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MetaMet - A Soft Systemic Way Toward the Quality of Information Systems

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Abstract

The quality of information systems (IS) is strongly related with the quality of the IS design process and both are fundamental issues in successful IS construction and use process. In the paper we present a MetaMet a quality oriented IS design approach which should result in quality information systems.

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Keywords: Information Systems, General; Software Engineering, General; Requirements/ Specifications

1.INTRODUCTION

The quality of information systems (IS) is strongly related with the quality of the IS design process and both are fundamental issues in successful IS construction and use process (successful in terms of all affected and involved parties and individuals). There are various definitions of software quality and various ways how to achieve it. The most usual approach [9] is on achieving more effective control of the IS design process, emphasising the need for improved project management and the introduction and subsequent enforcement of standards. In such manner the most effort has been devoted for the search of new metrics to monitor errors, reliability, usability, maintainability etc. In that way the quality is defined as [10]:

The totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs.

However, there are also some other more soft oriented views to IS quality. Their proponents emphasise that considering technical aspects of design process by itself is insufficient. The design process is multidimensional and must be treated as a learning, communication and negotiation process. In such manner the quality is defined as [9]:

Quality is perceived in terms of those external product attributes which are relevant for the particular types of users; or

Quality is judgement by customers of users of a product or service; it is the extent to which the customer or users believe the product or service surpasses their needs and expectations.

As seen from above two definitions the "soft" IS quality should not be considered as intrinsic to an IS, but it exists in the relationship between customer/user and product, where

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customer/users includes all involved and affected parties and product can include goods and services (see Fig. 1). Thereafter the quality is socially constructed phenomenon that is customer/user and situation dependent and changes over time in response to changes in environment, values, beliefs etc. Concerning above definitions and statements we can conclude that quality IS design is (or at list it should be) a very human intensive process. Such processes can not be tackled with "hard engineering approaches" but in more "softer way " using principles advocated by Checkland or Flood [4, 5]. According to their work we predetermined two main issues that must be considered in the manner to design successful information systems:

- we must obey to principles of participance, continuity, holism and endless learning. That means that we must take into account the whole "system" (not only involved but also affected participants of the IS design process and related environments, process, product etc.) and must consider the uncertainty of the situation (the value system of participants will change during the process, unexpected events will occur, situation can be changed etc.),
- we must be able to answer two *"basic questions"*.

  Question 1. *which* from many possible computerised information systems (IS) to design? and

  Question 2. *how* to design the selected one?

  Above two questions seems very reasonable and natural for any IS design situation, but are very rarely explicitly answered.

We argue that the design of an IS in the systemic and participative manner is closely related to the epistemology of *soft system design* (Checkland 1981, 1990; Flood 1991) and should be as shown in Figure 2. The *"conventional " IS system design* is closely related to hard-system thinking [4, 5]. It is in general concerned only with Level 0 design and one process. In contrary the systemic and participative design should be performed by three processes on two design levels. Taking into account all these facts we can state that the IS design methodology able to result in successful and quality systems should confront to characteristics shown in Table 1. As a result to above of above discussion and as a possible response to the software crisis we constructed a new IS design methodology called MetaMet (MetaMethodology). Their characteristics of MetaMet are very similar to characteristics required in Table 1. Thereafter it is our belief that MetaMet represent a possible way toward the improvement of IS quality.

Table 1. The required basic characteristics of MIS design methodologies

Current MIS Design Methodologies	New/Changed MIS Design Methodologies
sequential	iterative
unparticipative	participative
one - dimensional	multi - dimensional
mono - lingual	multi - lingual
one - aspect	multi - aspect
one - levelled	multi - levelled
systematic	systemic
technological system	human activity system
waterfall model	extended operational model
situation insensitive	situation sensitive
partial	holistic
control abstraction	knowledge abstraction

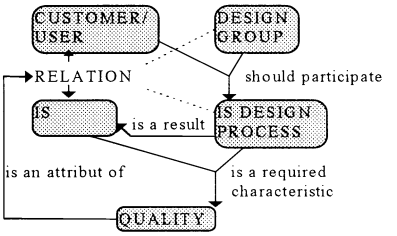

Figure 1. The Notion of Quality

2.RELATED RESEARCH

Many new software design paradigms have been proposed as a response to the software crisis. These range from solely technological to most elaborate paradigms, based on theory. Operational, prototyping and transformational paradigms [1] are most prominent among them. They try too incite user participation in order to deliver executable code early in the design process, and automate the production of software. Other approaches are more general and are usually based on AI or similar concepts. Their aim is to support a part of actions performed during the IS design process and are independent of the methodology used. A recent and very promising IS design approach called "Evolution of Software Processes" is based on the emerging view that software processes - like software - also needs to be evolved lest they become obsolete. The aim of the evolution is to fulfil the needs of the people who perform the process and the developmental and organisational goals to be achieved.

Despite many advantages of new software design paradigms and approaches it is argued [2, 8] that it is unreasonable to rely on only one paradigm, because the tools and techniques for one set of circumstances need not be appropriate for others. Various solutions based on metadesign and modelling of software design paradigms like domain analysis, metamodeling, system factory etc. were proposed recently in the manner to enable more flexible design in different design situations.

However, the majority of above approaches differs from the MetaMet in at least one of following features:

- they are concerned only with modelling, evolution etc. of the software processes and not with their design
- they are concerned only with some aspects, dimension and phases of the metadesign
- they do not provide a well defined metadesign methodology, theory or framework
- they are often to technological and neglect political, cultural and other dimensions of system design
- their metadesign life cycle follows the waterfall model
- they are concerned only with large systems.

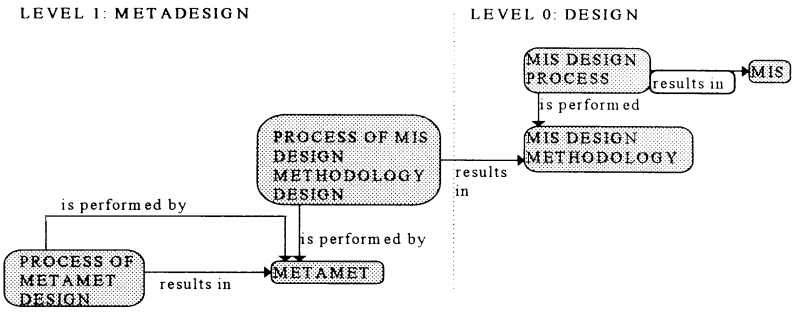

Figure 2. Two Levelled MIS Design

3.TWO LEVELLED DESIGN - WHY

All things are in state of flux
- Heraclitus of Ephesus

In those rare situation in which the question 2 is explicitly answered, it is normally transformed into the form *Which methodology to use to design this IS?* and it is our belief that this is simply not enough. Generally speaking in addition to the famous saying of Heraclitus presented above they are four claims supporting our view.

- First the IS design occurs in two contexts: the context within which the designer operates and the context produced by the *designing design* itself.
- Second the IS design can be defined as a *process* [Osterveil 1987, Kokol 1993] performed in a *specific design situation*, according to a *specific life cycle design paradigm* and using a *specific methodology*.

Analysing design processes, design situations, paradigms and relations between them [6, 7] (Kokol 1992b) we assert that:

1. there are no definitely good or bad design methodologies, they are good or bad only if associated with a specific design situation

2. there are design situations (or at least they will be in the future) for which no known design paradigm is appropriate.

- Third there is a variety of different IS design paradigms and it is very unbelievable that the IS design group has an expertise in selecting and applying the best of them.
- Fourth, it seems clear that software quality will be brought into the centre of the design process and thereafter we need software quality oriented processes and a way to design, measure and manage them (*"the product can not be better than its design process"*).

In that manner the simple selection of "the best" IS design methodology is at least very difficult if not impossible. Thereafter we assert that to enable successful IS design in all design situations we must first *design* (this design can in many situations be reduced to selection, but nevertheless this selection is carried out in a systemic fashion) an appropriate design paradigm. This activity was called the *metadesign* or *Level 1 design.*

4.TWO LEVELLED DESIGN - HOW

During the seventies the symptoms of the software crisis became visible also in our country and in the beginning of eighties it became critical. As a consequence we tried to overcome the crisis with the use of unconventional methodologies and latter on with the construction and application of new design paradigms. At that time we also introduced the idea of metadesign and more recent the approach now known as metaparadigm [7]. In last years we strive to improve the metaparadigm in the systemic manner and the results off our effort IS MetaMet presented in following sections.

Meta met is defined as

a process in which a problem situation containing a manual IS is transformed into an improved situation - employing a computerised IS - appreciating the epistemology of MetaMet, the characteristics of the problem situation, recent developments in IS research and science in general (standards, norms, technology, etc.) and the principle of uncertainty performed in an endless learning loop.

According to above definition the MetaMet should support following activities:

- formal description (metamodeling) of design paradigms, design process and design situations;
- formal evaluation and comparison of design paradigms;
- metadesign of design paradigms, where metadesign is treated in a very broad sense as invention of new design paradigms, adoption of known design paradigms, composition of known design paradigms, selection between design paradigms etc.;
- design of the IS using the metadesigned paradigm
- be able to learn and accumulate the knowledge from current MetaMet's applications and be able to reuse this knowledge in further applications;
- appreciate current state "of the art" in IS designs, system theory, science in general etc.

One of the most important Metamet's characteristics is that the design process should be performed during an infinitive learning loop. As a consequence the design and metadesign should advance in parallel. First an intuitive methodology is constructed reflecting the initial users and design group vision. The methodology is then used in IS design concurrently with the construction of the primary design methodology In the case of conflicts, new requirements, changing environment and other factors of *uncertainty* the primary methodology is improved

according to new conditions. During the MetaMet's use the SSM [4] is employed as a metadesign methodology.

5.EVALUATION OF THE METAMET USE

It is natural to ask question such as: *Does the metaparadigm work?, Is it good? Is it more usable then approach X?, etc.* But, as for any system approach, such questions can not be answered. There is in principle no way in which it could be proved or disproved that using the MetaMet is "*the best*" way to design information systems. In addition the traditional scientific evaluation method (empirical assessment of a given hypothesis) is not appropriate for the information system research [8]. But in the manner to implement the endless learning loop mentioned in previous sections we must be able to, at least, approximately rate the successfulness of using metaparadigm. This can be de done in two ways:

- we can employ the measurement approach proposed by Conrath [3]. Conrath suggests, in spite that no single measure can be adequate for an IS evaluation, that an IS should be assessed using four constructs: user satisfaction, system effectiveness, value and utilisation. In our case we implemented the Conrath's approach with a blind questionnaire that is answered by all known involved and affected persons. A symbolic median value is then calculated and it represent an overall view of the IS successfulness.
- we can evaluate the resulting IS design paradigm with the semi-formal approach introduced by Kokol [6]. This approach enables one to compare various design paradigms according to different dimensions. Using questionnaires answered by all relevant people we obtain a median value similar to above which represent the overall quality of the design methodology being designed and used.

After assessment of results of the MetaMet use in various design situations we can conclude that the MetaMet is a very promising method for the design of successful and quality information systems.

REFERENCES

1. Agresti W W: *New Paradigms for Software Development*, IEEE CS Press, New York, 1986.
2. Avison DE, Wood-Harper AT: Multiview-An Exploration in information systems development. *Australian Computer Journal, 18*(1986)174-179.
3. Checkland P and Scholes J: *Soft Systems Methodology in Action.* John Wiley & Sons, Chichester 1990.
4. Conrath D W, Sharma R S: Evaluation Measures for Computer-based Information Systems, *Computers in industry 21*(1993)267-272.
5. Flood R L, Jackson M C: *Creative problem Solving: Total System Intervention*, Wiley, 1991.
6. Kokol P, Stglic B, Zumer V: Software Design Tools Evaluation in Context of a Metaparadigm, *Proceedings of AQSDT'92*, Nahouraii E (ed.), New Orleans, IEEE CS Press, pp. 34-41, 1992a.
7. Kokol P: Metaparadigm: A Soft Systemic MIS Design Approach. *Journal of Medical Systems 17*(1993b)47 - 57.
8. Kokol P: Software System Design with the Metaparadigm, *Cybernetics and Systems 1994*, Trapl R. ed., World Scientific, Singapore 1994, pp. 385 - 390.
9. Vidgen R. T., A. T. Wood Harper: Establishing and managing a Relevant Notion of Quality. *Proceedings of SQM 93*, Elsevier 1993, pp. 117-132.
10. ISO: *ISO 8402: Quality Vocabulary*, ISO 1986.