment, he must activate the service by introducing in the True-Kare portal the identification code that comes with the equipment he received. Once the service is activated, the customer can benefit from the service and has to pay a monthly value to continue using it.

The starting point is the Ontological Model of the organization, which was built using the DEMO methodology. Figure 6 provides a general view of transactions

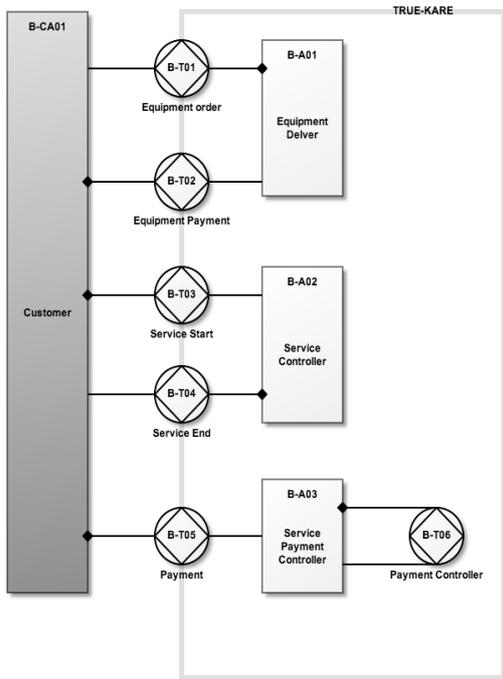


Figure 6: Construction Model of True-kare.

T1 (Equipment Order) and T2 (Equipment Payment). Both transactions involve the actors A1 (Client) and A2 (Organization). Transaction T1 is initiated by

actor A1 and executed by actor A2 (i.e. the equipment Order transaction is initiated by the Client and executed by the Organization). Conversely, transaction T2 is initiated by actor A2 and executed by actor A1 (i.e. the Equipment Payment transaction is initiated by the Organization and executed by the Client).

5.1 Discovery Activity Elements

The agenda of actor A01 is to capture the relevant Activities of the services offered by TRUE-KARE. The DEMO Constructed model is analysed and for each transaction an activity is created. The one to one mapping between transactions and activities is justified because of the redefinition of the concept of activity presented in section 4. Table 2 presents the Activities of our case.

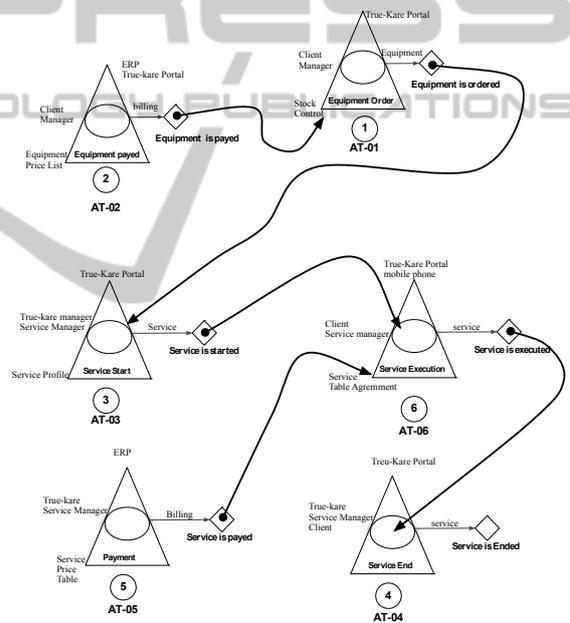


Figure 7: Activity System of True-Kare Service.

Table 2: Activities.

Activity	Name	Output
AT-01	Equipment Order	CLIENT has order EQUIPMENT
AT-02	Equipment Payer	CLIENT has paid EQUIPMENT
AT-03	Service Start	CLIENT has start SERVICE
AT-04	Service End	CLIENT has end SERVICE
AT-05	Service Payer	CLIENT has paid SERVICE
AT-06	Service Execution	CLIENT has used SERVICE

After identifying the significant activities, we have to recognize the elements of each activity: subjects, tools, rules, community and division of work. Figure 7 presents the elements found for each activity, as the result of work done actor role A02 (see Figure 4).

Actor role A03 has the responsibility to articulate the activities. Following articulations are proposed:

1. AT-01 /AT-03: sequential relationship. It means that to start a service client has first to order equipment;
2. AT-03 /AT-06: sequential relationship. It means that after the start of service, The client can use the service offered by TRUE-KARE;
3. AT-05 /AT-06: inclusion relationship. It means that for using the service the client has to pay for it;
4. AT-06 /AT-04: sequential relationship. It means that during the execution of service the client can end it;
5. AT-02 /AT-01: inclusion relationship. It means that the equipment order, depend of the payer of equipment, i.e., client has to pay for the equipment before he/she can get it.

Figure 7 presents the articulation between the activities, as the result of work done by actor A02.

5.2 Introduction Contradictions in the Organization Control Model

During the analysis of activities we have identified different types of contradictions. Following proposal presented in section 4.1, contradictions are grouped into several kind of norms: competence (which is measured in accordance with the capacity of the subject and the object of activity), tools (where it is analysed the mediation of subject and object through the use of tools) and finally tensions related to the objective of the activity (which is measured by the ratio of the rules with the purpose of the activity). Table 3 summarizes some of the manifestations of contradictions revealed while analysing the activities.

Table 3: Contradictions analysis.

#	AT	Contradiction	Description
C1	AT-01	Subject-object	Contradiction between seller and client.
C2	AT-01	Rule-object	Contradiction between equipment and service.
C3	AT-01	Subject-tool	Contradiction between True-Kare portal and client.

The contradictions analysed in Table 3 propose rules and feasibility control of those rules in order to monitor the operation of the organization. Some of these are presented in Table 4.

Table 4: Proposed feasibility control rules.

#	Measure	Feasibility Rule
C1	M01 Number of proposed sent to clients	M01 > 10 per month
C1	M02 Number of proposed accepted by clients	M02/M01 > 30%
C2	M03 Equipment price	M03 >= 5 (where 0 id bad and 9 is excellent price)
C2	M04 equipment deliver	M04 < one week
C3	M05 Client perception of service deliver	M05 >= 6 (where 0 id bad and 9 is excellent)

6 CONCLUSION

This article discusses how to use activity diagrams to identify different tensions within and contradictions between activities performed by people in the organization. The use of activity diagrams is a benefit, due to the fact that it allows the evaluation of individual and collaborative work, i.e., we can examine the individual task performed by people who contribute to the achievement of the results of collective activity. It also permits to introduce a way to understand the dynamics change of the organization.

The use of DEMO helps to delimit the area of operation of an organization, through the concepts of components, environment and structure, presented in the DEMO models. It allows the mapping of transactions into activities. After capturing the Activities Diagrams from DEMO models, we use them to analyse manifestations of contradictions present when analysing organizations. We focus mainly in the 1° order and 2° order types of contradictions, namely the contradictions between elements of an activity, and then we are able to identify the one element that is the cause of the contradiction.

The previous results were used to observe the activities and capture the type of rules that should be

tracked down in the GOD organization's control. The type of rules relates to people's capability, tools capability and the feasibility of the organization rules. The capability of people requires the continuous monitoring of people's commitments and their mapping with organization objectives. Tools capability measures the misalignment between what people expect from the tools and what they provide. This is a fundamental issue in the pursuit of improving tools for increasing business value. Finally organization rules feasibility measures alignment between business and people in the sense that people are able to fulfil the outcome of an activity with the existing business rules.

The use of the DEMO methodology and the GOD model had a major relevance in the enhancement of the feasibility of the True-Kare services because it established a common understanding of the essential business' services between the different kinds of people.

A future line of research is to improve the method of identification of organization's activities through The DEMO Models, eventually by the substitution of all activities analysis with an extension of GOD model and finding feasibility control rules with an ICT support so that valuable information to decide on aspects of viability is easy available to the organization.

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