

CLOUDS OVER INFORMATION SYSTEMS DEVELOPMENT PROCESS

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Abstract. *Due to simplifications of reality there are problems and crisis in different scientific fields (economics, management, information systems, and others). Although this fact has been recognized for many years, the theories and practices continue to be based on those simplifications. That's why some models and frameworks for improving sense-making for decision support are necessary. The Confluence framework is a sense-making device which can help in considering the depth and the breadth of the situation. In this paper an example of cloud-like use of the Confluence framework for the information system development process is given and pointed out that this framework is instrumental in building understanding that human unreadiness to accept existence of unordered space and necessity to live and work in it is real problem in information system development process (and other disciplines).*

Keywords: *Confluence framework, Cynefin framework, sense-making, information systems development process*

1. INTRODUCTION

Different scientific fields have been faced with problems and crisis. Many high-level researchers and professionals have admitted the limitations and imperfections of current paradigms in their disciplines. It has been pointed out that underlying assumptions of these paradigms could not be universally acceptable, and that corresponding theories and practices simplify the reality.

For example, it has been challenged the paradigm Rational Expectations Hypothesis /Efficient Markets Hypothesis in economics, the functionalistic paradigm in information system field, as well as scientific management as a theory of management.

But it seems that many researchers and professionals have ignored or have not cared about these challenges. The same errors and problems have been repeated many years. In information systems development, it might be even said that many organizations have not only failed to learn, but they have also learned to fail ([10]).

It is easier and safer for researcher (in his struggle for acquiring some academic rank) to participate in a study that follows dominant paradigm and focuses on a limited domain than to venture in distant and unknown territories ([1], [11]). That's why many professionals do not only know how to think and work in different way, but they are not even aware that the problems they have are so widespread in practice.

One reason for inadequacy of challenged paradigms is their neglect of complexities of the real world or treating them as they are negligible ([10], [11]). However, complexity caused by the number of interaction within and between systems is increasing. That's why a more realistic view of systems is needed. There is a need for a view which recognizes that besides ordered systems there are

unordered ones. Since patterns are unpredictable in unordered spaces even in the presence of perfect information, traditional methods for decision support are not appropriate in these spaces. Understanding of the current situation has been recognized as a critical foundation for successful decision-making across a broad range of complex and dynamic systems. There is a need for some new models and frameworks for improving human capacity to make sense of the world in all its complexity and uncertainty in order to make decision ([7]).

The Confluence framework is a sense-making device which can help in considering the depth and the breadth of the situation. Its brief description is given in the next section. An example of its cloud-like use for the information system development process is given afterwards in this paper.

2. THE CONFLUENCE FRAMEWORK

In this section some desirable characteristics of a sense-making device for decision making are given, as well as a description of one such device - the Confluence framework. This section is based on writings of C. F. Kurtz, the author of the framework ([5]-[9]).

2.1. Sense-making devices for decision making

Successful decision making requires ability to see both the breadth and the depth of the situation at once. The utility of a sense-making framework lies in its ability to help in building a rich, multi-view picture of the situation which enables emergence of new understanding. A sense-making framework has to help building understanding how the situation is seen from different points of view, how it is changing, what might have happened if things had gone differently. A useful sense-making framework has at least two dimensions because the essential activity in sense-making by using some framework is the mapping relevant elements onto the space of the framework. Framework dimensions have to be value-free and to represent a meaningful space. In other words, the framework must resonate meaningfully with the people who use it – it must work in practice, not just in theory, and there is no one position in the space more desirable than any other.

The Confluence framework is a sense-making framework approved in practice. It has been represented several years as the Cynefin framework i.e. as a version of the Cynefin. Indeed, D. Snowden, the author of the Cynefin, and C. F. Kurtz, the author of the framework which she has recently named the Confluence, merged their frameworks into the Cynefin framework in 2001. Some aspects of Kurtz's framework have been described as extensions of the Cynefin, but it has been said recently that two versions of the framework nevertheless represent the same framework, but two complementary ones.

The difference of the Confluence and the Cynefin frameworks are shown on figure no. 1. The Cynefin framework distinguishes domains of decision making: known, knowable, complex and chaotic, as well as disorder domain in the middle of the framework which points to lack of information and understanding for mapping the issue onto some other Cynefin domain. There are boundaries between these domains. On the other side, the Confluence framework has two dimensions of variation: hierarchy and meshwork, and no boundaries.

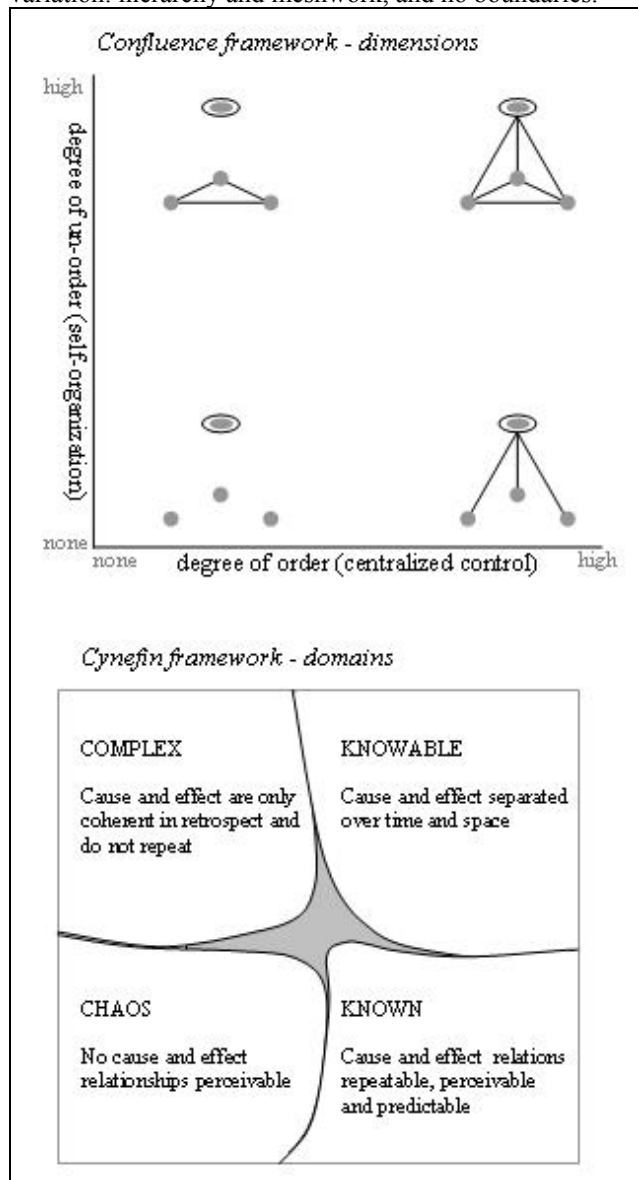


Fig. 1. Two complementary sense-making frameworks for decision support

Source: [6], [9] (with negligible modifications)

The ideas underlying these frameworks aren't unique. C. F. Kurtz has discovered that some old tools, for example (at least several thousand years old) the medicine wheel, had been also based on the similar ideas.

2.2. Description of the Confluence framework

As it was said above, the Confluence framework has two dimensions (axes) of variation. They are: (1) the degree of imposed order, and (2) the degree of self-

organization. The choice of axes has been made by the criterion what axes are reasonable to use when decisions are being made.

The first dimension represents the degree of hierarchy i.e. the strength of central connections. It is the central directorate who looks out over everything and tries to organize others. It stands not for people, but for tendencies within the people and situations and their combinations. The degree of hierarchy grows from left to right in the framework.

The second dimension relates to meshwork i.e. the strength of constituent connections. The degree of meshwork grows from bottom to top in the framework.

These generic patterns of central and constituent connections are shown on the figure no. 2. Pure hierarchy or pure meshwork only pertains to the corners of the space. Besides that, non-human aspects rarely go to extreme hierarchy and human aspects rarely go to the pure isolation. All sorts of mixtures are possible between extremes of hierarchy / meshwork.

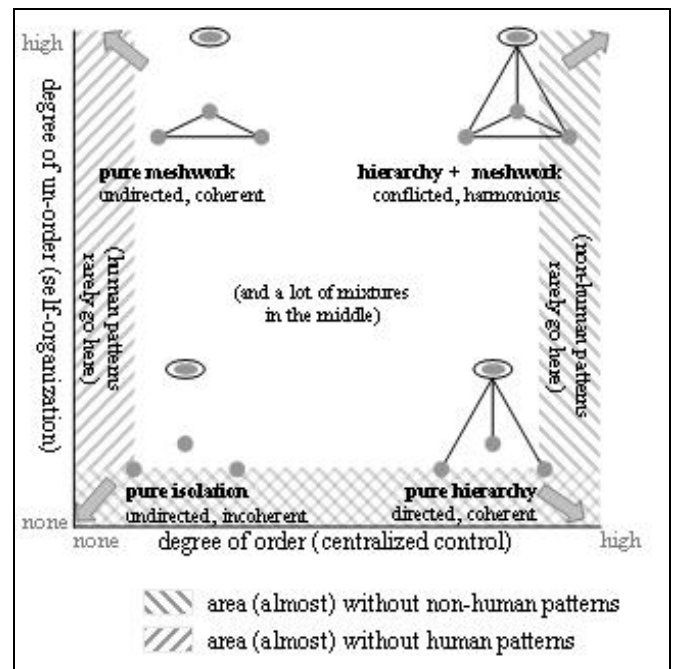


Fig. 2. Confluence framework - generic patterns

Source: [6] (with negligible modifications)

The issue under consideration may be represented on the space as a shape and so be over one or more areas of the space, not only at one location (or in one domain). The size of shape may show the quantity of internal diversity in it. Preferred shape for an issue representation should be a cloud (or more of them) because of its internal structure. Different clouds, with different density, thickness and heights, may represent different situational aspects. For example, concentration of some situational aspect over different spaces and gap between them could be represented in the cloud; the thinness of the cloud could represent lack of knowledge. Qualities useful for sense-making are: identity interaction, multiple perspectives and movement in meaningful space. It is useful to consider identities as determinants of behavior. In any aspect of life there are human identities flocking around it. Paying

attention to the identities and their flocking are very useful. Considering multiple identities broadens scope by introducing factors and influences which are usually neglected, and also deepens focus by examining in greater detail factors and trends that are so obvious they are usually overlooked.

It is useful to consider categorical, relational and positional aspects of identity. Categorical aspects of identity concern with what a person is or has. Relational aspects of identity have to do with a person's connections. Positional aspects of identity are based on its placement in the whole.

In order to determine identity interaction, it is meaningful to consider selection, mobilization and commitment processes. The selection process draws on categorical aspects of identity and characteristic-based evaluation of identity safety. The mobilization process is concerned with relational aspects of identity and membership importance evaluation. The commitment process involves utility evaluation of positional aspects of identity according to the placement in the whole.

Identity interaction can be mapped on the space of the Confluence framework. Different types of identity interaction have different sizes and cover different areas of the two-dimensional space of order – un-order (figure no. 3). They may be represented by different shapes or clouds.

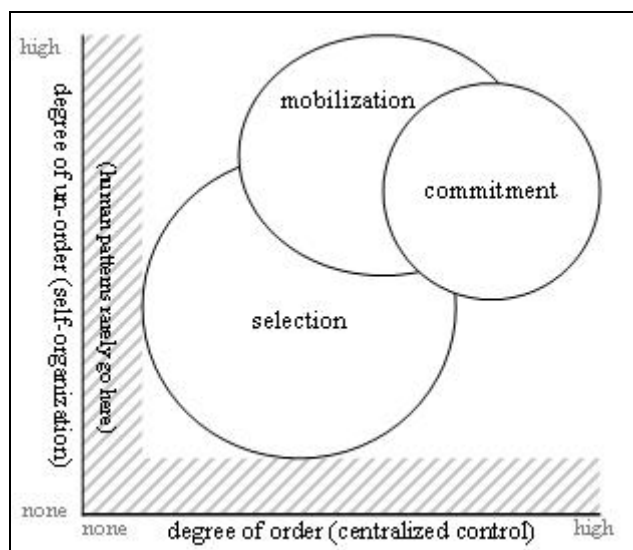


Fig. 3. Confluence framework-identity interactions
Source: [5] (with negligible modifications)

Perspectives of relevant identities on situation can be presented on separate layered frameworks, floating in vertical space like a geographic information system, or on the same landscape, overlaid and even interacting. It is particularly useful to show dynamics of situation under consideration in some way. Dynamics can include speed and acceleration as well as location. For example, there can be repeated patterns of movements that only appear in some circumstances or from some perspectives. Beside action-identity layer of the framework, it is possible to form alternative fictional layer representing dynamics of what-if situations.

The Confluence framework is complementary tool to the Cynefin framework, and vice versa. In some situations,

considering the Cynefin domains²¹ and the Confluence clouds in parallel may be more fruitful than pursuing only one approach.

3. AN EXAMPLE OF THE CONFLUENCE FRAMEWORK USE

In this section an example of the Confluence framework use is given. The framework is used to represent some situations in Water information system development for one public water management company in Serbia in order to explain some misunderstandings and some decisions in the information system development process in retrospect. An observed pattern of organizational behavior is also presented, as well as a what-if situation.

4.1. Situational description: information system development – in general

Information system development (ISD) is a high-risk undertaking. Failures in ISD remain common despite advances in development tools and technologies. One reason for this is the collapse of organizational intelligence required to deal with the complexities of ISD ([10]).

The dominant paradigm in ISD is the functionalist one. It has been used for decades in ISD. Most research is focused only on it ([1], [4]).

The functionalist paradigm is concerned with providing explanations of the status quo, social order, social integration, consensus, need satisfaction, and rational choice. Functionalist systems development is primarily a technical process. An expert for information systems (IS) has primarily to be expert in technology, tools and methods of system design, and project management. These methods help to make ISD more formal and rational. But, it seems that this concern with method is the true origin of crisis in information systems field ([2]).

The implicit assumption of the functionalist paradigm is that the ends are agreed. But in reality, ends are controversial and the subject of considerable disagreement and debate. That's why theories in use very often differ from the 'espoused' theories, which reflect orthodox practices. It has been argued that, even in highly structured organizations, improvisation is very important process in situations where rules and methods fail.

On the other hand, it has been pointed out that beyond great successes of information technology there are phenomena of strategic importance for everyday life, such as bricolage, heuristics, serendipity, make-do, rather than the idealities of methods ([2]).

²¹ The Cynefin domains known and knowable belong to ordered systems, in which patterns tend to repeat on. Repeatability allows predictive models to be created. Causes lead reliably and observably to effects. The main difference between the known and the knowable domains is in what is already known and what has yet to be found out. The complex and the chaotic domains of the Cynefin nest into a set of unordered systems, in which patterns are unpredictable even in the presence of perfect information. Patterns in the complex space depend on interactions. They appear and disappear there. When and how complex patterns will stabilize or disintegrate is impossible to predict. In the chaotic domain there are no perceivable relations between cause and effect.

Deeply rooted in the web of common-sense beliefs and background knowledge which serve as implicit theories in use, some alternatives to the functionalist paradigm in ISD have been developed: social relativism and radical structuralism. Besides these ISD paradigms, there is a theoretically based one - the neohumanism ([4]).

According to the social relativist paradigm information systems (IS) are part of the continually changing social environment and should help to identify which ends are desirable and feasible. Information systems objectives emerge as a part of organizational construction of reality, the sense-making process. The IS developer is a facilitator of ISD process. His role is to interact with management to find out what type of IS makes sense, but there is no objective criterion that distinguishes between good and bad IS.

According to the radical structuralist paradigm ISD is dialectic materialism, and the IS developer is a labor partisan. A fundamental social conflict exists between the interests of owner of the sources of production and the interests of workers. The IS developer is faced with a choice: to side with management and become their agent, or join the interests of workers.

In the neohumanist paradigm ISD is a process of radical change, emancipation, and potentiality. Since the concepts of work, mutual understanding, and emancipation are the three fundamental domains around which society and other forms of social organization are arranged, IS developer must have these three knowledge interest in mind. Information systems would have features to support work related to knowledge interest of technical control of natural objects, forces, and people and these would be similar to those developed under the functionalist influence. Other features would support the creation of shared meanings and reflect the knowledge interest in mutual understanding. This is similar to systems inspired by social relativism. Finally, there would be a comprehensive set of features to support emancipatory discourse between different social and organizational forces. The discourse has to remove all unwarranted constraints to social freedom and personal growth by social criticism and by application of technical knowledge and shared understandings. That's why IS developer needs to act as an emancipator in an attempt to draw together, in open discussion, the various stakeholders. He must genuinely participate in the situation in order to acquire an appreciation of the different viewpoints, existential situations of the different stakeholders' groupings and many obstacles to human communication and understanding.

3.2. Application of sense-making frameworks for ISD

Some initial researches recognize the importance of the Cynefin framework for information systems field and particularly information systems development.

In some respects the Cynefin domains signify different ISD paradigms. The Cynefin allows understanding that complexity within the IS field mirrors reality. It is just what gives credibility to the field. The Cynefin message to IS field is to accept diversity and change as strengths and to use the framework to support realistic research and practice ([3]). The Cynefin framework brings into the

design process the issues of disorder and chaos and accepts that there are contexts that include unpredictability and uncertainty ([13]). Failures and problems of the information system development process are caused by a lack of situational understanding and by non-understanding that the problems of complexity and chaos could not be solved by rigid methods and geometric representations ([12]). Complementarity of the Confluence and the Cynefin frameworks indicates the Confluence framework importance for IS field and ISD process.

3.3. Situational description: Water information system

In this section the author of this paper attempts to explain some decisions made in development process of Water information system (WIS) for one public water management company in Serbia by the cloud-like use of the Confluence framework. The explanations are based on deep situational understanding which the author has been built actively participating in the ISD process²².

The interpretation of the viewpoint underlying WIS development planning framework is given first. After that some dynamics of WIS development process is shown, including an observed pattern of undesired organizational behavior. Besides that, the fictional situation which represents what would be happen if it was being used some other ISD paradigm is given.

3.3.1. Water information system development planning framework

The interpretation of viewpoint given in WIS development planning framework is based on consideration of key elements for decision making related to this framework.

Any paradigm, with its implicit and explicit assumptions and associated methods, determines human behavior and roles of people. In other words, every paradigm determines possible identities in given situation. Due to the importance of thinking on identity interactions in building the Confluence framework, it seems that it is desirable and convenient to consider existing relevant paradigms and their usability in the situation. Besides the paradigms, the key elements for making the decision are those which enable determining paradigm usability in the situation. They certainly include other relevant plans, as well as already achieved results.

As it has already been said in this paper, four ISD paradigms could be considered: functionalism, social relativism, radical structuralism, and neohumanism.

Since the WIS has to serve company responsible for water management, it is convenient to consider different paradigms / approaches to water management too. Two different approaches to water management can be distinguished: sectoral approach and integrated one.

Integrated Water Resources Management (IWRM) is an integrating, cross-sectoral policy approach, designed to replace the traditional, fragmented approach to water resources management that has led to poor services and unsustainable resource use. It is a great challenge. It needs institutional changes, new institutional capabilities. Some

²² Project documentation is in Serbian and abundant, so the references to it are not given.

fundamental principles are universally acceptable, independently on the context and the degree of economic and social growth, but there aren't universal 'patterns' for transforming these principles into the practice. In other words, IWRM practice is emerging one. The areas of the Confluence framework covered by ISD and water resource management paradigms are shown on figure no. 4. The ISD functionalist and the radical structuralist paradigms assume that objective reality exists i.e. there are some considerable degree of order. The reality is knowable if it is not already known. The radical structuralist paradigm requires from IS developer to satisfy either needs of managers or needs of workers. That's why its cloud is over the area with less degree of order in comparison with the ISD functionalist paradigm cloud. Other two ISD paradigms assume subjective reality i.e. insignificant degree of order. The key difference between them is in the degree of self-organization. The neohumanist paradigm emphasizes the need for radical change, so its cloud is over the area with less degree of self-organization in comparison with the ISD social relativist paradigm cloud.

The author of the paper use different types and colors for clouds to show different height and density of related ISD knowledge. For example, the functionalist paradigm cloud is very thick, very dark and with big shadow, but the neohumanist paradigm cloud is thin and very wispy.

Clouds thickness represents quantity of relevant ISD knowledge, their color represents opinion how danger they are and shadow how much consequences they have brought. So, the cloud for the ISD functionalist paradigm is very thick because existing ISD knowledge is mainly in it. Its dark color and great shadow denotes that it has brought many problems and undesired effects and may be a dangerous, thunderstorm cloud.

The positions and the 'structure' of two clouds for water resource management approaches have been chosen in a similar way.

There are some other clouds over selection process of fundamental issues for WIS development planning framework (figure no. 4). Their labels are: relevant development strategies, attempt to use traditional ISD approach on previous project, documentation of previous project, and unused developed software.

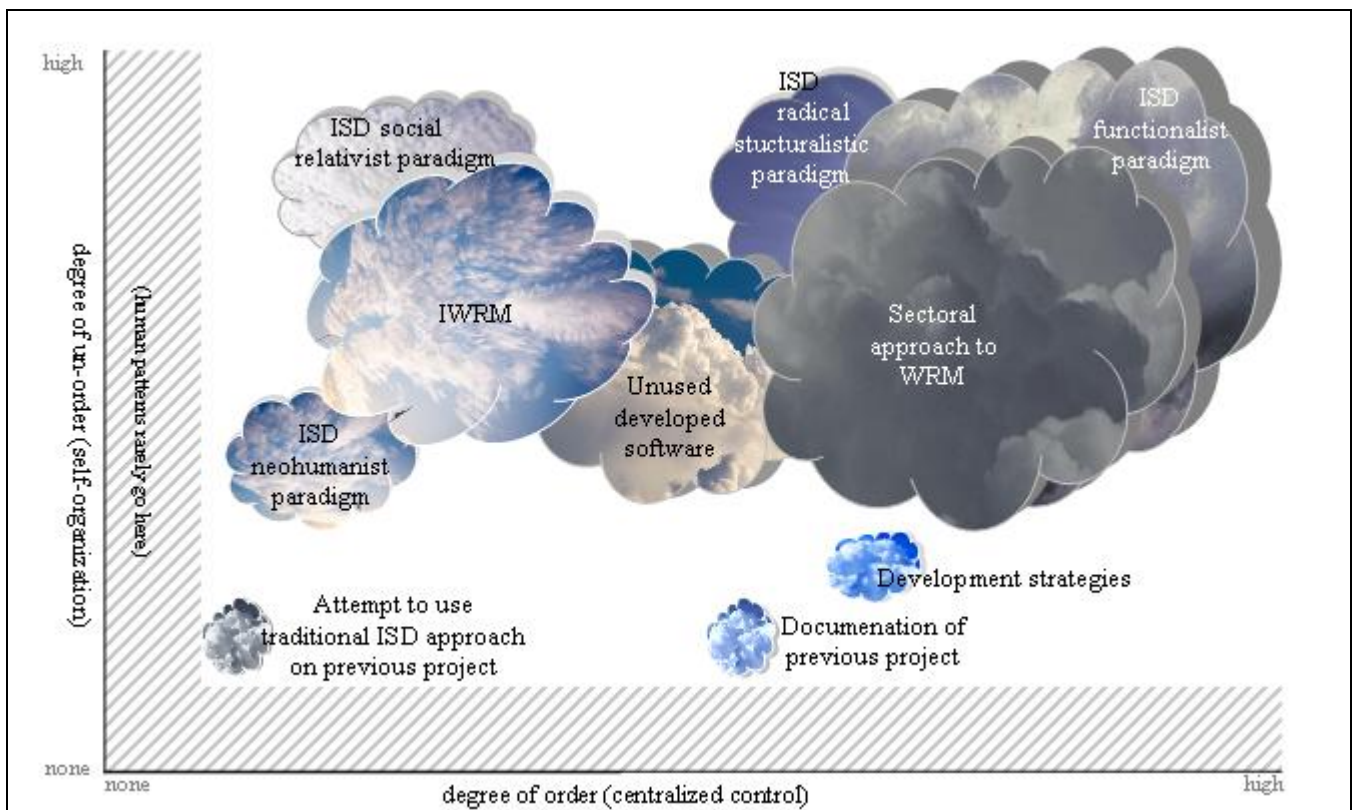


Fig. 4. The clouds over selection process of fundamental issues for WIS development planning framework

Relevant development strategies²³ give some directives for strategic information systems development, as well as natural resource information systems. Also they determine that water resource must be managed in the context of sustainable development.

The previous project related to integrated environmental information system development²⁴ has brought some new experiences – traditional ISD methods completely fail because IS investor, organizational management and the main users didn't want to take part in the ISD process. That experience, due to suddenly arrival to chaotic domain (in the Cynefin terms), has induced searching for a problem solution, and building knowledge on different ISD paradigms. The need to use the neohumanist ISD paradigm in that situation has been documented.

The fact that software developed according to the best / good ISD practices and world experiences in water resource management has not been used is particularly worrying. That failure has never been studied. It has been probably caused by insufficient quantity of both order and un-order in the situation where the software was implemented.

It may be said that the main criterion for selection WIS development planning framework key elements was what approach to water resource management would be acceptable into the future. According to accepted directive of sustainable development, IWRM approach was chosen. It determined acceptable ISD paradigm. Since IWRM requires radical change - breaking out of old ways of fragmented thinking and considering problems of water resource management in new ways, the ISD neohumanist paradigm was chosen.

The ISD neohumanist paradigm requires knowledge interests in technical control, mutual understanding and emancipatory discourse. That's why 'learning' clouds cover big area of the Confluence meaningful WIS space (figure no. 5). Beyond choice of 'sunrise' pattern for these clouds is the opinion that learning would bring bright future.

The area of clouds with label 'learning' is much wider than the area of existing knowledge. Big area is covered with clouds related to knowledge interests in: (1) mutual understanding, and (2) emancipatory discourse. The area of existing knowledge partly overlaps the cloud relating to knowledge interest in technical control (existing knowledge would be either used in the future or replaced by new one). Satisfying knowledge interests in mutual understanding and in emancipatory discourse requires not only IS developers, but all concerned with WIS and water resource management to learn.

That means that learning is a must for all. Commitment to learning is particularly required of all responsible for establishing WIS.

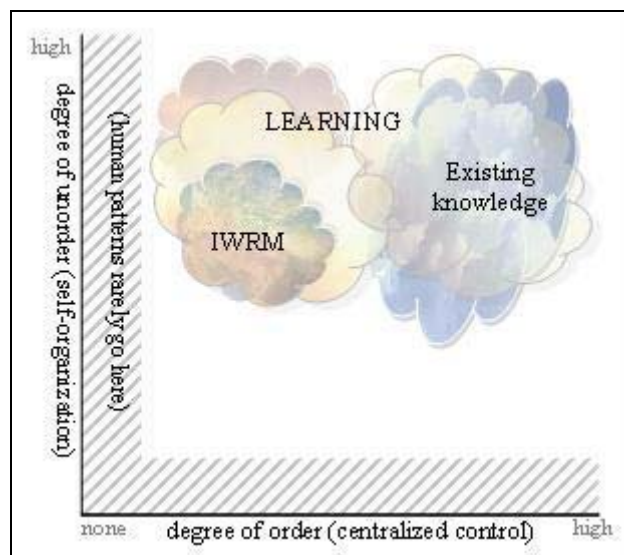


Fig. 5. The clouds over WIS according to WIS development planning framework

3.3.2. Water information system development process

WIS development has been started with making strategic plan. But, some dark, dangerous clouds appeared very quickly. Clouds over WIS development process are shown on figure no. 6. Different layers of the Confluence framework, which present selected situational aspects of the ISDP, are given on the figure. Arrows between these layers point to dynamics of the situation.

The first discussion between IS experts and organizational managers about the situational aspects pointed to great uncertainties in organizational environment. But, in a later interview one manager very categorically stated that there was no uncertainty for the organization, and that 'organization knows what it needs': data, a supervision system and a video projector. He was in ordered space. He attached no importance to un-order one. He had knowledge interest only in technical control.

Acquired appreciation of the different viewpoints in the organization and of some viewpoints outside the organization pointed to serious problems on the project. Organizational activities were very often in un-order space, but the organization was not aware of that. Dominant 'black-white' viewpoint disabled not only emancipatory discourse, but it even disabled any effort to build mutual understanding.

ISD developer tried to facilitate problem understanding by building some systems dynamics diagrams showing observed patterns of significance for the project. But, those diagrams were not used. The organization had made decision how to solve problem before the diagrams were presented.

The decision was to reduce scope of the work. The scope would not be management of all water resources, but only of drainage resources. IWRM principles were not abandoned. That means little reducing size of clouds relating to existing knowledge and learning, not their disappearing. In other words, the main problem remained.

²³Strategy for Development of Informatics in the Federal Republic of Yugoslavia, Resolution on Environmental Protection Policy

²⁴Conceptual Design for Integrated Environmental Information System for the Federal Republic of Yugoslavia

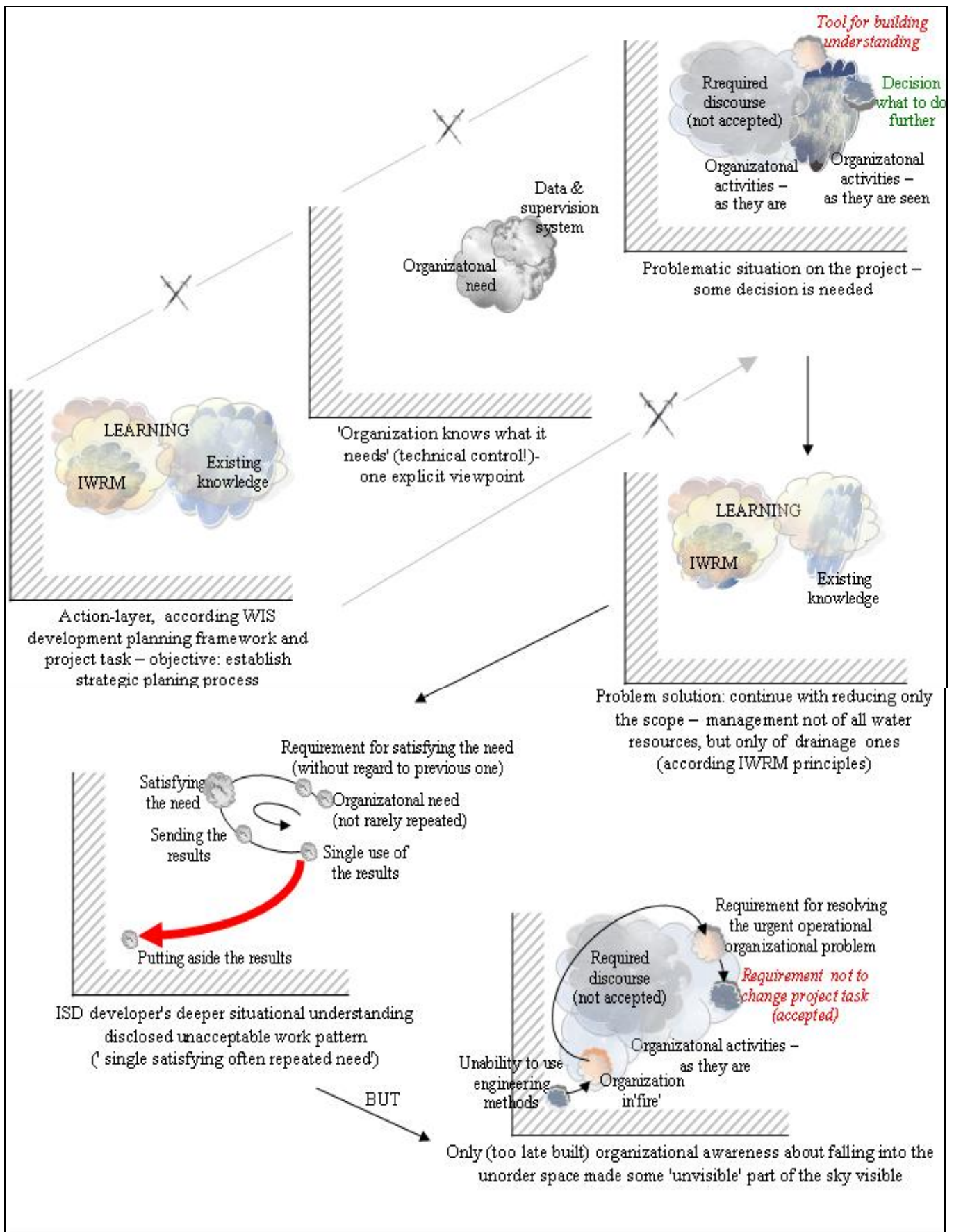


Fig. 6. The clouds over WIS development process

Further work on the project enabled deeper understanding of organizational situation. Some patterns of undesirable behavior were discovered. In fact, they showed that the organization sometimes itself fell into the chaotic space.

Again, there were no attempts to improve the situation. It seemed the organization didn't hear anything about that undesirable unordered space into which it has been entering itself.

But, 'invisible' parts of the sky suddenly became visible after the organizational sudden falling into the chaotic space when engineering methods had failed. But, that was not enough to admit uncertainty in work activities and the need to change some work plans and project tasks and adjust them to complexity of organizational life. The wish for technical control of the project was too strong.

3.3.3. What-if situation: traditional ISD paradigm in use

The non-traditional ISD paradigm has been used on the project. The question which appears is: "What ISD process would have been if the traditional ISD paradigm had been used?".

In this what-if situation, WIS would be a technical system, and IS developer would be an expert in information technology (IT) field.

Two cases of possible WIS development by the functionalist ISD paradigm will be considered relating to two different approaches to water resource management: (1) integrated, and (2) sectoral. These examples of what-if presentation are given on figure no. 7.

As it was said, IWRM approach need radical change in water resource management i.e. it requires changes in existing work activities and introduction new ones. The changes are not yet knowable, they have to emerge. WIS development would require movement from unordered space to complicated one.

The same problem would appear in the case of sectoral approach to water management because some organizational activities were in the unordered space. But, that fact wasn't known (it was discovered during WIS development process). In other words, problems would be discovered during the project. IS developer would probably make some improvisations in ISD methodology. In the case of success, IT solution would mostly determine the way of organizational work. But, since the organization thought that it was working differently, the success would not be expected.

It seems that only case without problems might be building IT support for well established work activity (if such existed).

3.4. Some considerations on the Confluence framework use for ISD process

In this paper the author represents her own initial attempts to use the Confluence framework for ISD process. The author thinks they are very encouraging. Issues in ISD could be clearly visually represented. The cloud appearance may indicate how much the issue in the cloud is difficult / important / dangerous according some viewpoint. Given example points out that human unreadiness to accept existence of unordered space and necessity to live and work in it is real problem in information system development process.

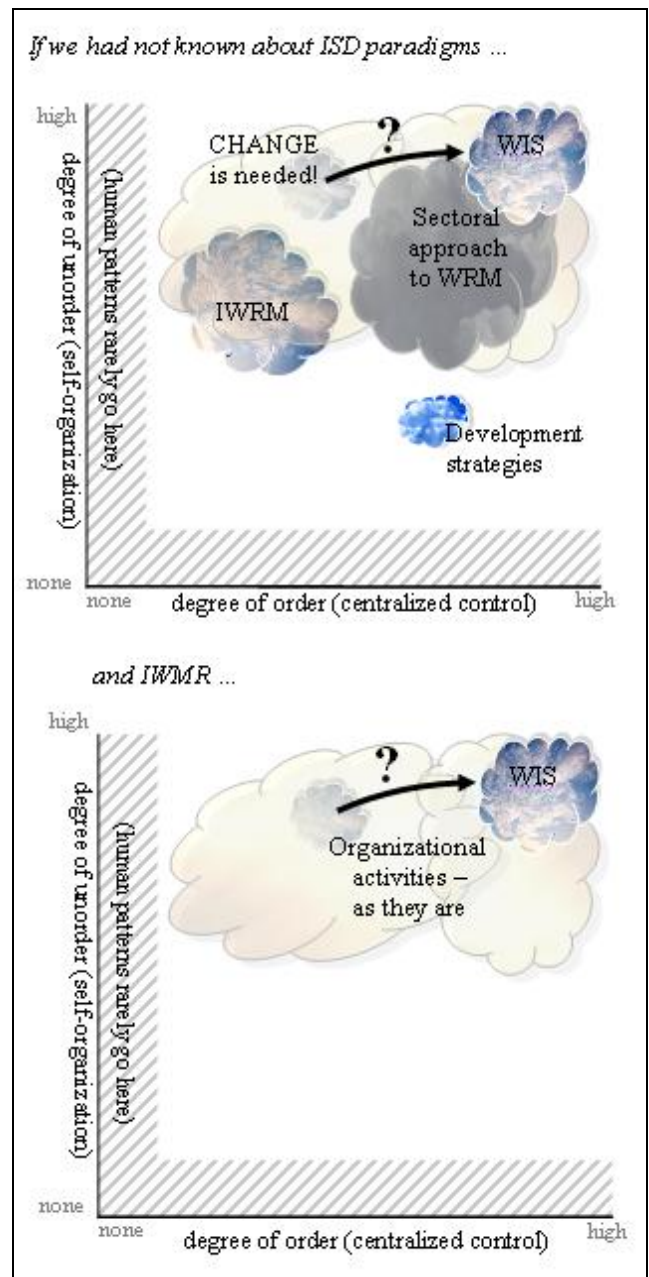


Fig. 7. What-if situation

Of course, there is a need for further investigations how to use Confluence framework for ISD. But, the key issue is the real wish to solve observed problem or dilemma. Without the wish, without the power to force problem solving, without capability to liberate ourselves from unwarranted constraints, clouds over the framework could be easily neglected and treated as they are bad (social, political) 'weather' forecast.

But if there is the wish, the 'clouds' probably could help IS researchers and experts to understand, together with experts from other relevant disciplines, some phenomena in IS field which are really spoken about.

4. CONCLUDING REMARKS

In this paper some problems in information systems field are touched. But, we are witnesses to crisis in many other disciplines too.

If crises are somehow connected to forgetting ([2]), we should ask ourselves what and why we have forgotten (in economy, management science, information systems field, environmental protection, etc.). It seems that we have forgotten that we live and operate in a complex world full of imperfections and unpredictabilities. We have forgotten it because we have formed idealized geometric universe, safe space full of straight lines and boxes, world of formal methods. But, with increasing complexity of the real world, these two worlds become more and more distant, connections between them are breaking down. Through this breakdown we encounter the world, possibly with different eyes.

The example of information systems development process given in this paper just points that forgetfulness is very great, as well as that breakdowns helps in 'changing' eyes. The cloud-like use of the Confluence framework is an attempt to present the conflict between real and ideal world (in the field in which the author had experience) in order to prevent some breakdowns and deeper crisis.

But, since it seems that crisis in different fields have the common causes, ideas on cloud-like use of the Cynefin framework might be useful for researchers and experts in other fields. It may a stimulus for better understanding of the real world and possibilities for using/ merging different knowledge in solving real problems.

In fact, we can try to back to the real world before new breakdowns and to understand not only how much it is complicate, but also how much it is complex and uncertain. In that process a sense-making framework which allows both order and un-order is welcome. It could help to appreciate possible connections between different spaces, as well as possibility to use knowledge from one space to another, or to merge knowledge from different spaces. Probably much hard multidisciplinary work would be necessary under clouds caused by our ignorance of real world. Knowledge about sense-making frameworks and consideration about their instrumentality is just the first small step on that way.

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