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ПЕРСПЕКТИВНЫЕ НАПРАВЛЕНИЯ ИССЛЕДОВАНИЙ В ОБЛАСТИ БИЗНЕС-ИНФОРМАТИКИ

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Перспективные направления исследований в области бизнес-информатики: Материалы круглых столов и аспирантского консорциума XI международной конференции. – г. Нижний Новгород. – 2012. – 146 с.

В сборник входят научные работы, представленные для обсуждения на круглых столах конференции и аспирантском консорциуме. Издание предназначено для специалистов, студентов и аспирантов, проводящих исследования по таким актуальным направлениям бизнес-информатики, как: управление знаниями; социально-экономические аспекты ИКТ; интеллектуальные системы в образовании.

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Foreword

This volume contains a set of scientific works presented for discussions within framework of satellite workshops and Doctoral Consortium of 11th International Conference on Perspectives in Business Informatics Research (BIR). Selected papers cover a broad scope of modern research in Business Informatics, and include new results in such domains as: Knowledge Management and Semantic Web, Business and information systems development, Business, people and systems interoperability and Business intelligence.

In 2012 the conference is hosted by National Research University Higher School of Economics (NRU HSE) in Nizhny Novgorod. Our university is Russia's leader in the field of scientific research conducted at the junction of Management, Economics and Governance of IT. In particular, NRU HSE is the originator and the promoter of Business Informatics in Russia. Therefore NRU HSE pays particular attention to sustainable international cooperation and leverages scientific research in that area.

We strongly believe that materials presented will contribute to further advances in Business Informatics and will foster intensive scientific cooperation between researchers.

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Information Inadequacy: Instances that Cause the Lack of Needed Information

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Abstract. Information is one of the most essential resources in our societies, as it guides human thinking, planning and subsequent actions, which in turn generates consequences that are desired or not. This study investigates the phenomenon of the lack of needed information, predominantly experienced with difficulties in human, social and industrial affairs. The empirical investigation suggests that the phenomenon of the lack of needed information seems to emerge because of diverse factors, ranging from political and cultural structures, through human individual capabilities, and ending with procedural and technological artefacts. The key conclusion of the present study is that while dramatic situations are increasing everyday, there is as yet no theoretical and practical guidance designed to comprehensively account for the phenomenon in context; only partial accounts are found. This study advocates that further research is needed to explore information inadequacy, and that such an account requires innovative and interdisciplinary focus.

Keywords: Information Inadequacy, Information Management, Information Needs, Information Retrieval.

1 Introduction

Information is one of the most essential resources in our contemporary societies, as it guides human thinking, planning and subsequent actions, which in turn generates consequences that are desired or not. The Lehman Brothers bankruptcy in 2008, the tsunami in Indonesia in 2004, the Space Shuttle Challenger destruction in 1986 are just three instances of dramatic situations, emerging continuously, where information plays a crucial role.

Situations like these are concerned with decision-making processes, i.e. “a sort of information” is presented as a stimulus to the subject, which is as yet unknown and requires rational behaviour to process it [1]. Philosophers, scientists and industrialists hypothesize about information problems and intend to develop theories or solutions that are partially helpful [2], [3], [4], among others.

Current research efforts suggest that the available information has a deep impact on personal well-being, decision-making processes, innovation and production [5] and [6]. Such a situation has been present for some decades now [7], mainly because of failure to achieve balance between the surging volumes of information we access (mostly affected by electronic information) and its obverse, the information underload [8]. Besides, information-related problems have an ethical dimension. Different social norms are created in organizations in order to keep control of information flows [6]. In practical senses, information-related problems seem to be fairly typical. Our everyday experiences manifest numerous instances in which information is the key that generates various consequences, many of which are experienced as failures and fatalities in human, social and industrial affairs [9].

This study investigates the phenomenon of the lack of needed information, predominantly experienced with difficulties in human, social and industrial affairs. Consequently, the challenge is to understand why situations like the Lehman Brothers bankruptcy emerge. To investigate this challenge, we have conducted an empirical inquiry with the objective to contribute to the development of an understanding of what causes the lack of needed information in human, social and industrial affairs.

The key message of this empirical inquiry gives us a basic understanding of the presented challenge, which is based on the following conclusion. There are numerous situations, emerging in very different contexts, where information is not provided in time to the actors who need it, thereby contributing to the generation of dramatic and unwanted consequences. Furthermore, the empirical analysis resulted in the identification of a new concept named information inadequacy, with the purpose to illustrate what is meant by the lack of needed information in human, social and industrial affairs. This concept presents an initial outline for a possible future theory of information inadequacy.

Section two presents briefly the Research Approach of this study. Section three presents a summary of analysis and the results obtained from the empirical inquiry. Section four discusses these findings and derives some implications, while the final section provides a summarized conclusion.

2 Research Approach

In this study, data collection and analysis are based on secondary sources collected from news reports that were carefully reviewed. The collection resulted in 50 empirical cases. The data analysis was conducted using open coding, axial coding and selective coding, which are adapted for the purpose of this research, according to procedural aspects illustrated by [10], enhanced by [11], [12] and [13]. See for more details [14].

The 50 empirical cases comprise of different dramatic situations that are selected for the purpose of emphasizing the phenomenon of the lack of needed information. More concretely, the selected number of situations are grouped as follows: Natural Disasters (9); Environmental Disasters (6); Financial Failures (7); Health Failures (6); Political Scandals (6); Conflict Situations (3); Engineering and Technological Fail-

ures (8); Nuclear and Chemical Disasters (5). The 50 cases identified are analysed further with grounded theory approach. They are categorized in an a priori manner, solely for the purpose of facilitating the reader's understanding of what situations are taken into consideration. However, this does not have any influence on the empirical analysis.

Data analysis emerged iteratively, starting with early open-ended research, primarily line-by-line text analysis, and continued with more strategic selection of emerging concepts and categories [11]. The benefit of the iterative process is that the initial phase of exploration followed a flexible path in terms of understanding and collecting data, while the later phase of conceptualization followed a more strictly organized path based on the strategic planning of analysis.

The coding process as formulated by the grounded theory approach is employed more formally in data analysis after all the data have been collected, selected and refined. The analyses were based on three types of coding presented by [10], which are: open coding, axial coding, and selective coding.

One of the key limitations of this study is that the research design was intended for understanding the phenomenon of the lack of needed information in dramatic situations. Evidently, the study does not consider everyday situations, where some of the current results may not be fully relevant.

3 Results

This section presents the result of the empirical investigation based on the grounded theory approach. An illustration of how grounded theory approach was utilized is given, which follows by giving an account of detailed results derived from the analysis.

3.1 Analysis and Results

The generated codes, concepts, categories and the core category are the main results that emerged during the application of the grounded theory coding procedure.

The actual conceptualization and interpretation of the phenomenon of the lack of needed information became clear in the early phase of analysis. The conceptualization of 50 cases developed on the basis of analysing each case, deriving characteristics that could show what causes the lack of needed information. The results of such a conceptualization were mainly dependent on several induced codes that were identified as recurring in many cases. For instance, codes such as "technology failed to alert" were crucial for interpreting the phenomenon in context.

The use of the majority of codes clearly presented significant similarities in all the situations, resulting in an early, yet a crucial interpretation of the phenomenon in context. The similarities identified pointed in one direction:

"Many crucial problems with information in human, social and industrial affairs are inevitable and usually happen unexpectedly for the information receiver – the affected. There are several factors that affect information transmission processes,

which may include: gaps in communication processes affected by lack of timely information, lack of transparency or lack of information management."

With such cases, the key message of the situations is self-explanatory even in an early phase of deriving results, which shows that information is so significant that we often fail to receive it in time, or alternatively, we fail to control it in time. Theoretically, this may happen as a result of non-rationalized complexity structures of communication [15], and yet no optimization has been achieved to provide proactive retrieval of information [16], [17].

The early interpretation derived from analysis gave an indication of what is understood in terms of the lack of needed information. This opened a new perspective and results continued to develop by inducing specific codes and concepts that would explain more concretely what such an early interpretation says more specifically. Thus, the emergence of some fundamental characteristics of the lack of needed information derived from the 50 selected cases, were understood and defined as follows:

1. Social/individual problems: intentional manipulation – explain irrational human behaviour, at times followed by unawareness.
2. Technological problems: technical malfunction – explain improper functioning of a technological system that may or may not be triggered by irrational human behaviour.
3. Legal problems: unethical exploitation – explain immoral human behaviour to gain personal advantage.
4. Political problems: intentional misinformation – explain irrational behaviour that causes uncertainty.
5. Economic problems: economic fraud – defines fallacious acts to gain personal advantage.

While the analysis process continued, the emergence of new and interesting characteristics developed progressively; thus, the early interpretation of the phenomenon of the lack of needed information became specific and reasonable [14].

The strong dependency between the identified groups of codes led to the construction of eight specific and meaningful categories that justified more concretely the characteristics that may possibly explain the phenomenon in context, the lack of needed information. These are: information is non-existent, information is insufficient, information is censored, information is undelivered, information is ambiguous, information is redundant, information is irrelevant, and information is undervalued. Besides, the use of constant comparative method and the analytical induction enabled characterizing the eight categories as eight sub-categories and their interrelations with codes and concepts, as their developing conditions were partially causal and partially constructed by the researcher's interpretation in two main categories: information lack and information overflow.

The result of the actual definitions of the sub-categorization is presented below. The resulting definitions were formally based on a hierarchical presentation of all generated codes and concepts, interrelated and presented in terms of a semantic tree (for details of the semantic representation, see Figure 1). The organization of the new

categories was analytically based on 35 codes (17 concepts, 13 substantive codes and 5 theoretical codes) as grouped in 8 sub-categories and based on the following definitions:

Information Lack

1. Information is non-existent – is characterized by failure to communicate information in situations when actions are unforeseen and the responsible body for transmitting information is unaware of such a need, usually due to mismanagement.

2. Information is insufficient – is characterized by failure to communicate on-time information as a result of pre-planning of circumstances that may cause unwanted results in a specific situation. Unawareness, mismanagement and difficulty in understanding represent failure to act in a timely fashion.

3. Information is censored – is characterized by serious violation of information. Such information is usually hindered intentionally, secretly and illegally for the purpose of suppressing original information that is intended for the public and that may be significant for their needs. Fraud is one of the key acts that reflect the censoring of information.

4. Information is undelivered – is characterized by incompetent acts of humans, with a dual outcome. The act is either done intentionally by prohibiting the use of information or the undelivered information is caused by unawareness.

Information Overflow

1. Information is ambiguous – is characterized by lack of control of information. It is usually accompanied by miscalculations and lack of accurate evidence that misleads important decision-making processes.

2. Information is redundant – is characterized by duplication or even multiplication of the same information (repetition of information's message in synonyms or with the same excessive expression) due to lack of control or unawareness.

3. Information is irrelevant – is characterized by types of information that have no validity and are shared by unknown sources. Such information holds misinterpretations.

4. Information is undervalued – is characterized by mismanagement that may cause misinterpretation of information, possibly by lack of awareness or unawareness.

The 50 selected cases also portrayed several analytical perceptions that resulted in the composition of the two well-defined categories, i.e. information lack and information overflow. Analytically, the emergence of these codes addressed communication processes as follows:

- "the sender (source) has intentionally manipulated information"
- "the sender (source) has unintentionally influenced information due to unawareness"
- "the medium was intentionally manipulating information or was not fully functional"
- "the recipient did not receive information or received partial information"
- "the recipient was confused with misleading information"

These initial conclusions guided the argument that the main causes of the lack of needed information that affects human, social and industrial affairs are mainly determined by information sender (source) and/or information mediator. Whereas information receiver is mainly understood as the object of affection, although in similar situations, information receiver may seem to influence the meaning of the information.

Finally, an important result was derived from these analyses: *information is key to every organizational aspect, whether it concerns one individual, a group of individuals, the situation itself or the immersion of the individual/group in the situation*. It is obvious here that all the generated problems that concern human, social and industrial affairs are basically caused by the lack of needed information, where information is regarded as the main instrumental resource. Given all of this, it became reasonable to describe the core category, in terms of "information inadequacy". In fact, information inadequacy is defined as a dilemma that is composed on the basis of two dichotomous forces, information lack and information overflow, which suggests how communication processes unfold in dramatic situations, which seem to provoke unexpected behaviour in human, social and industrial affairs.

To enhance the results derived, Table 1 illustrates them more comprehensively. The inclusion of core aspects in this table underlines several elements that explain how information inadequacy emerged. The very first column, "Cause Indicator", is considered as an initial point to start investigating the phenomenon. The second and third columns originated from data analysis by distinguishing them as "Characteristics (sub-categories)" or "Characteristics (main categories)". The last column represents the "Consequences" as a result of the dichotomy between the two Characteristics (main categories). These are theorized under the description of information inadequacy.

Table 1. Elements associated with information inadequacy presented on the basis of two main characteristics, i.e. information lack and information overflow and their interrelations with four sub-characteristics each.

Cause Indicator	Characteristics (sub-categories)	Characteristics (main categories)	Consequences
Lack of Needed Information Mainly caused by information sender (source) and information mediator.	*Information is non-existent*	*Information Lack*	*Failures and Fatalities in Human, Social and Industrial Affairs. E.g. Victims of a catastrophic event; Victims of a bankruptcy; Victims of a technological malfunction.*
	Information is insufficient		
	Information is censored		
	Information is undelivered		
	Information is ambiguous	*Information Overflow*	
	Information is redundant		
	Information is irrelevant		
	Information is undervalued		

The result of the actual definitions of the categorized codes and concepts and the emergence of categories, sub-categories and the core category is presented in the figure below. The resulting definitions are formally based on a hierarchical presentation of all generated codes and concepts, inter-related and presented in terms of a semantic tree as in Figure 1. The semantic representation of codes and concepts is divided in terms of two main categories, i.e. information lack and information overflow, due to limitations of space.

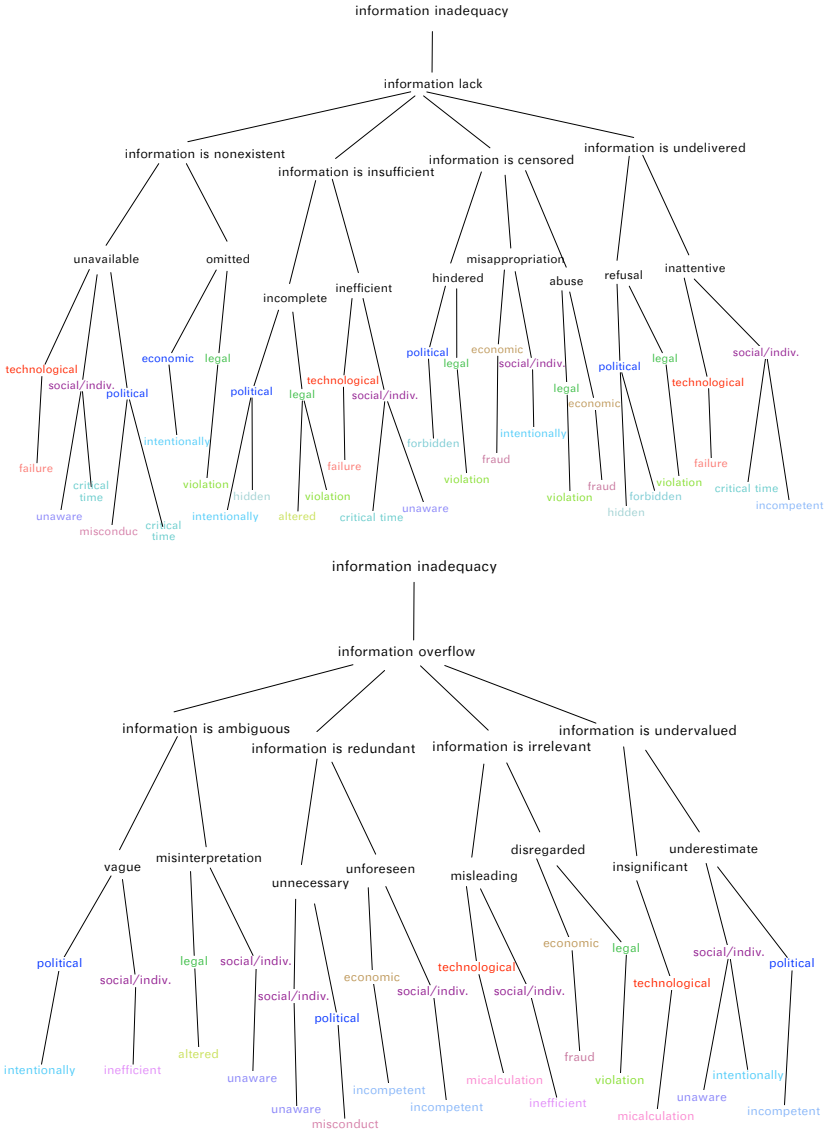

Fig. 1. A Semantic Representation of Information Inadequacy

The meaning of information inadequacy became clearer with a new interpretation which followed after firm results were generated. Hence, the core category understood from the analysis as information inadequacy is defined as follows:

"*dramatic situations that encounter information as the key resource in different situations and circumstances, manifest various consequences, many of which are experi-*

enced as failures and fatalities in human, social and industrial affairs. As a result, information-related problems become unavoidable. It is justifiable to state that information inadequacy as such is not taken as seriously as a problem that is accompanied by unwanted consequences. Tentatively stated, this initial outline is crucial."

4 Discussion and Implications

This paper has given an overview of an empirical investigation employing grounded theory approach on a collection of 50 empirical cases. The investigation resulted with the identification of hindrances of how the lack of needed information fails to reach the intended person at the right time and place by causing unwanted consequences. The data analysis suggested that information-related problems mainly appear because of hindrances that are caused by information senders (sources) and/or information mediators - human or technology. Such an understanding is crucial and informs future practices with information about the causes of the phenomenon in context in a comprehensive way.

Grounded theory approach became instrumental in this study. The development of an understanding of the phenomenon in context is achieved by suggesting that a number of characteristics (information is ambiguous, information is non-existent, information is redundant, and the like) and their interrelations present various patterns described as information inadequacies that emerge in a communication process. These are followed by a number of diverse factors, ranging from political and cultural structures, through human individual capabilities, and ending with procedural and technological artefacts that influence the rise of consequences.

Thus, the application of grounded theory approach has developed new and interesting results. The phenomenon of the lack of needed information developed in terms of a new understanding described as information inadequacy. The latter presents a proposal with a comprehensive outline that informs how information-related problems are generated in human, social and industrial affairs. The need to investigate this phenomenon was based on the importance of information as one of the most essential resources in our contemporary societies.

In practice, the proposed outline of information inadequacy addresses all humans who are concerned with information in everyday practices and intend to enhance their time by carefully managing information. More importantly, information inadequacy can be a diagnosis tool that allows industrialists, technology developers, environmentalists and others to think for a better future. In general, practitioners can use it to increase the level of contribution behaviours in organizations [18]. For instance, in a complex work task with information practices, low contribution in effective use of information may result from low motivation. Practitioners may assess this by looking at whether contribution behaviours relate to e.g. unawareness, intentionality, incompetence, violation, and the like. These determine specific ways to address difficulties through design of improved information systems with the focus on data and information quality.

Given the results of the empirical investigation conducted here, the identified factors portray how hindrances to information provision may be utilized as guidelines for the diagnosis and re-design of information provision processes. In short, this would imply that each hindrance identified, might be used to direct new and innovative diagnostic and re-design teams that focus on information management and on more careful planning of information flows that are present and important in dramatic situations that happen in human life or business processes. For example, given the exposure of information in different circumstances, the very production of information must be protected against hindrances before it becomes vulnerable. According to the current findings, this can be achieved by carefully considering at least the five identified factors that range over political and cultural structures, human individual capabilities, and procedural and technological artefacts, which are able to direct information flows in an unpleasant way. In conclusion, the results of this investigation have developed an interesting outline of information inadequacy by applying grounded theory approach [19]. Such an understanding may possibly guide further development of a future theory of information inadequacy that can be instrumental in developing more efficient information systems for organizations and societies for an operational use of information.

5 Conclusions

This study has proposed an initial outline of information inadequacy that resulted from the need to understand the phenomenon of the lack of needed information. Some dramatic situations were introduced for the purpose of triggering the research process to take an analytical position. Dramatic situations such as the Lehman Brothers bankruptcy in 2008, the tsunami in Indonesia in 2004, the Space Shuttle Challenger destruction in 1986 or the release of the atomic bomb in 1945 have been key empirical cases that initiated an analytical investigation to explore the phenomenon of the lack of needed information. The challenge posed at the beginning of this study presented the need for an inquiry that required analytical investigations. The challenge has emphasized a concern that is rather intriguing and complex, why such situations emerge.

The findings here show that information inadequacy remains a challenging dilemma that will continue to cause problems in human, social and industrial affairs. Thus, this study is a call for future research to develop the current and initial outline of information inadequacy in at least three dimensions. First, a further development of the content that represents information inadequacy, i.e. factors and their interrelations can be extended. Second, the empirical validity of the current elaboration, based on a very large number of cases (e.g. 1000) can strengthen the initial outline of information inadequacy. Third, the research object, i.e. not only “dramatic situations” but also the “everyday situations” can be considered as cases where information inadequacy is present.

These proposed dimensions can be studied by looking more concretely at socio-psychological factors and technological factors that influence the emergence of information inadequacy.

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Towards Improving Structure and Content of Information Demand Patterns

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Abstract. Work presented in this paper originates from the field of information logistics and aims at the reduction of information overload. Among the approaches for reducing information overload, the concept of information demand patterns (IDP) was developed for capturing organizational knowledge on how to improve information flow in enterprises. The paper investigates how the structure of IDPs is perceived by potential users and what enhancements of the structure could be made for improving content and quality of IDPs. For this purpose, an investigation including two steps is performed. The first step involves students in a university course who apply the IDP structure for developing IDP candidate descriptions. The intention is to explore whether the IDP structure reached a level of maturity to transfer it to non-experts in the IDP field. The second step evaluates the IDP developed by the students with respect to the quality of the different parts of the IDP structure. The conclusion of the investigation is that the IDP structure in general is applicable and useful, but consistency between the different IDP parts needs to be improved by providing aids and guidelines.

Keywords: Information demand, information demand pattern, demand modeling, validation.

1 Introduction

Work presented in this paper is a contribution to the field of information logistics, which aims at improving information flow in enterprises and organizations [1]. The general intention is to contribute to reducing information overload, which more and more is perceived as problem in enterprises [2]. Among the many approaches for achieving a more demand-oriented information supply, modeling and analysis of information demand have been proposed [3] and the concept of information demand patterns has been developed. Information demand patterns are considered as a way of capturing organizational knowledge about what information is required for specific roles in an organization.

Application and validation of information demand patterns so far was based on industrial case studies, like in collaborative engineering [4], and surveys in higher education [7]. This paper aims to extend work on information demand patterns by addressing the aspect of how to improve the inner quality of information demand patterns, i.e. the completeness, accuracy and pertinence of the pattern content, which is structured into different parts. For this purpose, an investigation including two steps is performed. The first step involves students in a university course who apply the IDP structure for developing IDP candidate descriptions. The intention is to explore whether the IDP structure reached a level of maturity to transfer it to non-experts in the IDP field. The second step evaluates the IDP developed by the students with respect to the quality of the different parts of the IDP structure. The main contributions of this paper are (1) results from validating the concept of information demand pattern in a university course, (2) results from evaluating the different parts of information demand patterns regarding their quality and (3) conclusions how to improve the concept and structure of IDP.

The remaining part of this paper is structured as follows: section 2 describes the background for the work by introducing the concept of information demand and information demand patterns. Sections 3 and 4 contain the two-step investigation performed: Section 3 focuses on the first step of the investigation, i.e. the set-up, data collection and results of applying IDP in a university master course for developing IDP candidate descriptions. Section 4 covers the second step of the investigation, which is a quality assessment of the different parts of the IDP candidate descriptions produced in step one. Section 5 draws conclusions and presents an outlook on future work.

2 Background

Work on understanding the nature of information demand and on identifying and structuring patterns of information demand form the background for this paper. This background will briefly be summarized in this section. Furthermore, the section summarizes the results of a previous IDP validation exercise performed in higher education in 2010 (section 2.3).

2.1 Information Demand

The notion of information demand is closely related to work in the area information logistics, which considers understanding information demand as key aspect of information logistics solutions [4]. Information demand usually includes different dimensions, like the content required, the time of delivery, the location, the presentation and the quality of information. The research field information logistics explores, develops, and implements concepts, methods, technologies, and solutions for the above mentioned purpose.

Lundqvist explored the nature and characteristics of information demand in an enterprise context in an empirical investigation [5]. The conclusion from the study is information demand of employees in an organization is to a large extent based on the

organizational role and the tasks an employee has. This role-centric perspective with task and responsibilities as primary characteristics has been the starting point for developing the a method for information demand analysis [3].

Lundqvist defines information demand as: "*Information demand is the constantly changing need for relevant, current, accurate, reliable, and integrated information to support (business) activities, when ever and where ever it is needed." [5, p. 61]*

2.2 Information Demand Patterns

The concept of information demand pattern originates from work in the research and development project Information Logistics for SME (small and medium-sized enterprises) (infoFLOW). infoFLOW included seven partners from automotive supplier industries, IT industry and academia. The objectives were to develop a method for information demand analysis [6] and to identify recurring elements in information demand, i.e. patterns of information demand. The general idea of information demand patterns (IDP) is similar to most pattern developments in computer science: to capture knowledge about proven solutions in order to facilitate reuse of this knowledge. In this paper, the term information demand pattern is defined as follows: *An information demand pattern addresses a recurring information flow problem that arises for specific roles and work situations in an enterprise, and presents a conceptual solution to it.*

All information demand patterns are supposed to have a uniform structure, which consists of a number of essential parts used for describing the pattern:

- The *pattern name* usually is the name of the role the pattern addresses.
- The *organisational context* explains where the pattern is useful by identifying the application domain or the specific departments or functions in an organisation forming the context for pattern definition.
- The *problems* of a role that the pattern addresses are identified. The tasks and responsibilities a certain role has are described in order to identify challenges and problems, which this role usually faces in the defined context.
- The *conceptual solution* describes how to solve the addressed problem. This includes the *information demand* of the role, which is related to the tasks and responsibilities and usually consists of different elements; *quality criteria* for the different elements of the information demand, like the importance of accuracy, completeness and timeliness; the *timeline* indicating the points in time when the different information demand elements should be available.
- The *effects* that play in using the proposed solution are described. If the different elements of the information demand should arrive too late or are not available at all this might affect the possibility of the role to complete its task and responsibilities. Information demand patterns include a description of potential economic consequences; time/efficiency effects; effects on increasing or reducing the quality of the work results; effects on the motivation of the role responsible; learning and experience effects; effects from a customer perspective.

The above parts of a pattern are described in much detail in the *textual description* of the pattern. Additionally, a pattern can also be represented as a *visual model*, e.g. a

kind of enterprise model. This model representation is supposed to support communication with potential users of the pattern and solution development based on the pattern. An example for an actual pattern for the role of "Material Specification Responsible" in a manufacturing enterprise can be found in [4].

2.3 Validation of IDP in Higher Education

As a contribution to increasing the maturity of IDP, a validation activity was performed in 2010 in the context of higher education [7]. We investigated the use of information demand patterns in higher education by performing an exercise with 22 students divided into 12 groups in a master course on information logistics. The intention was to explore whether the IDP structure has reached a level of maturity to transfer it to actors outside the development team and whether it also can be applied for capturing information demand in general. The exercise consisted of a practical task and a questionnaire designed to capture experiences and impressions of the students. The practical task was to describe the information demand for a task or a role, where the students felt that they are experts or have at least a lot of experience.

The main result of the validation activity was that the respondents participating in the exercise managed to produce information demand descriptions using the pattern structure, which indicates that they understood the structure as such and were able to apply it. The work also resulted in some proposals for improving the IDP structure, e.g. by putting more weight on actual information sources, and in improving the way of teaching information demand modeling, e.g. by spending more efforts on enterprise modeling aspects such as role modeling. These recommendations were implemented in the IDP structure and taken into account in teaching activities.

3 Study on Development of IDP Candidate Descriptions

In order to improve the maturity of IDP structure introduced in section 2.2, a two-step investigation was designed focusing on the "inner" quality of information demand patterns, i.e. the completeness, accuracy and soundness of the different parts of a pattern (e.g. context, problem, information demand, effects, etc.). The first step introduced in this section basically is a repetition of the validation exercise presented in section 2.3 in a different context: again, students in a university course are asked to apply the IDP structure for developing IDP candidate descriptions. The intention of this repetition is twofold: we wanted to confirm the result of the first exercise that the pattern structure can be applied by non-experts in the IDP field and we wanted to create a larger sample applicable for the second step of the investigation, which focuses on the quality of the different parts of the IDP structure and is presented in section 4. The remainder of this section describes the set-up for the investigation, shows selected results of the data collection and compares the results with the previous validation exercise.

3.1 Set-up for Data Collection

The data collection was performed in an exercise within the above mentioned master course in Riga, Latvia. The information system development course was attended by 18 students. The participating students did their bachelor degree in Riga. As a preparation for the exercise, the students were introduced to the area of information logistics on basic principles of information logistics, demand modeling approaches and typical applications. This included an introduction to the concept of information demand pattern including examples.

Afterwards, the students were given an exercise consisting of a practical task and a questionnaire to be filled in after the practical task. The students had to accomplish the task on their own, which resulted in 18 solutions handed in. The task was introduced by the teacher, but there was no further guidance provided during the work on the exercise.

The practical task was to describe the information demand for a task or a role, where the students felt that they are experts or have at least a lot of experience. They were encouraged to consider different areas when deciding on the task or role they want to describe, including their private or social background, the university context or any other field. The description of the information demand had to be structured like an information demand pattern (see section 2.2). A template was provided for this purpose as well.

The questionnaire included 9 different questions, four of them with a five-point Likert scale, one with a nominal scale, one with an interval scale and three for free text answers.

3.2 Data Analysis

All 18 students, which in the following will be called respondents, submitted information demand descriptions following the pattern template and all filled in the questionnaire. The information demand descriptions addressed the following subjects:

- Human resources manager
- Client / credit manager
- Employee of logistics department
- Data update responsible
- Automation of scheduled request output saving in project accounting module
- Responsible for warehouse operations
- Responsible for coordination of audit project team
- Responsible for organizing a team building event
- Responsible for cleaning clothes
- Business visionary
- Bus terminal accounting software administrator
- Helpdesk employee
- Website editor
- Responsible for online shop
- Change administrator

- Change administrator for game software
- Administrator for server load balancing

In the questionnaire, the respondents were asked whether the elements in the IDP structure are needed in order to describe information demand or whether there are superfluous elements. Sixteen respondents answered that all elements are needed, two of them responded that one element – timeline – was not needed.

When asked whether anything is missing in the IDP structure, two respondents demanded: more visualization of information to understand the pattern easier and an appendix to provide more information about filling in the pattern in detail. The other sixteen students considered the structure as complete.

Table 1. Response distribution for "How difficult to *identify* were the different parts?".

Element of IDP structure	Very difficult	difficult	Neither difficult nor easy	easy	Very easy
Context	1 2 9 4 2				
Problem	1 3		10	2 2	
Tasks/responsib.	1	2	12	3	
Info demand	1 9 7 1				
Quality Criteria	3 8 6 1				
Timeline	2 3 7 6				
Effects	1 9 6 2				

When asked "How difficult to *identify* were the different parts of structure?", the following distribution of answers was observed (see table 1). This distribution follows in most rows the Gaussian distribution. The information demand, quality criteria and effects are believed to be more difficult than the other elements of the IDP structure.

The question "How difficult to *describe* were the different parts of structure?" resulted in the following response distribution (see table 2). Again, most of the responses follow Gaussian distribution with exception of one aspect. To describe the effects of receiving information too late or not receiving is considered difficult by half of the participants. As seen one participant did not answer this question.

Table 2. Response distribution for "How difficult to *describe* were the different parts?".

Element of IDP structure	Very difficult	difficult	Neither difficult nor easy	easy	Very easy
Context		3	10	3	1
Problem		5 9 2 1			
Tasks/responsib.	1 2 9 5				
Info demand	1 5 8 3				
Quality Criteria	2 5 7 3				
Timeline		3 8 6			
Effects	1 7 6 3				

Regarding the aspect "How much time was needed to identify and describe the different parts?", table 3 shows the distribution of responses. Here, describing the information demand was considered the most time consuming activity, as 51% of the respondents answered that "very much" or "much" time was needed. Describing quality criteria and effect also were considered time consuming by roughly 47% of the respondents.

Table 3. Response distribution for "How much time was needed for the different parts?".

Element of IDP structure	Very much	much	Neither much nor little	little	Very little
Context	1	5	9	3	
Problem	1	5	9	3	
Tasks/responsib.	1	5	9	2	
Info demand	1	9	7	1	
Quality Criteria	2	8	7	1	
Timeline		4	7	5	2
Effects		8	7	1	1

When it comes to the time needed to develop the information demand description, the field is located close to each other except one participant needing more than 12 hours (see table 4).

Table 4. Response distribution for the overall time needed for completing the exercise.

Time needed	Number of responses
less than 2 hours	
2 hours – 4 hours	8
4 hours - 6 hours	7
6 hours - 8 hours	2
8 hours - 10 hours	
10 hours - 12 hours	
More than 12 hours	1

3.3 Discussion

The main conclusion from the performed exercise is that there are clear indicators to believe that

- The respondents understood concept and structure of information demand patterns and were able to apply it on their own, and
- The structure proposed for information demand patterns is also suitable for describing information demand in general.

Both conclusions are supported by the fact that 18 complete information demand descriptions for different tasks or roles were developed by the participants in the exercise without guiding or supporting them in the actual development process of these demand descriptions. This indicates that the students learned how to use the

information demand pattern structure for capturing information demand descriptions. The pattern structure was judged suitable and complete by the clear majority of the students. The weight of these observations is relatively low due to the limited experience level of the students, but nevertheless contributes to the validation of the IDP concept.

The list of developed information demand descriptions shows a wide bandwidth from more socially oriented tasks (like "organizing a team building event") to strictly business-oriented ("human resources manager") or IT-oriented roles (e.g. "administrator for server load balancing"). The quality of these patterns was only evaluated by the teaching team in the course who checked the consistency between the different parts of the description, the understandability of the different textual elements, the completeness of the description, and whether the descriptions were sound and reasonable. This "perceived" quality of the patterns might be sufficient as initial check, but would have to be complemented with an "in-use" check of the description, i.e. applying them in a real-world situation for performing the task/role under consideration.

With respect to the perceived quality, the impression was that those patterns who addressed quite small and very specific roles or tasks were the better ones. Examples are "organizing a team building event" or "responsible for cleaning clothes". Furthermore, it was observed that some of the business related demand descriptions were very detailed and high-lighted interesting challenges. An example is the "helpdesk employee", which was reflecting a lot of experience, since the respondent developing it had several years of job experience on this position from his time before starting the master education. Thus, the results of the exercise also include some information demand descriptions, which can be considered as candidates for future information demand patterns.

The answers from the questionnaire regarding difficulty and time needed to identify and to describe the different elements of a demand description can be used as basis when improving the exercise and the course on information logistics. More emphasis in next year's teaching should be put on repeating organizational concepts like "role" and "task" and how to actually describe them in a proper way. This is in line with the conclusion from the study performed in 2010 [7].

Furthermore, the quality of the information demand descriptions probably could be improved by several measures. One aspect could be to add more examples for information demand patterns and perform the stepwise development together with students in order to improve the understanding of the concept and the different elements of an IDP. Furthermore, the evaluation of the patterns could be made part of the course, by providing a guidance for the evaluation process and letting the students evaluate another group's demand description.

When evaluating the free form questions of the questionnaire, an interesting observation surfaced: the students had to learn that they really have to be experts in the domain in order to be able to describe the information demand. More than half of the groups indicated that the hardest task in the exercise was to scale down the role or task under consideration to a scope which really reflected their own area of expertise.

3.4 Conclusions from the first investigation step

The results of the investigation done in Riga have been presented in section 3.2 and have been discussed in section 3.3. It is clearly to see that most of the achieved results are very similar to the first investigation done in 2010. The results of the first investigation are confirmed. Some noticeable differences will be discussed in the following.

The students in Riga needed less time to accomplish their task filling out the information demand pattern template than the students from the first investigation done in 2010. A possible explanation is quite simple because the teacher in the 2010 study accepted the pattern only after having a look at the pattern handed in. Therefore some pattern descriptions were given back to the students in order to improve the quality.

Noticeable is as well that information demand and effects were the parts which were most difficult to identify and to describe. Furthermore information demand and effects were the most time consuming part of the pattern. A relation between time an quality can be supposed.

As shown above this study was useful to confirm the result from the first study. The IDP pattern can be applied by non-experts without further guidance, but was not suitable to indicate how to improve the pattern quality.

Therefore one more investigation step is needed, which is described in section 4.

4 Quality Assessment of the IDP Candidate Descriptions

As illustrated in section 4, both university exercises were performed in order to get indications whether the IDP concept can be used by non-experts in the field and whether and where improvements would be recommendable. Starting from the results presented in 3.3 and 3.4 we decided to investigate in more detail why participants perceive the parts "information demand" and "effects" as more difficult as the other parts. An interesting question in this context is, whether the quality of the "information demand" description and the "effect" description is worse than the quality of the other parts and the overall pattern, since the respondents consider these two aspects as more difficult. If this conjecture could be confirmed, more efforts should be spent on supporting the developers of IDP descriptions with respect to these two aspects: information demand and effects. This section describes how this second step of our investigation was performed, what results were achieved and which conclusions to draw.

4.1 Data Collection Process

As already pointed out there were 12 respondents in the first exercise and 18 respondents in the second. We decided to draw a sample of one third of all information demand pattern. It is reasonable to consider the ratio of the respondents from both investigations. Therefore 4 IDP's should be from the first exercise and 6 from the second one. We numbered the IDP's from the first investigation from 1 to 12

and the IDP's from the second from 1 to 18. To draw the random sample we used 2 respectively 3 hexagonal dices.

When evaluating the quality of the ten patterns, we decided to apply and extend criteria addressing the quality of the pattern content originating from document engineering [8]. We defined the criteria as follows; "content" refers in this context to the textual parts in the pattern description:

- Comprehensibility (co): The content is well-structured and formulated clearly. The reader is able to understand the content easily.
- Completeness (cm): The content includes all information to completely describe the subject under consideration.
- Consistency (cn): No contradictions within the content or with respect to other parts of the pattern description can be detected.
- Soundness (so): The given information fits to the subject addressed and is considered realistic.
- Clarity (cl): The content or the information demand pattern can be applied without modifications.

In order to evaluate the presented criteria we decided to use marks from 1 to 5 being common practice in German Universities. In this context the marks are used as follows:

- 1 (excellent quality): The IDP is applicable without restrictions.
- 2 (good quality): The IDP is applicable with minor restrictions.
- 3 (average quality): The IDP is applicable with restrictions and needs minor revision.
- 4 (limited quality): The IDP is applicable with major restrictions and needs much revision.
- 5 (unusable quality): The IDP is not applicable.

Every IDP was evaluated according to the above criteria differentiating five specific parts of an IDP: context and problem, tasks and responsibilities, information demand, effects, and the pattern in total. This leads to 25 marks per IDP, i.e. five criteria for each of the five parts. Furthermore, the IDPs were evaluated by two researchers independently from each other. After the individual evaluation the results were compared and discussed. There were three differences about the rating between the investigators. After a discussion the identified reasons were as follows: two misunderstanding about the content of the IDP and one difference in the expectation about the results. The investigators were able to clarify the differences which leads to a joint view presented in section 4.2.

4.2 Results

The results are presented in table 5 and table 6, respectively. Table 5 shows the results for the "pattern in total" and the part "context and problem". The results for the other parts had to be omitted due to space limitations in this work. The missing parts are tasks and responsibilities, information demand and effects. The ten evaluated IDPs are named from A to J in order to save space and since the names of the IDPs are not important for the further analysis.

Table 5 Example results in excerpts

IDP	Pattern in total					Context and Problem		...
	co	cm	cn	so	cl	co	Cm	
A	2	1	1	1	2	1	1	
B	3	5	5	2	5	3	3	
C	3	3	3	2	3	3	3	
D	3	2	3	1	2	2	2	
E	3	4	4	2	3	2	4	...
F	3	4	5	2	4	3	4	
G	1	1	1	1	2	1	1	
H	2	3	3	1	2	3	2	
I	3	3	4	2	4	3	4	
J	3	3	3	3	3	2	2	

Table 6 shows the overall results about all investigated parts of the IDPs. The arithmetic average is presented for each rated part of the IDPs.

Table 6 Overall results

IDP	Pattern in total	Context and Problem	Tasks and Responsibilities	Information Demand	Effects
A	1,4	1,0	1,6	1,0	1,6
B	4,0	3,0	2,0	3,8	3,8
C	2,8	3,0	2,4	1,6	2,8
D	2,2	2,8	2,0	2,0	2,0
E	3,2	3,0	3,0	3,2	2,6
F	3,6	3,4	3,0	3,6	3,8
G	1,2	1,0	1,0	1,0	1,6
H	2,2	2,4	2,8	1,6	1,2
I	3,2	3,4	4,0	1,4	1,4
J	3,0	2,6	5,0	2,4	2,4

4.3 Discussion

The results of investigation did not confirm the conjecture that the quality of the parts "information demand" and "effect" is worse than the quality of the other parts and the overall pattern quality. The evaluation results did not show any patterns of dependencies at all between information demand, effects, context & problem or tasks & responsibilities. This means it can not be concluded that a certain quality level of one pattern part causes a certain quality level for another pattern part.

But the results showed that consistency and soundness got the lowest quality marks of the five evaluation criteria and that the "tasks & responsibilities" part gets the worst quality rating among all the parts of an IDP.

Our conclusion from the above results is that we need to support the construction of IDP in general and the development of the part "task and responsibilities" much more. Regarding the overall IDP, consistency and soundness between the different parts need to be improved. This could be done by offering checklists and practices for interconnecting the different IDP parts. Regarding "tasks & responsibilities", more examples and a thorough introduction into the concept of a role and the implications towards responsibilities from organization theory could be suitable measures.

5 Summary and Future Work

This paper extended work on IDP by addressing the aspect of how to improve their "inner" quality, i.e. the completeness, accuracy and pertinence of the pattern content. For this purpose, an investigation was performed two steps. The first step involved students in a university course who apply the IDP structure for developing IDP candidate descriptions. The second step evaluated the IDP developed by the students with respect to the quality of the different parts of the IDP structure.

The main conclusion from the first step is that the respondents seem to have understood concept and structure of information demand patterns and were able to apply it on their own. The students learned how to use the information demand pattern structure for capturing information demand descriptions. The pattern structure was judged suitable and complete by the clear majority of the students. The significance of these observations is relatively low due to the limited experience level of the students, but nevertheless contributes to the validation of the IDP concept.

The conclusion from the second step is that consistency and soundness got the lowest quality rating and that the part "tasks & responsibilities" needs improvement. Such improvements could be reached by checklists and practices for interconnecting the different IDP parts.

This motivates continuous work into at least three directions:

- A method development effort should be initiated in order to create a systematic and integrated IDP development method.
- A similar validation effort should be made outside the academic context, i.e. to transfer the concept of information demand patterns to an industrially oriented community and evaluate the results of modeling information demand in such a setting
- In order to validate the IDP concept, the quality of the actual demand descriptions developed with this concept also has to be evaluated in a more systematic way than what was done in the exercise described

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Multimode Information Logistics for Conceptual Correspondence Monitoring

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The paper addresses problems that arise in situations where conceptual correspondence has to be monitored. This type of monitoring requires manual, semi-automatic and automatic information processing and exposes high level of complexity. The paper discusses challenges of use of multimode logistics in monitoring conceptual correspondence and reports on how the challenges can be met partly by using functional and morphological spaces of representation of information logistics.

1 Introduction

In contexts where information changes rapidly, its monitoring can be a necessary for fulfillment of the mission of the enterprise and staying competitive with respect to the similar enterprises in the environment. Monitoring is "the act of observing something (and sometimes keeping a record of it)" [1]. The main purpose of monitoring is to provide the ability to observe a situation for any changes, which may occur over time. Basic functionality of monitoring includes gathering of source data, data processing, and analysis to provide decision support information according to particular metrics [2]. Usually monitoring concerns quantitative information. Recently the need to consider conceptual information has also been recognized [3[, [4], [5]. The sources of numerical data usually are hard sensors or databases [6], and data is handled by well defined algorithms. In case of conceptual information, more often than in numerical data cases, the information may be handled by soft sensors (human brain) [6]. Another important issue is predictability of pre- and post-monitoring information logistics, which is much lower in the case of conceptual information than in the case of numerical information.

In general, information logistics [7] process transforms a given input into some form of output. The input is some kind of fragmented information or knowledge description that is derived from a so called information supplier. This input information can be handled manually, automatically, or semi-automatically. The process output is an information product that becomes accessible and delivered to the information receiver who can make use of the information. The basic ingredients of the information logistics process are supplying information, producing information and distributing information. Information logistics aims to guarantee that information with good quality is produced and delivered to the ‘customer’ to the right place just in time [8]. In

most cases information logistics has been considered in pre-defined organizational networks and by considering different roles in the enterprises as points of information demand and/or offer [7]. When conceptual information is concerned, quite often it may be obtained from the sources that are emergent rather than pre-defined. For example, there are new scientific results, which might be included in the study program of the university: it is not possible to predict the time of emergence of the scientific discoveries and it is not possible to predict how exactly this information will reach the decision makers. In this paper we focus on information logistics in the situations with the following characteristics:

- There can be emergent nodes in the information logistics network
- Information under the consideration is mainly conceptual in contrast to the numerical one
- At least one node in the network has the task of monitoring of conceptual correspondence of information obtained from different sources

The paper contributes to the managing in the above mentioned situations which are scarcely investigated in the domain of information logistics. Additionally, the paper adopts an understanding of information as a phenomenon that exists only in the moment when knowledge interprets the data which has been perceived [9]. Thus, the knowledge of each information processing node and data available are considered in the emergent (at least partly) information logistics network. Each node of information processing is viewed either as having hard sensor(s) and different levels of artificial intelligence or soft sensor(s) and human intelligence, or combination of both [6].

The paper is structured as follows. In Section 2 the need for and approaches to the identification of conceptual correspondence are surveyed. In Section 3 the conceptual correspondence as a monitoring parameter is discussed and potential information logistics inside the monitoring node and around it are considered. In Section 4 the substance and the level of intelligence of nodes of information handling in the logistics network are considered. In Section 5 the problems in multimode information logistics are discussed and some of their solutions considered. In Section 6 brief conclusions are presented and future work outlined. The issues discussed in the paper are illustrated by examples of knowledge demand and offer correspondence monitoring.

2 Identification of the conceptual correspondence

Identification of conceptual correspondence is mainly necessary in the context of knowledge management. Hereby we understand conceptual correspondence as an indicator of correspondence between two or more knowledge bodies or their parts. These knowledge bodies can be reflected in various information sources such as web pages, databases, "on paper" resources, human and artificial agents etc. In this paper we focus on such sources that are available in textual form [10].

As the conceptual correspondence is regarded as metrics that shows similarity between knowledge bodies it cannot be detected just by keyword search or planar statistical text comparison methods. Conceptual correspondence is about the correspond-

ence of meanings. Thus, it requires understanding the relationships between the concepts. The most usual mode of evaluation of conceptual correspondence is the manual one where the correspondence is detected or perceived by human experts. Manual identification and understanding of texts is time consuming. This causes necessity to develop automated or semi-automated approaches and tools to reduce the time and effort required for identification of conceptual correspondence.

To identify the conceptual correspondence between various sources automatically or semi-automatically, information should be properly managed and processed. Key aspects to pay attention to in this task are the identification and representation of information sources (knowledge bodies) that are to be compared and the identification of changes in these sources over the time [11].

Since relationships between the concepts play a major role in evaluation of conceptual correspondence, the conceptual structures should be derived from textual information, if they are not already pre-defined. In conceptual structures information usually is organized in a meaningful way by using concept relations in the form of concept hierarchies or in more formal way - in form of ontologies [5], [6], [12], [13], [14], [15]. Information represented in form of ontologies can be understandable not only to humans, but can also be processed by computers. When conceptual structures are represented as ontologies the number of ontology matching techniques and tools can be used, e.g., the techniques described in [16]. There are also automatic conceptual structure comparison methods and tools available that can be used in the cases when conceptual hierarchies or controlled dictionaries are available [17]. Interactive inductive learning methods are developed for comparison of conceptual structures in semi-automated mode [18].

From the point of view of information logistics there are different information logistics networks behind various methods of identification of conceptual correspondence. For instance, for two bodies of knowledge that are represented as texts there will be the flow of information from the sources of the text to the points where ontologies corresponding to the texts are created and then from these points to the ontology matcher tool [19], then to the tool that can present the results in a meaningful way and then to the users of information about the identified correspondence. In the case of inductive learning there will additionally be an information flow from the expert(s) who prepare the learning example sets to the correspondence identification tool as well as information flows to and from the expert each time the tool requests the expert help [18]. Thus, in information logistics for monitoring conceptual correspondence, the method of identification of the correspondence predefines a particular information logistics network that is a part of overall information logistic network for monitoring conceptual correspondence.

3 Monitoring of the conceptual correspondence

The basic ingredients of the information logistics process are supplying information, producing information, and distributing information [8]. Basic functionality of monitoring includes gathering of source data, data processing, and analysis to pro-

vide decision support information [2] according to particular metrics. This lets to conclude that in the cases when one of the nodes of the logistics network is a monitoring node, its structure will be a nested information logistics network, since the monitoring process has all basic functions of the information logistics. Therefore, in the remainder of the text we will refer to the internal and external information logistics with respect to the monitoring node which performs the function of the monitoring (Fig. 1). The discussion in this paper is limited to a specific monitoring case where the monitoring parameter is a conceptual correspondence between particular conceptual structures.

Fig. 1 Monitoring node (basic functions: different sensing and propagating sub-functions can be used for information transfer from and to nodes of external (to monitoring node) information logistics environment); each sensing sub-function can be viewed as having soft or hard sensors depending on whether it is performed by humans or artificial performers [6].

Information logistics can be defined in *functional space* where in the logistics network each node is a function; and in the *morphological spac*e where each node of the network is a particular agent or object that handles the information [20], [21]. In this section the logistics is described in the functional space, the issues of the morphological space will be discussed in the next section.

Functions in the functional space can be interpreted as services organized in a service-oriented architecture. Thus, in functional space of information logistics, the functions that are organized in service-oriented architecture will form a particular network according to their actual involvement in information processing. This can be exemplified by services of the EduMon system that has been designed for monitoring correspondence between industrial need and educational offer of knowledge for university study programs. The functionality of this system can be considered as a monitoring node in the information logistics for conceptual correspondence monitoring. Thus, the external information logistics of the monitoring node can be defined by configurations of the following services forming the EduMon architecture [22]:

- Group 1: information source management services (SoMS)
- Group 2: information retrieval services (IRS)
- Group 3: information extraction services (IES)
- Group 4: change management services (ChMS)
- Group 5: storage management services (SMS)
- Group 6: analysis services (AS)
- Group 7: notification services (NS)

- Group 8: presentation services (PS)

These services can be described according to the basic functions of monitoring node presented in Fig 1:

- *Sensing* function is responsible for identification of information sources in the monitoring environment. Monitoring environment here refers to all functions that can be related to but that do not belong to the ones performed by EduMon system. In EduMon, the sensing function is performed by services of Group 1.
- *Transforming* function processes are all source information gathered from monitoring environment. In EduMon, the transformation process aims at extraction of concepts and generation of conceptual structures (hierarchical or in the form of ontologies). Then, generated conceptual structures can be compared and their correspondence identified. The transformation in EduMon is performed by services of Groups 2-6.
- *Propagating* function distribute the information about correspondence between conceptual structures to other nodes such as functions performed by communication portal and information consumers of the EduMon System. The propagating function here refers to Services of Group 7 and Group 8.

Depending on the physical performer of the services, each function and service at any level of the representational granularity can be performed manually, semi-automatically, or automatically. This requires considering all three of these modes of information handling in the information logistics for conceptual correspondence monitoring.

4 The modes of information handling

In the context of meaningful information processing the tool that processes the information is knowledge. This is well illustrated by the theory of information codes [23, 24], which is partly adopted here for description of information logistics. According to this theory it may be assumed that among the nodes in the information logistics network information is circulated using so called information codes. These codes can be perceived by information processing nodes (IPN) having perception capability. The node uses its knowledge to obtain data from the information codes and with the help of knowledge interprets the data and obtains the information (if a particular node has an information interpretation capability) (Fig. 2) [9]. IPNs with an appropriate level of intelligence then can incorporate the obtained information in their knowledge and make new interpretations of pieces of their knowledge with the purpose to propagate the information codes to other IPNs.

In the functional space the network of information logistics is formed by functions (or configurations of functions or services) without focusing on IPNs performing these functions. However the logistics can be also described in morphological space, where the nodes of the network are IPNs with a particular built in or obtained knowledge and particular levels of intelligence. With respect to conceptual infor-

mation handling both human and artificial intelligence can be a property of nodes included or emerging in the network.

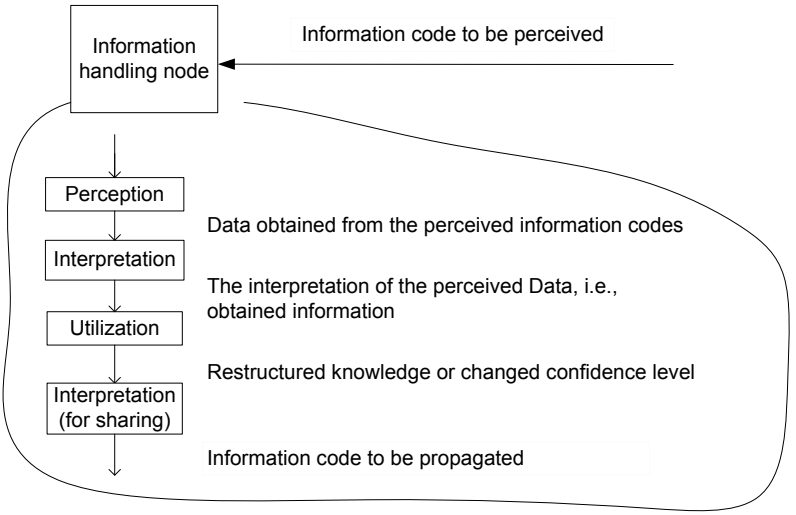

Fig. 2 Inside the information handling node

Concerning artificial nodes (AIPNs), the following cases of information handling capability have to be considered:

- AIPN as transmitter only – the node, that can only perceive the information codes and make them available for other nodes without meaningful interpretation; the only product of available from this type of nodes is data that can be propagated to other nodes of the network.
- AIPN as a transmitter and saver and/or transformer of information. In this case artificial information handling node can save and/or transform the information that it is able to perceive (e.g., DBMS with data). In this case the interpretation mechanism is built in and resembles knowledge of programmer of the node rather than the knowledge of the node itself; still this node can produce data as well as information. But it does not change the structure of the frame of knowledge (or data) which it uses for information processing.
- AIPN as a transmitter and saver and/or transformer of information, and/or learner. This IPN has all capabilities listed in the previous point and additionally it can learn from its own "experience", i.e., it has a measure of artificial intelligence that is not only built in, but can be acquired/extended during the process of information processing.

Each function or service represented in the functional space of logistics can be performed by one or several IPNs represented in the morphological space of logistics and vice versa. Table 1 presents different exchange possibilities in the morphological space of information logistics. *D* in the table means data, *K* means knowledge, *I* – information as intended, I' – information that differs from the intended one (it refers to the cases where the receiving node interprets the data differently to compare to

node that has initiated the information exchange). HIPN – stays for human information processing node; AIPN – stays for artificial information processing node. Each cell in the table represents all possible information code flows between two IPNs. Only IPNs having transmission capability are included in the table. The "black-hole" nodes are not considered in this paper.

Table 1 Information handling capabilities of IPNs

Node	HIPN	AIPN transmitter	AIPN Transmitter/ saver/ transformer	AIPN Transmitter/ transformer/ saver/learner
HIPN	D→D,I',K' I→D,I,I'K' K→D, I,I'K,K'	D→D I→D K→D	D→I' I→I,I' K→I, I'	D→D,I',K' I→D,I,I'K' K→D, I,I'K,K'
AIPN transmitter	D→D,I',K'	D→D	D→I'	D→D,I',K'
AIPN Transmitter/saver/ transformer	D→D,I',K' I→D,I,I'K'	D→D I→D	D→I' I→I,I'	D→D,I',K' I→D,I,I'K'
AIPN Transmitter/saver/ Transform-er/learner	D→D,I',K' I→D,I,I'K' K→D, I,I'K,K'	D→D I→D K→D	D→I' I→I,I' K→I, I'	D→D,I',K' I→D,I,I'K' K→D, I,I'K,K'

Table 1 shows that there are different ways how data, information, and knowledge can be shared and received (or taken in) depending on the nature of sharer and receiver. Any sequence X→Y between nodes represented in Table 1 may be regarded as particular flow of at least one of three phenomena: data, information, and knowledge represented by information codes. HIPN can deal with all three phenomena while different artificial nodes can be restricted to data only, and data and information only. All three AIPN can deal with artificial knowledge only [25].

Human information processing and artificial information processing relevant in morphological space of information logistics representation should also be considered in the functional space of information logistics representation. Depending of the elements (or their networked combinations) of the morphological space which are taking part in fulfillment of particular functions represented in the functional space; the functions may be handled in various modes, namely, manually (human information processing), automatically (artificial information processing), or semi-automatically (both human and artificial information processing nodes are involved). Taking into consideration that in both representation spaces there can be nested nodes, different spectrums of information handling modes at different levels of granularity of the representation may be observed. The more diverse the spectrum the more complex is the overall information processing, because each processing node requires corresponding interfaces between the nodes to ensure that the information code provided by a partic-

ular functional node in a particular mode of performance is perceivable by another functional node in each possible mode of performance. As an example in Table 2 the variations of modes of information handling of monitoring node described in Section 3 (see also Fig. 1) are given at the highest level of functional granularity. All three basic functions of the monitoring node (sensing, transforming, and propagating) can be performed in manual, automatic and semi automatic modes, so it means that there are 27 options of how the monitoring node can be configured in the logistics network and executed (see Table 2; similar table of service modes had been discussed in [11]).

Table 2 Monitoring node configuration options. (rows - information transmitted from; columns - information transmitted to). Example - if sensing is handled manually (M) and transforming - semi automatically (SA), then propagating function can be still handled manually (M), automatically (A), or semi-automatically (SA) (see text in bold with grey background)

	Sensing	**Transforming**	**Propagating**
Sensing	-	M-M, **M-SA,** M-A SA-M, SA-A, SA-SA A-A, A-M, A-SA	-
Transforming	-	-	M-M, M-SA, M-A **SA-M, SA-A, SA-SA** A-A, A-M, A-SA
Propagating	-	-	-

Table 2 represents the complexity of external logistics of the monitoring node. It has to be taken into consideration that the monitoring node is related to other nodes in its external logistics network. In morphological space some of these relationships for EduMon system are illustrated in Fig 3.

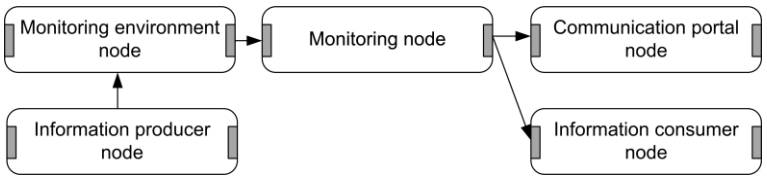

Fig. 3 External relationships of the monitoring node (morphological space of information logistics); it is assumed that the monitoring node in the morphological space includes all IPNs that participate in fulfillment of its functions represented in the functional space of information logistics)

Full complexity of multimode information logistics is seen when combinations of internal and external networks of logistics for monitoring of conceptual correspondence are considered, including the acknowledgment of the fact that in both types of networks there can be emergent IPNs and functions, which can require any modes of information handling.

5 Challenges of multimode information logistics

As discussed in previous sections, monitoring of conceptual correspondence requires use of multimode information logistic. This means that theoretically any connection between information processing functions can be implemented in 9 different combinations. Obviously, not all of these combinations will be relevant in reality. Nevertheless, there is a high complexity of information handling in situations of multimode logistics. One of the ways how to cope with this complexity is to distinguish between the functional and morphological levels of representation. This is illustrated by simplified EduMon [11] examples reflected in Fig. 4 and 5. In these figures one node at the morphological level of representation corresponds to one node at functional level of representation. In real situations many-to-many relationships may exist between the nodes at different representation levels; nevertheless, knowing which nodes of morphological level participate in which functions at the functional level can help in developing artificial IPNs for the logistics network and managing the network. In Fig. 4 and 5 the abbreviation IPN is shortened to IP for the sake of easier comprehension. Abbreviations of node names in functional level are described in Section 3. Abbreviations of information processing modes are described in Section 4.

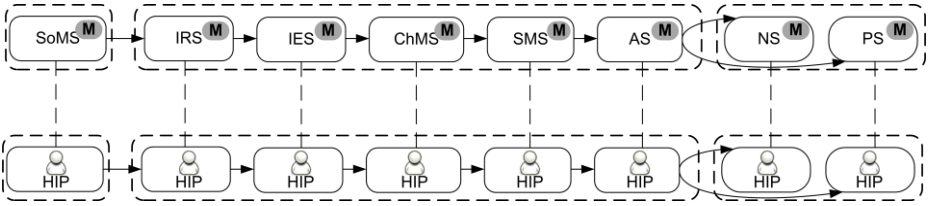

Fig. 4 Single-mode logistics as a special case of a multimode information logistics; HIP nodes should be considered here as different information processing roles [7] that can be performed by a random number of performers.

Figure 4 shows a specific case of the logistics where all functions are performed manually. In this case there is only one interface option and it can be negotiated, not only used as prescribed. Thus, the handling of emerging nodes in the network is trivial, at least theoretically. The situation becomes much more complex when different types of IPNs are involved (Fig. 5).

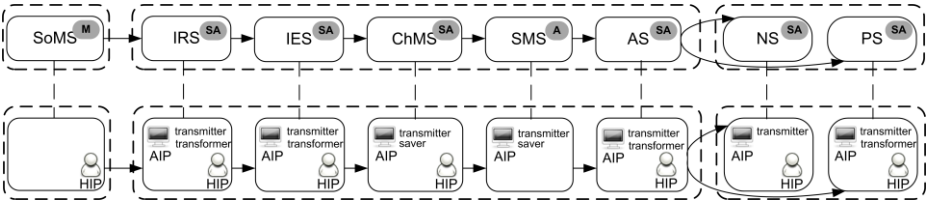

Fig. 5 Multimode logistics (the relationships between multiple sub-elements of the nodes are not shown at the morphological level of logistics representation)

In Fig. 4 and 5 only two of many possible case sensitive information logistics sequences of EduMon monitoring node internal logistics are shown. To ensure that the results of functioning of monitoring node are always meaningful and reach the "customers" of information it is necessary to ensure that all possible functioning modes for all relevant network configurations are supported. This includes handling of emergent nodes at both levels of representation in external and internal logistics of the monitoring node. Emergent nodes at morphological level can be connected to the logistics network on their own initiative or in the result of activities of artificial agents searching for relevant nodes [11]. In handling above mentioned complexity it also is important to consider granularity of representation, especially in cases of emergent IPNs and corresponding emergent functions and to acknowledge all possible variations of connections at all levels of granularity each of which can invoke multiple mode functions. It is essential that the smallest level of granularity of representation in the functional space would correspond to the actual activity of an emergent node in the morphological space.

Conclusions

The paper addresses information logistics for monitoring correspondence of conceptual structures. The conceptual correspondence is a non-numerical parameter and its monitoring requires human participation and can be enhanced by automatic processing of conceptual data such as texts, conceptual hierarchies, and ontologies. These features prescribe complex multimode logistics of information for conceptual correspondence monitoring. The paper points to the following challenges of multimodal logistics:

- Necessity to handle internal and external logistics of monitoring function
- Nested structure of information logistics network
- Several levels of granularity of functionality
- Several levels of granularity of performers
- Case sensitive configurations of the network
- Emergent nodes and emergent configurations in information logistics network
- Manual, semi automatic and automatic modes of functioning of one and the same node of the network
- Intelligence demanding methods of comparison of conceptual structures

The paper describes in detail the roots of these challenges and suggests to use two-level interrelated representation of information logistics, namely, the representation in the functional space and the representation in the morphological space, taking into consideration nested nodes that themselves can be represented as networks in both spaces of representation. Similar approach is well known in enterprise architecture modeling. In information logistics more emphasis should be put on correspondence between information flow configurations than it is currently common in enterprise architecture modeling [26].

In information logistics usually organizational roles are considered as nodes of the network. The paper proposes an information processing node as a smallest granularity element in the morphological space of logistics. Such approach provides a possibility to use finer configurations of the network which, in turn, can give an opportunity to achieve higher flexibility of the network and is helpful in handling emergent configurations of the network.

Future work concerns adopting, adapting, and developing graph based algorithms for functional and morphological spaces of representations in order to perform management of information logistics for conceptual correspondence monitoring. Another direction of future work is to examine whether the approach proposed in this paper may be helpful for monitoring systems which deal with numerical values rather than with conceptual structures.

The issues discussed in the paper are backed up by the experience gained in development of educational demand and offer monitoring system for university programs.

Acknowledgment

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Towards Adaptive Business Models for Intelligent Information Logistics in Transportation

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Abstract. Technological innovations in the area of wireless sensor networks have established themselves as enablers for new kinds of IT services in many application domains. In order to fully exploit the potential of these technologies, which offer features such as self-organization and spontaneous networking, various industries show examples for innovations on the level of service management as well as with respect to the underlying business models. This paper investigates potential links between technological innovations and service management or business model flexibility for an example of intelligent information logistics services in transportation and logistics. Based on a case study from transportation, it is shown how self-organization built into a technological platform creates the basis for new types of services and how this affects business models. The contributions of this paper are (a) an industrial case illustrating new kinds of information logistics services, (b) an analysis of this case from the viewpoints of service management, knowledge architecture and business model, and (c) an analysis how technological infrastructure and business model effect each other.

Keywords: Information Logistics, Business Model, Self-Organisation.

1 Introduction

During the last years, technological innovations in the area of wireless sensor networks have established themselves as enablers for new kinds of IT services in many application domains. In order to fully exploit the potential of these technologies, which offer features such as self-organization and spontaneous networking, various industries show examples for innovations on the level of service management as well as with respect to the underlying business models. This paper investigates potential links between technological innovations and service management or business model flexibility for an example of intelligent information logistics

services in transportation and logistics. Information logistics aims at improving information flow in organizations by means of information systems.

The logistics industry has changed under the impact of the internal European market and of an increasing globalization into a high-technology industry, making intensive use of modern information technology. At the same time, the industrial demand for more dynamic logistics solutions with adequate IT support is increasing. Many industries experienced a shift in sourcing and logistics strategies from long-term customer-supplier relationships to more networked strategies adapted for global markets, like value networks, flexible supply networks, cluster-based approaches up to on-demand cloud constellations.

Within the logistics industry, the transportation area is considered as promising application field for new types of intelligent information logistics services, since

- Advances in wireless sensor networks and sensor/actuator technologies allow for new ways of tagging and tracking goods and vehicles,
- Many different actors with heterogeneous information systems offer possibilities for automating or transforming processes by means of system integration,
- Due to growing requirements from environmental or security regulations, and an increasing awareness of sustainability issues on the customer side, the market for applications creating more ecological and economic services is developing fast.

Based on a case study from transportation, this paper shows how self-organization built into a technological platform creates the basis for new types of IT services and affects business models. Usually, changes in a business model cause a top-down alignment process starting from the business model and initiating adaptations in the technological infrastructure, which in intelligent information logistics includes the required component services and a suitable knowledge representation. To some extent, self-organization might turn the direction of the alignment process upside down, as self-organization often will start from the bottom level when new features in the technological platform are detected, which trigger a restructuring process of the service infrastructure and offer new potentials on the business model level and an adjustment of the business model. The contributions of this paper are (a) an industrial case illustrating new kinds of information logistics services, (b) an analysis of this case from the viewpoints of service management, knowledge architecture and business model, and (c) an analysis how technological infrastructure and business model effect each other.

The remaining part of the paper is structured as follows: section 2 summarizes the background for the work from the areas of business models, IT services management and knowledge representation. Section 3 introduces the industrial case study including the knowledge representation implemented, the component services[1], and IT services offered. Section 4 discusses the impact of self-organization in knowledge base or service infrastructure on business models and neighboring technological layers. Section 5 summarizes the work and draws conclusions.

[1] Services offered by infrastructure components in order to provide a technical interface.

2 Background

As a background for the work presented in this paper, we will describe the areas of business models, IT-Service management and knowledge representation:

- Business models determine the value creation offered by the IT services to the customers.
- IT services implement both services provided to customers and self-organisation and need to be continuously managed and improved within an IT-service management,
- Knowledge representation is the conceptual fundament for implementing information logistics services,

All three areas will be used when describing the case study in section 3 and when analysing mutual affects in section 4.

2.1 Business Models

Business models have been an essential element of economic behavior since decades, but received significantly growing attention in research with the advent of the Internet (Tapscott et al., 2000) and expanding industries dependent on post-industrial technologies (Perkman and Spicer, 2010). In general, the business model of an enterprise describes the essential elements that create and deliver a value proposition for the customers, including the economic model and underlying logic, the key resources and key processes.

Zott and colleagues identified three major lines of work in their analysis of recent academic work in business model developments (Zott and Amit, 2010):

- Business models for e-business scenarios and the use of IT in organizations
- The strategic role of business models in competitive advantage, value creation and organizational performance
- Business models in innovation and technology management

For business model development and representation, the business model canvas from Osterwalder (Osterwalder et al., 2005) and the schematic business model representation from Weill and Vitale (Weill and Vitale, 2001) are supposed to support stakeholder communication. Many practitioner-oriented studies found major challenges in transforming promising business models into viable structures, i.e. it is important to support implementation of new business models with focus on organizational and technical infrastructure for delivery and fulfillment. For new kinds of information logistics services, we consider both value creation based business models for the service industry and approaches from e-business as promising (Rappa, 2001), (Wirtz, 2010).

Wirtz describes his e-business oriented business models by six partial models:

capital model, procurement model, manufacturing model, market model, service offer model, and *distribution model*. This way, the essential parts of value

creation are covered. The *capital model* is subdivided into financing model and revenue model. The *financing model* describes the sources of the capital that is necessary for business activity. The revenue model on the other hand provides means to generally systemize business models by four dimensions: direct or indirect generation of revenue, as well as the transaction-dependent and the transaction-independent generation of revenue. The *procurement model* describes production factors and their sources. Here the distribution of power between suppliers and demanders is an important aspect. The *manufacturing model* covers the combination of input factors to new goods and services. Demand structures as well as the competitive situation are described by the respective sub-models of the *market model*. The *service offer model* defines which IT services are provided to the customers, while the *distribution model* focuses on the channels that are used to make the IT services available to the specific customer groups. Wirtz has proposed a categorization of e-business models by the kind of IT service offered (see figure 1). Originally he distinguished content, commerce, context and connection services for B2C markets and sourcing, sales, supportive collaboration and service broker services for B2B markets (Wirtz, 2010).

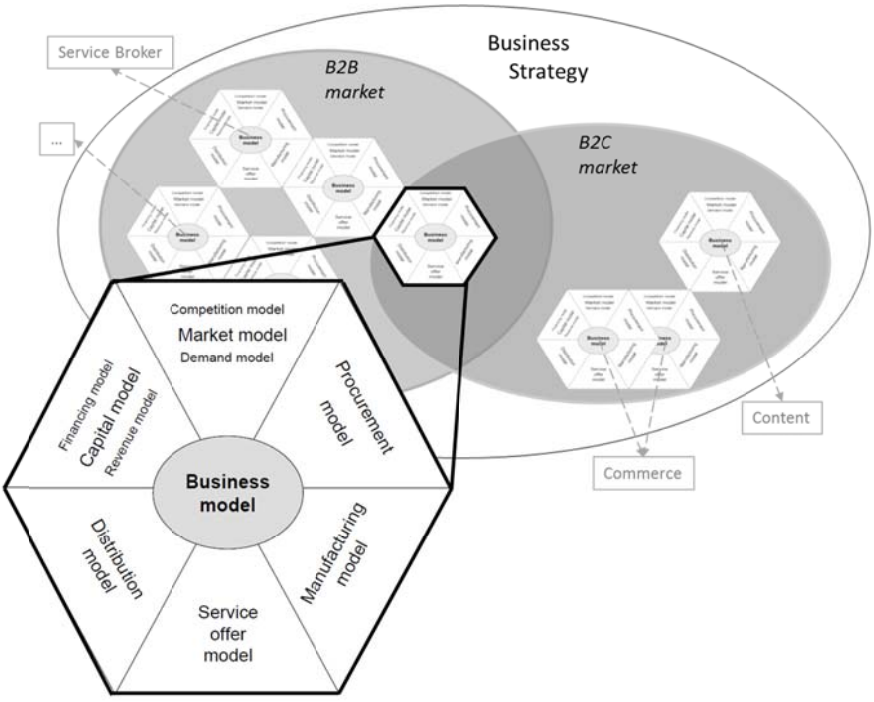

Figure 1: Partial models of the integrated business model according to Wirtz (Wirtz, 2011)

This has been outdated by the ongoing diversification of offered IT services in the past years. However, the concept of business model classification and identification by the offered IT services can be adopted. Thus each IT service has its own business model and vice versa.

In addition to the original six partial models a consideration of strategic aspects seems to be necessary from the perspective of business model management. This includes general strategic goals as well as the identification of core assets with strategic relevance, the companies' position in the extended value chain, and the distribution of knowledge in company networks. These aspects and the partial business models covering external factors like demand structures define the context for business model design in operational management (Wirtz, 2011).

2.2 IT service management

The role of the IT in an enterprise changed within the last decades. Competitive advantage and profit are two objectives a modern IT department focusses on. Decision makers realized that competitive advantages not only rely on technology or applications but also on a different view on IT in general (Tallon & Kraemer, 2003).

This idea has been extended and described by van Bon as follows: *„Providers of IT services can no longer afford to focus on technology and their internal organization[;] they now have to consider the quality of the services they provide and focus on the relationship with customers.*" (van Bon, 2007)

This leads to a transformation into service providers enabled by Information Technology Service Management (ITSM) which is said to be a subtask of Information Management. Optimal support of business processes by the information technology department is ITSM's main objective. All activities are focused on the customer. (Hochstein et al, 2005)

An extended definition of ITSM is given by Addy. "*IT Service Management is the planned and controlled utilization of IT assets (including systems, infrastructure and tools), people and processes to support the operational needs of the business as efficiently as possible whilst ensuring that the organization has the ability to quickly and effectively react to unplanned events, changing circumstances and new business requirements as well as continuously evaluating its processes and performance in order to identify and implement opportunities for improvement.*"(Addy, 2007)

A crucial concept in that context is the IT service, which is provided by an IT service provider to their customers. An IT service supports business processes of the customers and appears to the customer as a coherent unit. An IT service consists of an assembling of people, processes and technology. (van Bon, 2007) A service might consist of other IT services as well. These services will be called sub-services according to Schaaf. (Schaaf, 2007). For the purpose of disambiguation, component services is used throughout this paper as a notion for infrastruc-

ture component interfaces that are based on service oriented technology. Hence, there is a clear difference between IT services which resemble products offered to customers and component services which resemble technical interfaces.

There are several frameworks which enable enterprises to implement the ITSM approach in order to increase the output of the IT. Popular examples are Microsoft's Operating Framework (MOF), ISO/IEC20000 or even COBIT, which is basically more an IT-Governance framework. (Galup et al., 2009)

The Infrastructure Library (ITIL) is the most commonly used one. It has been developed by the British Office of Government Commerce (OGC) in the late 1980s. The OGC documented ITSM implementations in enterprises in the UK and evolved the ITIL framework. Being a framework of best practices the consequent alignment of IT services to the needs of the customers is evident for ITIL. (Galup et al., 2009)

ITIL is structured into five parts which roughly represent the IT service lifecycle. *Service Strategy* covers the overall orientation of the IT service management. *Service Design* concerns the design of IT services. *Service Transition* supports the implementation of IT services in the given environment. *Service Operation* is in charge of ensuring smooth operation of IT services including processing changes to the IT service environment. Finally *Continual Service Improvement* describes tasks and methods to continuously improve the implemented IT services. (Addy, 2007)

Concerning our focus on possible changes of IT services by self-organization, *Service Transition* is the most relevant part. Within *Service Transition* there are several processes like *transition planning a support, change management, service asset and configuration management, release and deployment management, service validation and testing, change evaluation and knowledge management*. Among them, *change management* which uses standardized methods to ensure the efficient handling of all given changes to the services describes the processes that need to be implemented. (Addy, 2007)

2.3 Knowledge Representation

In order to capture the underlying assumptions, facts and rules for information logistics services, knowledge representation techniques are frequently used. Knowledge representations are developed in a process of knowledge modelling. Modelling knowledge allows us to bring knowledge forth and make it explicit (Sowa, 2000). Modelling displays the implicit knowledge about a subject in a form that can be used in information systems. Knowledge-based systems are usually built with the help of declarative languages because their form of expression is closer to human languages. Formal logic and ontology languages can be used for this purpose.

The knowledge representation for information logistics services can be structured into three levels: the overall knowledge architecture showing the elements

and construction principles "in the large", the domain ontology constructed based on the knowledge architecture for a certain application domain, and the knowledge base containing all knowledge and collecting new facts for a specific application. "Domain ontology" and "knowledge base" are established terms in computer science and explained in detail in (Stab and Studer, 2009).

However, the term "knowledge architecture" is less established and needs clarification: Architectures in general identify main building blocks of the system under consideration including their interfaces and structural relationships. Similarly, knowledge architectures focus on the knowledge building blocks needed for a specific application and their relationships. In this paper, an enterprise perspective has to be taken in order to also capture potential dependencies between knowledge building blocks and business models. The term enterprise knowledge architecture will be used and defined as follows: *The enterprise knowledge architecture identifies elements of enterprise knowledge including their structural relationships and their context of use (Sandkuhl, 2011).* The main difference in comparison to other architecture perspectives is that the context of knowledge use is modeled explicitly, since the context of use is essential for tailoring the knowledge to the demand at hand.

The constituents of an enterprise knowledge architecture potentially include business processes, organization structures, products structures, IT-systems or any other perspective relevant for the system under consideration. Established approaches for modeling enterprise knowledge can be divided into at least two major communities: the enterprise engineering community and the artificial intelligence inspired community. Lillehagen and Krogstie (Lilleh agen and Krogstie, 2009) provide a detailed account of enterprise modeling and integration approaches from an enterprise engineering perspective. Fox and Gruninger (Fox and Gruninger, 1999) are prominent representatives of the AI-related approaches favoring ontologies for knowledge representation.

Self-organization in information logistics services is only possible, if the knowledge architecture and the services based upon this architecture include adaptation mechanisms. Self-organising systems are characterised by their capacity to spontaneously (without external control) produce a new organisation in case of environmental changes. The architecture of a self-organizing system is one in which components automatically configure their interaction in a way that is compatible with an overall architectural specification (Georgiadis et al., 2002). This adaptation of the configuration is in service based systems realized by specific infrastructure services, i.e. component services for producing the new organization internally in the system.

3 Case Study from Transportation

The case study used in this paper is based on an industrial research and development project from transport and logistics industries. One of the world's largest truck manufacturers is developing new transport related services based on an integration and orchestrated interpretation of different information sources, like on-board vehicle information systems, traffic control systems and fleet management systems. Our case aims at using wireless sensor networks in trailers for innovative applications. In comparison to the well-equipped trucks, most of today's trailers are poorly equipped with electronic systems, although they "carry" the actual goods. Trailers are during a transportation assignment often switched between trucks and logistics operators, and they outnumber the number of trucks by far.

The wireless sensor network is installed in the position lights of a trailer. Each position light carries a sensor node able to communicate by ZigBee[2] with neighboring nodes and equipped with a radar sensor. The radar sensor could be used for protecting the goods loaded on the trailer against theft, offering additional assistance to the driver of the truck (e.g. lane control, blind spot support) or for surveillance of the goods (e.g. sealing different compartments of the trailer). The wireless sensor network in the position lights is controlled by a gateway in the trailer, which communicates with the back-office of the owner of the trailer or the owner of the goods, and – for some application cases – with the on-board computer of the truck.

3.1 Knowledge Architecture

Within the knowledge architecture observations acquired through the different sensors in the trailer have to be combined with information coming from other sources, like an authentication service for the driver's identity. Furthermore, we have to detect potential critical events, according to what is specified by the IT services. Thus, "context" includes both all characteristics needed to determine the situation of a trailer and the characteristics of the actual information logistics service to be supported. For this purpose, the knowledge architecture had to accommodate basic transportation domain knowledge, the sensors and their observation possibilities, and a conceptual model for situations.

The basic transportation domain knowledge in the ontology had to be based on proven and industrially accepted developments. After an evaluation of SCOR[3] based information models and TAPA TSR requirements[4], the decision was made

[2] http://www.zigbee.org

[3] http://supply-chain.org/scor/

[4] http://tapaemea.com/public/trucking_security_requirements.php

to use the MSI group[5] information model as basis and specialize it for the case under consideration.

Another part of the domain model covers the sensors in the trailers and the control hierarchy, which at least consists of the sensor nodes, the trailer gateways, the trailer fleet of a customer of a service type, and the set of all customers of a IT service type. For the trailer-WSN related part of the domain model, the OGC[6] sensor web enablement, in particular the sensor observation service (SOS) (OGC, 2007), was taken as starting point. Hence, like in SOS, an observation is modeled as an event which produces a result whose value is an estimate of a property of the feature of interest. Based on the generic types in SOS, specific property types were derived for the service under consideration, like geographic position of the trailer.

The next part of the domain model had to cover the situations of a trailer. Situation in this context means the set of all observations, which need to be detected by the sensors and stored in the knowledge base on the controlling gateway due to the current configuration. An example is given in the introduction to this section. For this part of the domain model, the TSO model[7] developed for civil security applications and the situation pattern from the ontology design pattern portal[8] (ODP) served as starting point. The TSO model introduces missions and different event types connected to missions. For our modeling purposes, the TSO event category "TRP" (transport) was found relevant. The situation pattern from ODP was used to introduce the recommended properties and relations between sensors and situations.

3.2 Information Logistics Services

Several use cases were defined within the project, which aim at specifying the planned information logistics services for the customer. One of these use cases is a service protecting the trailer as such when parked against theft, i.e. that the physical lock is broken and it is towed away by an unauthorized truck. Authorizing the transport of a trailer in this use case would show the following characteristics:

- The protection service is booked by the trailer owner.
- The trailer is parked, i.e. not moving.
- The protection mode is activated for the trailer.
- A truck driver sends the "unlock" request.
- The authorization process of the truck driver is successful (i.e. identity is proven and trailer owner has authorized the driver).
- The driver is in the close vicinity of the trailer.

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[5] http://www.msigroup.se/index.php/en

[6] http://www.opengeospatial.org/

[7] http://www.tacticalsituationobject.org/

[8] http://ontologydesignpatterns.org

In case the above sequence is violated, a notification is sent to the back-office operator who decides on alarming the police or taking other counter-measures.

Based on the above use case, component services can be determined, which have to be provided by the IT-infrastructure. These component services include general administration services, like to create/read/update/delete trailers, trucks, drivers, forwarders or haulers in the database of the back-office system and general operational functions, like create/read/update/delete transports (assignments of transport source, destination and allowed track to trailer) and assignments (assignment of truck and transport to driver). For our purposes, the component services specific for IT services are of special interest. These services of the above use case "trailer theft control" are shown in table 1.

Table 1: Component services for IT service "trailer theft control"

IT Service	*Component Services for Implementing the IT service*
Trailer theft control	• Operational functions – Request access – Grant Access, Withdraw access – Authentication request,authentication response – Pause access, resume access • Control functions – Activate/deactivate tracking – get/set transport status, trailer status, truck status, driver status • Events – Heartbeat – Movement – Adjacent object – Physical lock broken

In addition to the above IT service, many more new services are under preparation. Examples are an electronic seal at the rear door of the trailer in addition to the physical lock and the commonly used manual sealing procedure, an electronic fence implemented by radar sensors in the side-marking lights against theft of goods on the trailer, or temperature supervision of cooled cargo on the trailer implemented by temperature sensors spontaneously connecting to the wireless sensor network. All these services would require additional component services. For brevity reasons, we will focus on "trailer theft control" in the remaining part of the paper.

3.3 Business Model

When presenting the actual business model of the "trailer theft control" service in table 2, we assume that the IT-infrastructure for the back-office and the physical

components in the trailer (side marking lights and trailer gateways) already have been installed, i.e. the focus is on the service as such.

Table 2: Business model of "trailer theft control"

Partial models of business model		*Business model of trailer theft control*
Market model	Demand model	Main target group are medium-sized and large haulers operating substantial fleets of trailers. Within this group, different segments have to be distinguished, like soft-shell trailers for electronic fence products.
	Competition model	For transport access control, conventional secure parking areas and security services can be considered as competition. The offered IT service as such up to now is unique on the market.
Procurement model		Different elements of the services are contracted to service providers: • authentication of the truck driver: provided by trust center • communication between gateway and back-office: provided by telco • security service in case of security incident, e.g. attempt of theft: provided by security provider
Manufacturing model		The general administration services, operational services and control services all are provided from the own back-office of the enterprise using own IT hardware and software systems
Service offer model		The transport access control service is offered as stand-alone IT service or as "security bundle" with the services "electronic fence" and "electronic seal".
Distribution model		Distribution is based on the (mobile) communication channels offered by telco. Additionally Service delivery depends on the customer's ability to provide an appropriate operating environment for the back office applications needed.
Capital model	Financing model	Operating costs are financed by internal funds of the enterprise.
	Revenue model	The pricing for the service includes a basic fee for each hauler depending on the size of the fleet. Furthermore, for each trailer to be supervised, an additional fee is charged, which is calculated based on the duration of the protection. In case the service is bundled within the security package, the basic fee is the same as for a single service, but the trailer-based fee is higher.

4 Impact Analysis of Self-Organisation

Usually changes in business models are initiated from the management level of an enterprise based on changing competitive situations, market developments or business strategies. These business model changes in turn in itiate service transformation or service innovation, i.e. the service infrastructure needs to be adjusted to the new business needs. Service transformations and innovations might require adjustments in the knowledge architecture, e.g. additional sensor types, combinations or features might be needed. This top-down alignment process starting from the business model and including service infrastructure and knowledge architecture to some extent might be turned up side down with the concept of self-organization implemented on all levels. Self-organization often will start from the bottom level when new sensor types or sensor/actuator instances are detected. They trigger a restructuring process of the operative knowledge basis, which in turn needs adjustments on the service infrastructure level and offers new potentials on the business model level. This section will investigate the potential for adaptive business models triggered by bottom-up alignment processes. More concrete, we will analyze the consequences of self-organization based on three different scenarios in the industrial case study:

- Scenario 1: an operative sensor type is no longer available (e.g. because goods equipped with this sensor type are unloaded from the trailer) and removed from the knowledge base.
- Scenario 2: an already known sensor type becomes operative, i.e. is available in the knowledge base
- Scenario 3: a new and so far unknown sensor type is detected and inserted in the knowledge base

4.1 Impact of Knowledge Architecture on Services

Changes in the knowledge base occur on multiple occasions. With reference to the above mentioned scenario we can broadly distinguish between changes that occur in consequence of regular business process execution and changes that do not originate from regular business cases.

Scenarios 1 and 2 belong to the first type. A change in sensor data availability for known sensor types is common to transport processes. Load/unload processes are a good example here. In consequence of such changes the availability of component services varies in location and time. The offered IT services should not be affected. Possible interruption of service delivery should be handled in the underlying contracts, especially by appropriate Service Level Agreements (SLA).

In contrast, scenario 3 causes the second type of change. Services based on situations and events derived from the new sensor type are not yet offered nor are appropriate SLAs identified. Once the new sensor becomes available, events generated by it will become part of the knowledge base. In a first step these events

can be provided by generic component services which allow a direct offer of these services. Service transition can be done automated because the process is highly standardized. A more comprehensive way of sensor integration could be implemented by adding knowledge about sensor metadata such as availability or common situations that share events from the new sensors. More specific services and service levels can be derived and offered. However automated service transition should always integrate the business model context. Business rules as described in the next section may prohibit the offering of certain IT services and service levels.

The term self-organisation was briefly introduced in section 2.3. In the context of intelligent information logistics services, the service infrastructure is supposed to adjust itself by identifying, integrating and activating services available in the infrastructure for dealing with new sensors. More concrete, there have to be services implementing the self-organisation feature. Only if these services are no longer sufficient or if no suitable service can be identified, we have to enter in scenario 3 the service transition phase.

4.2 Impact of Services on Business Model

This section analyzes what impact changes in the service infrastructure possibly could have on elements of the business model.

As described in section 2.1, each service defines its own business model. Before going into detail, some general considerations of possible impacts of service changes should be done. Obviously, different services (business models) do not necessarily have different *financing models*. The *financing model* taken for example can be seen as preset for a company or at least for a business unit. Since we do not consider organizational changes, this sub-model can be seen as a constant.

It is worth, looking into the other sub-models in order to check whether differences between the IT services can be expected. There are two main assumptions and their implications:

1. The impact of changes is limited to operational and tactical level. Hence, strategy changes do not need to be considered. Assuming a constant strategic context, *market model* and *financing model* (see above) can be seen as common to the IT services.
2. The general technical infrastructure is not influenced by the changes. This assumption can be derived from the first one because the chosen infrastructure is a strategic asset. Since *manufacturing model* and *distribution model* are specific to the given technical infrastructure (see section 3.3), these models can be considered as common to the IT services as well.

Of course, there are different *service offer models* – each business model is defined by its specific IT service. The IT services combine different component services. As described in section 3.3, these services may be procured from external service providers. Since the combination of component services varies between the IT services, the set of external service providers may vary too. This means

varying *procurement models*, which might even influence the *revenue model*, because calculation of prices is indirectly or directly bound to price models of external service providers.

The possible *revenue models* may also depend on the market strategy, existing contracts with customers, and the technical infrastructure for billing. In the context of self-organization a set of business rules may be defined which allows an automated determination of the possible *revenue model*(s) for a given service.

Besides the technical interdependencies between component services there may also be strategic interdependencies between IT services as well as sub-service relations. Thus, the resulting relationships between IT services should be covered by business rules for *service offer models* as well.

In order to describe the proposed business rules for *service offer models* and *revenue models*, generic services and revenue models should be defined.

In conclusion, changes of the following models are not likely to happen on services changes unless the changes have strategic impacts:

- *Financing model*
- *Manufacturing model*
- *Distribution model*
- *Market model*

A change is expected for the *service offer model*. That includes specific *procurement* and *revenue models*. The transition procedures for the IT services ought to be based on defined business rules.

As described in section 4.1, only scenario 3 may result in a change of the IT services. One or more new IT services may be offered based on the new sensors data. Those that can be matched to predefined procurement and revenue models according to the business rules will be implemented and create new business models.

4.3 Impact of Knowledge Architecture on Business Model

This section discusses what impact changes in the knowledge architecture possibly will have on elements of the business model. For scenario 1 and 2, changes in the knowledge base do not directly affect business models, since the service infrastructure implements an abstraction level "hiding" the knowledge architecture changes. Possible effects of service transition processes for the service infrastructure already have been discussed in section 4.2.

However, for scenario 3, i.e. a new and so far unknown sensor in the knowledge base, the business model might be affected: if the self-organization feature of the service infrastructure manages to adjust to this new type of sensor by finding and integrating suitable IT services, there will be a change in the service infrastructure in that new IT services offer new kinds of value creation not foreseen in the business model. If this opportunity of value creation shall be converted in a corresponding IT service, the business model has to be adjusted,

whereas the service infrastructure does not have to enter a service transition phase in ITIL, since it adjusted itself.

For an analysis, which parts of the business model would be affected of such an adjustment, we can refer to what was found in section 4.2: The service offer model including the corresponding specific procurement and revenue models will be affected. Financing model, manufacturing model, distribution model, and market model will only require adjustments in case of strategic changes related to the new value creation opportunity.

5 Summary and Conclusion

Based on an example of intelligent information logistics services in transportation and logistics, the paper investigated potential links between technological innovations and service management or business model flexibility. In this context, it was essential to recognize the different models interacting on this issue as there are: knowledge representation and architecture, IT services and the business model. The business model conceptualisation according to Wirtz proved a useful framework to analyse and distinguish those parts of the business model affected by changes in the infrastructure (i.e. service offer model, procurement and revenue models) from those staying unaffected (i.e. financing model, manufacturing model, distribution model, and market model).

The analysis of IT-service management in general and ITIL in particular for identifying the phases and functions relevant for adaptation of information logistics infrastructures showed the importance of service transition and change management. However, these ITIL-parts are not required, if self-organisation on service-level is sufficient for adapting to changes.

By describing the case study we were able to find that changes in the knowledge architecture lead to changes in the IT services, which was an expected result. Furthermore, we showed that changes in the knowledge architecture also could lead to adaptation needs in the business model if the self-organisation feature of the service infrastructure manages to adapt to these changes without a specific service transition phase and if the emerging value creation opportunity shall be converted to IT services. This analysis results shows the need for further investigation towards business model adaptability.

In this context, future work has to be directed to modelling the actual relations between the knowledge architecture and parts of the business models in order to determine whether business model adaptability is possible. For this purpose, we need an extended conceptual model specifying more details of the business model and formalising them. To the best of our knowledge, such a conceptualisation does not exist as of now.

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Information Logistics: A Proposed Notion

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Abstract: This paper presents a novel notion of Information Logistics (IL). It attempts to remedy the current situation where a diversity of IL notions is offered, both practices and studies, with very little unifying foundation. Such a unity is regarded as desirable to facilitate a further and positive development of IL practices and studies, and thereby to offer knowledge and practical solutions to the numerous informational challenges in human, industrial and social affairs. After a brief etymological inspection of IL, its definitions, as provided by both academics and practitioners, are investigated. Next, the IL notion as proposed here is founded on the practice of information supply or transfer, and distinguishes between IL practices, IL studies and IL meta-studies, and IL technology and IL engineering. The overall aim here is to trigger a much-needed debate about what IL is, rather than to offer a final IL notion.

Keywords: Information, Logistics, Information Logistics, Information Logistics Practices, Information Logistics Studies, Definition.

1 INTRODUCTION

This paper presents a novel notion of the understanding of 'Information Logistics' (IL).The IL notion proposed here is based upon current diverse notions of IL studies and practices, yet it goes beyond a mere synthesis in that it offers some novel articulations and distinctions of IL characteristics. This, in turn, aims to facilitate a further development of IL as a domain of practices and studies.

The remaining part of this Introduction presents a rationale as to why we should be concerned with IL as such and also with its notion, followed by a short methodological account of how the IL notion as advanced here was elaborated. Finally, the structure of this paper is described. However, two notes need to be articulated firstly.

The first note is that the content of present paper may be regarded as work-in-progress, in at least two senses. In the first sense, it is a version of reflections made by its author over a period of several years. These reflections have not yet been exposed to debate; when this has been done the proposals put forward here may advance further. In the second sense, any attempt to offer a definition of human enterprise or conduct is subject to evolution as the defined object is typically evolving; few if any such definitions may be final. So, while an objective of this paper is to offer an alternative notion of IL, the purpose here is to trigger an important discussion and reflections upon the meaning and content of IL. Such a discussion and reflections may potentially facilitate further advancement of IL.

The second note is of a more practical nature. As implied by the above, this paper presents a rather comprehensive elaboration in a very limited space; and for that reason some components of this elaboration will not be expanded upon. The focus here is clearly on the overall key message, rather than on justifying all underlying assumptions.

1.1 Why Information Logistics and its Notion?

On December 29, 2003, a team of physicians at the Sahlgrenska University Hospital in Sweden received the results from a woman's tissue test. They showed an aggressive tumor in one of her arms, which led the team to decide to amputate the woman's arm. New post-surgery tissue tests showed that there was no aggressive tumor and that the team had received incorrect information – but it was too late for the woman's arm[1].

On December 26, 2004, the second largest earthquake ever recorded on a seismograph took place. This 9.1 Richter scale undersea earthquake, with its epicenter in the west coast of Sumatra, activated a devastating tsunami that hit the coasts of the Indian Ocean around Indonesia and claimed more than 200 000 lives. The Pacific Tsunami Warning Centre in Hawaii, that detected the earthquake and anticipated the forthcoming tsunami, provided warning information seventeen minutes prior to the event to a variety of Indonesian authorities who failed to forward it to those who needed it most[2].

These two unfortunate real life cases illustrate failures in supplying the right information at the right time to the actors needing it. Our social, industrial and human affairs do, of course, offer numerous successful and failed instances of information supply. Both are relevant as successful information delivery may tell us what assures such success while the failed cases may tell us what causes such failures and also their consequences. To these ends, a young and diverse domain of practice and intellectual studies has emerged, starting in the mid 1970's, called Information Logistics [1]. In broad and preliminary terms, IL is understood here to be concerned with information supply or transport, and is therefore highly relevant to the current Information Societies [1].

A previous investigation of IL studies and practices [2] shows us that IL as a domain is diverse; giving rise to the lack of a common notion of what IL is about. While diversity as such may be regarded as positive for IL in its present state, facilitating its further development, this lack of a common denominator or links within its diversity seems to act as an obstacle to its further development. Therefore, as an attempt to remedy this obstacle, a novel IL notion will be presented here.

1.2 Methodological Note

The approach assumed here, with the aim of producing a novel and forward-seeking notion of IL, included the following steps. Firstly, an etymological inspection of the meaning of Information, Logistics, and Information Logistics; secondly, a

[1] see: http://www.dn.se/nyheter/sverige/amputerade-arm-i-onodan (February, 2011)
[2] see: http://news.bbc.co.uk/2/hi/science/nature/4381395.stm (March, 2011)

comprehensive review of the published literature that explicitly addresses IL; thirdly, a sampled review of IL practices. Next, a critical analysis arising from the previous steps provided a foundation for a consequent formulation of a novel notion of IL. From a methodological viewpoint, the whole exercise was guided by J.P. van Gigch's [3] Meta-modeling methodology aimed to facilitate disciplinary investigations.

Disposition-wise, the next section presents the various current understandings of IL: based on its etymology, in its studies, and in its practices. The section thereafter presents the IL notion as proposed here with its various articulations such as IL practices, IL studies, and IL meta-studies. A brief positioning of the proposed IL notion versus other related domains, such as Logistics, Information Systems and Communication, is also presented. The final section articulates the contribution made here, suggests some further inquiry, and offers a conclusion.

2 CURRENT NOTIONS OF INFORMATION LOGISTICS

This section as a whole attempts to unearth the current notion of IL, which is presented in a series of steps, as follows. Firstly, a short etymological inspection is presented; secondly, a review of current IL literature is made; thirdly, a brief review of some IL practices is presented. All this gives rise to a conclusion regarding the present understanding of IL.

2.1 The Etymology of Information Logistics

One possible way to gain an understanding of what 'Information Logistics', is to inspect its etymological origins. While experience has shown that the actual and current meaning of a word is typically not completely equal to its origins, an etymological inspection often provides a broad sense for the understanding of an expression.

Starting with the term 'Information', its etymology suggests an origin in the Greek term '*informare*' alluding to the *formation of an individual's mind-set* [4, 5, 6]. This suggests that information is something that forms our mind, our understanding. The current status of Information Studies suggests that there exists no single and final agreement as to what information is, but rather that there is a set of competing notions, ranging from those founded in thermodynamics, then in signal theory, to semantic and hermeneutic notions [7, 8]. The etymological origins, then, clearly relate to the latter notion. Therefore, the position assumed in this investigation is that (semantic) information is made up of symbols and/or signals that are interpreted by an actor into a meaning, at a given moment, with prior knowledge and understanding, in a given social and physical context [6, 7, 8, 9, 10]. ('Information' has close and sometimes confused relations with *data* and *capta*, on the one hand, and with *knowledge*, on the other hand [11]; however space limitations do not permit any discussion of these relations).

Next is the meaning of 'Logistics'. Its etymology shows its origin in the Greek term *'logos'*, [4] relating to today's 'logic', 'rationality', 'reason' or 'calculation'. Current understanding of 'logistics', on the other hand, connotes the human enterprise of *an efficient flow of goods* [12]. This latter meaning seems to originate from the

ancient military need to acquire arms, ammunition, and other goods, in order to enable the army's operations [13]; there is a need for rational planning to assure efficient supply.

Taken together, these etymological roots suggest a kind of neologism where two meanings may be assigned to the expression 'Information Logistics'. One, that is strictly etymologically grounded, is about a '*rational handling of meaning formation'*, while the second one, reflecting more current practices, is about an '*efficient supply of symbols that form meaning'*. Clearly, one could ask, what is the difference between Information Logistics and Communication? Anticipating the investigation below, we may express the fact that 'Communication' and its studies typically focuses on the semantics, or meaning, of a provided symbol or signal, while Information Logistics tends to focus on the delivery of those very symbols and signals – a distinction that is easier to make in theory than in practice. Now we are ready to look into existing IL literature to find the meaning of 'Information Logistics' there.

2.2 Review of Current Information Logistics Literature

This section presents the various notions of Information Logistics as given in the dedicated IL literature. A comprehensive literature review of IL publications has been made and presented elsewhere [2], and constitutes the source for the present inspection. More than 100 publications were reviewed and organized into ten 'Schools of IL', where the latter relates to a particular intellectual IL setting and approach. Since then yet another IL approach has emerged which also is included in this investigation. Table 1 provides formal IL definitions as given by the eleven IL Schools respectively. In the text below, each School's notion of IL is commented individually, and a collective understanding of IL notions is then derived. This exercise does not provide any critical evaluation of respective IL School, as it is clearly outside the scope of the aim of this paper; such an evaluation is presented in [2].

Information Logistics Schools Individually Understood

The first published academic text, where IL is explicitly elaborated, originated from Harvard University in 1978, and is labeled here *Local Distribution of Information* – see Table 1. Its focus is on the distribution of media information, such as newspapers and TV, where the underlying question asked was: what are the crucial problems associated with local distribution of information? The provided IL definition shows that IL is understood in terms of the various functions of information handling – e.g. transformation, packaging, transfer – for a consumer whose timely use of such information may generate value. This provides a rather broad understanding of IL, not limited to information transport only; however, 'information supply' constitutes the central function articulated here.

Next, the *Information-Production-Time* School of IL, see Table 1, mainly attempts to bring the thinking and practices of conventional logistics (i.e. material flow) into the realm of information. Various models are thus extracted from logistics and interposed into the handling of information. In this, various information functions are articulated, such as production, storage and transport of information, while time and

its use constitutes a key dimension of concern. This suggests that the notion of IL assumed here is rather broad, and that it includes various information handling functions, yet again, that the supply of information seems to be the key underlying interest here, as inherited from the supply of goods. In addition, the notion of information as such is rather mechanical or physical, focusing its syntax, as a central underlying assumption held here is that the thinking and practice of conventional logistics may be used for the handling of information.

The third school is the *User-Demand Information Supply* School of IL, see Table 1, which is the most successful IL research program so far, assessed in terms of the number of publications and also the real life applications [2]. The focus of the IL notion here clearly lays on successful information supply, where success is articulated in terms of time, content, location, or format. Further, IL is also all about developing means, methods and tools, to reach such successful supply. One striking property of this IL notion is that it is formulated in an imperative mode, rather than in a descriptive one as is orthodox in scholarly contexts. Also, this assumed "ought to" mode is reflected in the works generated, which are closer to software engineering than to empirical science [2]. In short, this IL approach is about development of methods and tools to enable systems solutions to supply information successfully.

The fourth approach is the *Information Flow Efficiency* School of IL, where the focus is on the flow or transport of information between actors – see Table 1. The focus also lies on the logical configuration of a structure or actors for optimal information exchange, in large volume information networks. 'Optimal information flow' is here understood in terms of the speed of information exchange or transport – e.g. in contrast to the previous focus on timing of delivery. A novel contribution in this IL notion is its distinction between planning and realization of information flows.

The fifth IL approach is the *Cross-Functional Supply of Analytical-Information* School – see Table 1. At least two features make this IL definition unique. First, IL is only concerned with the supply of information to be used strictly for decision-making processes; secondly IL supplies information between and not within, organizational units. As noticed elsewhere [2], these limitations upon IL and its information supply seem to be arbitrary and poorly justified. The common feature offered here as well is the supply of needed information.

Sixth is the *Outsourced Information Handling* School of IL, see Table 1. This approach is constituted by one publication only, which is more of an 'idea paper' character. As the IL approach above, this notion also focuses on cross-functional information exchanges, both within and between organizations. In this, it implicitly refers to a novel configuration of a firm when information exchange facilitated by technologies may decrease transaction costs – clearly, something which is of particular benefit to cross-functional IL.

The seventh approach is the *Information-Flows in Supply-Chains* approach to IL – see Table 1. Unlike the other IL approaches described above, this IL notion focuses only on information flows executed in the context of an industrial supply chain, a limitation without given justification. As with the previous approaches, focus is on the flow, transport, exchange of information, here between the various actors involved in a supply chain process. Interestingly, IL is regarded here only as a support function for conventional logistics, or transport of physical goods.

Information-Flow Modeling is the eighth IL approach inspected here – see Table 1. As with the above-mentioned *User-Demand Information Supply* School of IL, this approach focuses on the imperative of successful supply of information rather than offering a descriptive position.

Ninth is the *Global Cross-Reference Database* approach to IL – see Table 1 – also constituted by one idea paper. Similarly, the focus here is on information distribution, with the qualifications of a specific actor, time and purpose. However, more underlying here is that IL practices, to be successful, must contain information that is universally indexed, in order to make it practically possible to distribute it between a wide number and kind of actors.

The tenth School of IL here is the *Information-Flows in Processes* – see Table 1. Again, the selected IL notion assumes here an imperative mode of successful delivery of information, where success is characterized in various functions such as actor, time, content, format, etc. An underlying focus both in the ninth and tenth approach to IL is the position that IL practices are always executed in the context of processes and their constituting activities.

The final IL school reviewed here is *Information for Systems Maintenance* – see Table 1. This approach also assumes an imperative mode of information provision, with its specific qualifications for success. The focus here is on a particular domain of IL context – systems maintenance – which has made it particularly interesting with regard to the various data formatting issues needed for successful information exchange and provision.

Information Logistics Schools Collectively Understood

Now it is time to articulate any patterns within the above presented selection of IL notions. Firstly, and centrally, in broad terms all the IL notions inspected here focus on IL being concerned with *information transfer*, *supply, forwarding* and the like, as its key function. This in turn relates well with the results from the above presented etymological inspection.

Secondly, the various IL notions provide a variety of additional qualifiers for the aims of such an information transfer. These qualifiers include timely information delivery, optimal information transport, to the right place and actor, at the right cost, in the right format, and with the right quality. One can wonder whether such a list of qualifiers or IL functions is, or ever will be, complete and also what are the sources of these functions. As the inspected IL notions are defined mainly in terms of its functions and purpose and not in terms of its underlying structure (other than actors and networks), we can never be sure about the finality of such a list.

Thirdly, information transfer is to be conducted between various actors, both machine and human, often in the context of a network of actors. The focus here is typically on the *information receiving actor*, while the information producers, senders and mediators are typically ignored in IL conceptualizations, without much justification. Conventional logistics has shown that a successful flow of materials is highly dependent on the sender and the mediators, if the receiver's needs are to be satisfied, which suggests that the given IL notions need to include these components [12].

The fourth item here is concerned with the fact that the reviewed IL notions mainly regard information receiving actors as passive actors. Not a great deal has been elaborated by IL research about information receiving or information producing, sending and forwarding actors and their characteristics, other than in machine terms such as software for information identification and filtering. Clearly, human actors who consume, forward and produce information are much more than so! Humans have explicit and implicit needs, desires, agendas and capabilities that challenge the idea of successful supply of needed information – for example, we may go in into a bookshop and leave it with a book that we had never intended to buy [14]. Therefore, the position here is that an expanded notion of information processing actors is needed in order to understand and develop IL practice and studies.

The fifth issue focuses upon the information functions inherent in IL. While some IL notions suggest that information transfer, or transport, should be regarded as the only information function of IL, other IL notions suggest that information transfer is the central one and that there need to be other supporting information functions. These may include information production, storage, transforming and consumption. Again, experience from conventional logistics, or material flows, suggests that this last notion of IL, we can call it the broad notion, with several supporting information functions, is more fruitful for the conception of transport [12]. This is so as successful transport of materials and information may not be conceived and executed in isolation from the other functions mentioned.

Sixth is our concern with the notion of information, inherent in IL. There seems to be a kind of ambivalence as on the one hand information is seldom explicitly elaborated, other than in very broad terms such as 'the right information', 'index', or similar. On the other hand, the concrete theoretical and technological contributions given by IL are not concerned with information other than in terms of its syntaxes, or its underlying data. This seems to be an inheritance from the closely-related disciplines such as the fields of Information Systems and Software Engineering that hold a similar position [17, 18]. While such a notion of information as a passive symbol is comfortable and fruitful for the conception of technology, it is less beneficial for the understanding of how actors generate, transfer, receive and consume information that is meaningful.

The seventh characteristic of IL is the distinction between execution of IL and the planning of such an execution. In practical terms it seems to be a central distinction as if complex IL operations are to be successful, in whatever way measured, they require planning, monitoring, evaluation, in other words, that which is typically known as management [38]. In this sense it may be meaningful to speak about IL management and IL operations, where the latter is the core that realizes IL while the former is the one that directs or governs the latter.

Eighth is the fact that the inspected IL notions speak about IL both in descriptive terms, i.e. how information transfer is actually conducted and in imperative (or prescriptive) terms of what IL operations should do (i.e. provide the right information to the right actor at the right time etc…). Also, some of the IL notions are concerned more with organizational operations and their information and technology in general terms, while others focus only on specific software configurations and solutions. This suggests the interesting case that IL is concerned both with actual information flows, but also with the design and establishment of new ones. Further, IL is concerned with

the technology that enables such information flows. This multiple interest of IL, similar to that of the Information Systems discipline [17], is promising as the various interests may complement each other in a productive manner for the whole of IL as such. For example, if empirical IL studies find a set of factors that typically hinder successful provision of information, operations and technology could be designed in such a way as to remedy some or all of these obstacles.

The ninth item articulated here is the distinction between micro and macro focus of IL. Most of the IL Schools, reviewed here, focus on micro aspects of information provision, i.e. the individual information handling actors and their structure in the form of one or more organizations. However, two IL Schools have assumed a macro focus. The Harvard study focused on the media distribution industry in the USA while the Frankfurt studies investigated the automotive industry in Germany. This micro-macro dualism manifested by IL as a whole is positive as shown in other disciplines (e.g. economics or sociology), as knowledge produced at micro-level may inform macro-level concerns and vice versa.

The tenth observation here goes somewhat beyond the formal IL definitions provided, and inspects how the various studies were actually conducted. This shows that IL as a whole offers a range of research and engineering methods. There exist studies that utilize positivistic approaches with hypothesis testing and there are studies that rely on a hermeneutic approach. Also, there are more design-oriented approaches where various methods are developed for the design of IL operations and finally there are software engineering approaches that produce conceptual schemes, data processing methods and similar. As a whole, IL shows that it has a large portfolio of methods of inquiry which is a good sign. One missing research approach is that of critical research, as manifested in sociology, business and management studies and also more recently in Information Systems studies [15].

A final observation to be articulated here is that the various IL notions inspected here were developed and exercised in various operational contexts, typically different industries, ranging from media, through supply chains and logistics, to systems maintenance and organizational processes. This suggests the good news that the provided IL notions are general enough not to be dependent upon very specific operational or industrial context.

In summary, the examination above suggests that the current IL notions all focus on the function of information transfer, transport or supply. There is also a great diversity with regard to such items as the qualifying aspects of information supply, a narrow or broad notion of IL in terms of its constitution information functions, a concern with the planning or the conduct of IL, a focus on micro and macro IL aspects, a descriptive or normative approaches to IL, a scientific or an engineering interest, and a variety of research methods utilized. This shows that the IL domain, as a scholarly enterprise, while rather young and of small volume, shows potential in its diversity when compared to more mature and well-developed disciplines. However, the above-conducted inspection has also unearthed some concerns, such as the omission of information production, sending and consumption, the rather primitive notion of an information handling actor, such as a receiver, the syntactical focus on information, and the lack of a critical approach to research.

A key message here is that IL practices and studies lack a common understanding of what IL is about, i.e. a common notion that could encompass the diversity

identified here. It is now time to turn to the IL practices and seek the inherent IL notions.

2.3 Review of Information Logistics Practices

It is now time to look into the given IL notions by its actual practitioners. To be sure, this is not the place to present a comprehensive investigation into the IL notions provided by all practitioners; rather we will recap on a previous study identifying 21 organizations that dealt with IL [2]. All these organizations were companies offering professional services and technology solutions targeting the domain of IL. Interestingly, these companies were well spread globally, from Australia and Japan, through South Africa and the Europe (Italy, Switzerland, Germany, Sweden, and UK), to USA. All 21 organizations articulated a concern about adequate information transport or supply, enabled by information and communication technologies. And this information supply seemed to be the only common denominator, as the domain of applications and industries varied significantly.

The text below is a brief account of two organizations only, to illustrate this diversity. One firm offered a so-called technical information handling service as its information logistics offering. This included its ability to diagnose a client's technological entity, e.g. a truck, and also the target information consumers' needs, then construct an information model of that entity and populate it with actual information; thereafter to develop a relevant medium for storage and transportation of information to the latter's consumers.

Another firm offered so-called invoice handling as its information logistics service. One example of its clients was a large bank that needed to send customized financial information to its customers every month, the volume of this information exceeded one million units. This IL firm therefore accessed the bank's information warehouses, extracted the needed information, organized the information entities to be supplied, designed the actual presentation format and then delivered the information through different channels (i.e. mail or email), depending on the customer's preferences.

Where possible, we shall now make an attempt to relate the IL practices as reviewed here to the findings from scholarly IL notions, as presented above. Firstly, it is obvious that both IL practices and IL studies regard IL in terms of *information supply, delivery, or transport*. Secondly, that IL practices offer qualifiers for successful information delivery, such as *time, format, or cost*. Thirdly, IL practices seem to include several different information handling actors such as receivers, forwarders, senders and producers, whereas IL studies tend to focus on information receivers and ignore the others. Fourthly, IL practices also seem put more effort into understanding the various actors involved in an IL network, such as the information consumers' needs and wants, while this effort is almost absent in the IL studies. Fifth, both IL studies and IL practices distinguish between IL operations or execution and IL management or governance. While IL studies seem to operate under two alternative IL notions (narrow and broad) with regard the constituting information handling functions; IL practices appear to employ the broad notion, where information generation, storage and transformation support successful information transfer. Sixth is the distinction between the descriptive IL and imperative IL. Almost by necessity, IL practices operate in the imperative mode as they aspire to introduce

IL solutions, changes and improvements. Seventh is the distinction between micro and macro IL, where IL practices seem to operate currently only within the micro sphere. Eighth is that the inspected organizations manifested a great variety in terms of their IL context, such as geographical, industrial and types of application, which would suggest that IL is generic, which in turn conforms to IL studies. Finally, we would like to add another feature, not discussed above, as IL practices seem all to be based on information and communication technologies as enablers for IL, which is more or less explicit in IL studies.

This brief review suggests that there are several attributes of IL where IL studies and IL practices are in conformance. However, a few attributes have been identified, where IL practices hold a slightly different, less ambivalent, position to the one held by IL studies, and where we believe IL practices may inform IL studies in a positive manner. This includes the broader notion of IL, in terms of its constituting information processing function, and the broader and more elaborated notion of information handling actors within an IL network. In addition, IL studies suggest that IL practices should also focus on the macro sphere which seems to be ignored for the moment.

Given this conclusion, the overall message here seems to be that IL practices are largely in conformance with IL studies and vice versa, yet that there also are opportunities for development.

3 THE PROPOSED NOTION OF INFORMATION LOGISTICS

It is now time to present the proposed notion of Information Logistics. While this notion is firmly rooted in the above-presented inspection of IL studies and IL practices, it attempts both to encompass all of these and at the same time offer something forward-striving in terms of its structure and content. The account below starts with a brief recapitulation of the assumed notion of information as such, after which it elaborates the notion of IL practices, and then continues with an articulation of IL studies and IL meta-studies.

3.1 Information

The notion of *Information* is crucial for an understanding of IL, as the former is the subject of the latter. In line with the-above mentioned reasoning, information is understood here to be non-random data (pattern of symbols and/or signals) that at a given time is interpreted by an actor, human or machine [5, 6, 7, 8, 9, 10]. The latter has a prior knowledge that enables a purposeful process of meaning assignment to data. This means that it is productive to differentiate between *information logistics* and *data logistics*, where the latter focuses on the symbols and signals only while the former is also concerned with the purposeful meaning generation from these data. In this context, a purposeful interpretation of data by an actor suggests that the obtained information is to be used for some end, hence has some *potential utility*. The characteristics of information as listed here are reflected in the proposed notion of Information Logistics, below.

3.2 Information Logistics Practices

Turning now our focus to IL, we wish to propose here a generalized understanding of Information Logistics phenomena as *those arrangements of objects and processes that conduct transfer, of information, from a sender to a receiver, and include supporting functions of information generation, storage, transformation, and consumption.*

Natural vs. Artificial Information Logistics

A useful distinction may be made between natural and artificial IL phenomena. The former may be exemplified by the numerous information transfers in nature, in physical, chemical and biological contexts – as the human genome! This kind of information transfer is functionally enabled by physical structures, and is not the concern of Information Logistics studies as in this paper. While we do not suggest that the natural IL phenomena should become a main target of IL studies, we do suggest that knowledge of these natural IL phenomena may sometimes be applied to the study and design of artificial IL phenomena.

Artificial IL phenomena are created by man for some purpose, and are also understood in general terms as *IL practices*. An ancient example of such is the various wall-paintings found in caves, created several thousand years ago with the purpose of passing on information to someone. Another illustration, over two thousand years old, is the legend whereby the ancient Greek soldier Pheidippides ran from the battlefields of Marathon to Athens, to inform the inhabitants of that city that the Persian army had been defeated. Both these examples clearly illustrate that the production of information and its carriers, data, is done for a reason, as is the design and execution of the transport of data, and that the data received is interpreted in into meaning, or information, and that the received information is typically utilized for some end. In this sense, we may further specify that *IL practices are purposefully created by humans, at a given time, and concern those arrangements of passive and active actors and processes that conduct purposeful transfer of information, from a sender to a receiver, and include supporting functions of information generation, storage, transformation, and consumption*. The emphasis here that IL is a purposeful human enterprise is to generalize for all the potential qualifiers that particular IL practice may seek, such as information delivery on time, in the right format, at the right place or cost, and the like. Also, this emphasis accounts for the imperative or normative mode of IL practices.

As a consequence of the here proposed notion of both ‘information’ and ‘information logistics’ we wish to introduce a further distinction of three layers of concern that characterize all information logistics phenomena, this is between: ‘*datalogy*’, ‘*infology*’ and ‘*tektotology*’[3]. Datalogy, or the study of data, addresses the

[3] The terminology and meaning utilized here is borrowed and adapted. Langefors [10] introduced the distinction between ‘datalogy’ and ‘infology’, while Le Moigne [26] proposed a neologism of ‘tektology’, adapted from Bogdanov [37] and further developed be Le Moigne to connote an organization; the correlation of these three terms and its meanings is proposed here though.

symbols and signals necessarily involved in all IL operations. infology, or the study of information, addresses the information necessarily involved in all IL operations. In this context, information arises from data, or symbols, that are interpreted by some active actors, man or machine. This in turn requires us a third layer of concern, tekto and its study: tektology, that of active actors and their operations, typically in terms of some organization and their processes. Analytically regarded, this distinction of three perspectives, or three kinds of properties, of IL operations, guides us in the understanding, analysis, designing and managing IL operations. Data and datalogy focuses on the 'how' question, information and infology focuses the 'what' question, and tekto and tektology, focuses the 'why' question, of any IL operations. The following trivial example illustrates this. Sending a message may be conducted by means of a conventional letter or an e-mail, among others. The utilized language and letters may be different, and when sending electronically, the message may be encoded in various alternative ways (e.g. ASCII, Hexadecimal) – all these are datalogical concerns. However, the conception of what should be the content of the very message, disregarded from how it is encoded, is an infological concern. However, the conception of the context for information, i.e. when it is formulated and also interpreted, is the tektological concern – e.g. a person that is moving her head up-and-down in one cultural context may be interpreted sending the message of 'yes', while in another cultural context sending the message of 'no'.

Information Logistics Operations and Management

A further distinction which may be introduced within IL practice is that between IL operation(s) and IL management. While the latter concerns all those activities that include analysis, planning, directing, follow-up and evaluation of IL conduct or execution, the former is concerned with IL conduct or realization itself. This distinction has proven be fruitful in other domains of human enterprise, such as creation and running of firms, where specific scholarly disciplines target the two spheres, i.e. Operations Management [39] and Strategic Management [40].

Information Logistics Technology

A further distinction to be articulated here is that of IL Technology. Starting with the term 'technology', which is etymologically rooted in *'techne'*, we can recall its dual meaning: both narrow and broad [16]. The former refers to physical artifacts created and used for some purposes; this is well illustrated by contemporary Information and Communication Technologies. The latter, or broad, meaning of technology connotes all the humanly created procedures and organizations which serve some end; for instance, the business processes that contemporary managers are concerned with. This means that IL practices are humanly devised and constituted by IL technology, in both broad and narrow terms, suggesting the need for particular IL practices, namely *IL development* and *IL engineering*; the latter produces IL technology in its narrow sense while the former produces IL technology in its broad sense.

3.3 Information Logistics Studies

Given the above-provided notion of IL practices with all its qualifiers, we are now ready to elaborate the notion of the academic enterprise of IL Studies, *which is understood here as the intellectual domain that utilizes a set of scholarly methods, originating in various academic disciplines, such as natural sciences, social and behavioral sciences, engineering and design studies, in order to study existing Information Logistics phenomena as well as the processes that design and develop such phenomena.*

Information Logistics Studies: Analytical and Design

The notion of IL studies as proposed above implies a rather common distinction between analytical studies, and so-called design studies (also called applied studies). Analytical IL studies are concerned with the investigation and understanding of existing IL phenomena while Design IL studies focus on the development and evaluation of various methods and procedures aimed to facilitate the creation and establishment of IL phenomena, e.g. IL engineering. This distinction reflects similar distinctions in other academic quarters, for example the distinction between sociology and social work, between psychology and psychotherapy or between chemistry and chemical engineering.

Information Logistics Meta-Studies

Finally, we wish to make yet another distinction here between IL studies and IL meta-studies. In the first case, the object of investigation is the IL practices, as defined above, i.e. the concrete physical actors and processes that transfer information in some manner, to some end. IL meta-studies, on the other hand, have their object of investigation in the described IL studies. For example, while IL studies may be concerned with how information is provided to citizens prior to a national election, an IL meta-study may be concerned with how the actual IL study is designed and conducted. The role of IL meta-studies is central as it enables a conscious and deliberate reflection upon the conduct of IL studies, their direction, content and quality. This is especially crucial for disciplines that are multidisciplinary and underdeveloped, as is the case with IL studies.

3.4 Other Closely Related Studies

We will now briefly articulate the relations and also the differences between IL on the one hand and on the other hand a set of other domains of studies, more specifically the domains of Information Systems, Computer Sciences, Information Theory and Information Studies, Communication Studies, and Logistics. The main aim here is to articulate the unique potential of IL.

Information Systems

We can start with Information Systems [17]. This is a diverse academic enterprise generally concerned with the utilization of Information and Communication Technologies in human and social contexts, such as organizations. The primary concerns are the study of IS in terms of their development, adoption, use and effects or consequences. Clearly, IL may be regarded as a subset of the IS domain. However, we wish to mention at least two reasons for why IL should not be absorbed by IS. The first is that the key concern of IL is different, namely the delivery of needed information, however defined. Very little if any concern about information and its successful supply has been made within the domain of IS studies. A second reason is that while IL today often employs various ICT artifacts for the execution of IL operations, it is not always so; ICT is a mere tool, not an end. Indeed, many contemporary IL operations do not employ ICT – for example the receipt of an invoice through regular mail. The IS discipline is, on the other hand, totally concerned with the use of ICT.

Computer Science

Next, and closely related, is Computer Science (CS) [18]. This is a broad domain appearing to include various aspects of both hardware and software and the underlying symbol processing methods executed by the computer. CS aims to provide efficient computation and thus potential tools to enable Information Logistics practices. IL studies may thus inform CS of needed tools or computations while CS may inform IL of potential tools. These two domains of practice and studies are thus complementary.

Information Theory and Information Studies

Information Theory [19] and Information Studies [20] are two distinct academic domains. The former is concerned with formal elaborations of signal transfer, where information is regarded only in terms of the probability that a signal will arrive at the receiver's end as intended, it is thus mainly a syntactical concern. Information Studies, on the other hand, is concerned with the semantic content of a symbol or signal. These two domains are complementary, or like two sides of the same coin. In turn, both are highly relevant and complementary to IL practices and studies, as the latter's subject of concern is a purposeful supply of information, both from a syntactic and a semantic angle.

Communication Studies

Communication Studies [21] is a social and behavioral domain that addresses the common practices of meaning sharing, such as, for example, in the case of product marketing. Centrally underlying questions here are: what is the intended meaning of a given communicative conduct, and then: what is the actual meaning obtained from that conduct. Communication practices and studies are thus focused on the meaning-sharing aspect of information. In this sense, Communication practices and studies

may be regarded as partially overlapping IL practices and studies; however, IL's unique position that it is concerned both with the semantic and the syntactical aspects of information supply. This dual concern is considered crucial, as the position hold here is that successful information supply is more likely to be understood when information's semantic and syntactical aspects are addressed together in an integrated manner.

Logistics

Finally, the domain of Logistics practices [12] and its studies is understood here to be the purposeful supply of material goods and its studies. In this sense, Logistics operates in another realm of human experience; the tangible and physical. However, various links exist between goods logistics and information logistics. One obvious link is that when information is transported by physical means, such as conventional letters are, then IL enters the domain of Logistics practices. A second link is that successful conduct of goods logistics is sometimes dependent upon supporting information flows, hence the practice of Information Logistics [25].

4. CONCLUSIONS & FURTHER INQUIRIES

In this paper, we offer a novel notion of IL arising from the diversity of current IL studies and IL practices and at the same time providing a unification of that diversity, and thereby going beyond the current understanding of IL. This forward-seeking elaboration seems to be crucial as IL is still a rather minor and young domain of practices and studies, yet its central proposition [2, 14] – *to provide the right information at the right time to the actors needing it* ... – seems to be much in demand in our contemporary societies, experience various kinds of information failures, frequently with highly undesirable consequences.

The IL notion proposed here enables us now to advance several steps forward the development of IL practices and IL studies. Space limitations allow us to mention only two such directions. Starting with the IL notion as proposed here, one initiative is to review current research, which is not explicitly labeled as IL, yet addresses the IL phenomena as defined here. This kind of review may result in a sort of IL knowledge catalogue, providing more systematic information as to what is known and what is not known about IL phenomena. The following are two examples of such non IL-labeled IL studies. One study addresses the role of cultural and geographical contexts for successful information transfer between human actors [22]; informing us about the key factors that may hinder and facilitate successful information flows due to such contexts. Another more recent study informs us about the function of information channels to generate productivity increases in firms [23]; it shows that synchronous channels (e.g. telephone, face-to-face) contribute less to such productivity increase than do the asynchronous channels (e.g. email, databases).

Another direction for the development of IL practices and studies is to target the macro-sphere, i.e. our current societies. There is a significant volume of literature on the so-called Information Society [24]. While that literature provides information about the aggregate effects of information flows introduced in our societies, they fail

to inform us how this information flow functions and can thus be managed successfully, which must be the subject matter of Information Logistics practices and studies.

In this sense, there here advanced elaboration of Information Logistics also serves as an invitation to both its practices and studies to further reflect on the current IL practices and understanding and to further improve these, as IL seems to important for our current and future societies to be ignored.

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Table 1. Shows formal notions of Information Logistics as given by the eleven IL Schools here inspected.

#	Name of IL School	Definition of Information Logistics	Source
1	Local Distribution of Information (Harvard University, USA)	"Information logistics, as a function of the business enterprise, devotes primary attention to the production, storage, packaging, and movement of information (products). With this in mind, information logistics will, for our discussion, refer to the management of all activities which facilitate information (as a product) movement in order to supply customers with the place and time utility in information goods and services they demand."	Wormley P. W. (1978); [1]
2	Information Production Time (Vrije University, The Netherlands)	"Information logistics is a relatively new area. Some first publications saw light. They indicate that application of logistics in information production might be valuable."	Gerrits, J.W.M. (1995). [27]
3	User-Demand Information-Supply (The Fraunhofer Institute, Germany, and other collaborating sites in Russia, Sweden, and other places)	"The main objective of Information Logistics is optimized information provision and information flow. This is based on demands with respect to the content, the time of delivery, the location, the presentation and the quality of information. The scope can be a single person, a target group, a machine/facility or any kind of networked organization. The research field Information Logistics explores, develops and implements concepts, methods, technologies and solutions for the above mentioned purpose"	Sandkuhl, K. (2007). [28]
4	Information Flow Efficiency (Frankfurt University, Germany)	"If information logistics is regarded as the planning of information flows, this consequently implies the planning of an information-logistical infrastructure. In doing so, two essential areas need to be distinguished. Whereas on the one hand network relations and/or supplier-requestors relations need to be defined and structured, on the other hand the resulting information-logistical basic infrastructure must be designed and optimized"	Grolik, S. (2007). [29]
5	Cross-functional supply of analytical information (University of St. Gallen, Switzerland)	"Information logistics (IL) comprises the planning, control, and implementation of the entirety of cross-unit data flows as well as the storage and provisioning of such data. In order to differentiate IL and operational data integration, only those data flows are considered to be IL components which support decision making. If data is used for decision-making in the same organizational unit where it originates, such flows do not fall under our IL definition because in this case, most of the managerial challenges do not occur."	Winter, R. (2008) [30]
6	Outsourced Information Handling (Washington University, USA)	Two indirect notions given: a) Information to handle the services of physical goods logistic operations b) Information handling of information as a product, independent of physical goods, which includes: gathering, selection, organizations, synthesizing and distribution of data between individuals within and between organizations, all with the goal to achieve improved availability of crucial business information that is independent of	Chaffe, B. C. (2001). [31]

		the system.	
	Information-flows in Supply Chains (Halmstad University College, Sweden)	"…the concept of Information Logistics links the functions of business logistics and information management. It focuses on vertical coordination within firms and horizontal coordination within and beyond the boundaries of the firm. In a conceptual perspective, information logistics is a crucial element of a revised model of the firm. In an inter-organizational perspective, information logistics refers to emerging telecommunication infrastructure."	Chibba, A., & Rundquist, J. (2003) [32]
	Work-flow Modeling (Växjö University, Sweden)	"Right information to the right person at the right time at the right place and at the right cost."	Flensburg, P. (2004). [33]
	Global Cross-reference Database (Private company, Norway)	"We speak about *information logistics*, i.e. the distribution of information for a specific purpose to a specific audience at a specific time."	Simonsen G. H. (2005). [34]
	Information-flows in Processes (The Nyenrode Research & Innovation Institute, The Netherlands)	"The Information product needs to be delivered in the right format, at the right place, at the right time, for the right users, all demand driven."	Olthof, W., et al.(2008). [35]
	Information for systems maintenance (Luleå University of Technology, Sweden)	"The aim of information logistics is to provide just-in-time (JIT) information to targeted users and to optimize the information supply process, i.e. making the right information available at the right time and at the right location."	Karim et al, (2009). [36][

Workflow Specification in S-BPM and UML: Commonalities and Differences

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Abstract. The paper discusses aspects of subject-oriented specifications related to the object-oriented approach of UML. It focuses on the notation of S-BPM and related notations as activity diagrams, communication diagrams and task models. Advantages and disadvantages of different notations are discussed und some notation extensions are suggested.

Keywords: Process Models, S-BPM, Communication Diagram, Activity Diagram, State Chart Diagram.

1 Introduction

Information logistics aims at improving information supply in organizations in order to facilitate efficient operations and decision making. Starting point for improvement processes usually is an understanding of the current situation, which can be achieved by modeling business processes and information flows in these processes.

Business process modeling and the specification of workflows are still a challenge because of the diversity of aspects that have to be considered. On the one side specification models have to be informal to allow communication between different stakeholders. On the other hand such specifications have to be precise to reduce the number of possible interpretations. If business process automation is the goal there should only be one possible interpretation.

The solution might be to start with an informal abstract specification and later on refine this specification to a precise formal one. In this way ~~a~~ several models are necessary. Thus, more effort is required in order to specify and maintain the models.

However, not only the effort needed to specify models is important. It is also important that the specification can be evaluated to ensure a certain level of correctness. After discussing object-oriented approaches for years, the discussion of subject-oriented business process modeling appeared. The paper discusses the main ideas of this approach as well as the implementation of those ideas using other notations. The discussion in the following chapter is especially focused on activity diagrams and state charts in UML. It is structured in such a way that first, an introduction to S-BPM is illustrated using an example. This example is further used to

provide other specifications in a subject-oriented way. Afterwards, a discussion of possibilities for cross-pollination of different notations is performed and some conclusions for improved notations are drawn. The paper concludes with a summary and an outlook.

2 Specification of Workflows

Workflow specifications become more and more important. They are needed to specify precisely business processes that are still only performed by humans. Usually, a software supporting such processes is called people-based. Additionally, workflow specifications are important for automating the business process. Software agents are used to replace humans.

With the growing number of applications based on Service-Oriented Architecture [17] there is an emerging need for specifying business processes that are supported by a combination of such services. However, nearly all software applications are related to business processes that have to be analyzed and redesigned to run the business in an optimal way. In the literature a lot of workflow specification languages exist. Some are designed to specify the technical details that have to be provided for workflow execution systems. Other languages are designed for modeling the business process on an abstract level. Such specifications are focused on the domain of application rather on an implementation on a computer system. Among such languages, the most important might be BPMN[3] and EPC [7].

2.1 Subject-Oriented Business Process Modeling wit S-BPM

The idea of *Subject-oriented Business Process Management* (S-BPM) has been discussed for several years ([9], [10], [11]). In the meantime a series of conferences (S-BPM ONE) [18] has been established to discuss the further development of the methodology.

According to Fleischmann & Stary [9] S-BPM "allows for interactive structural flexibility of organizations, (re-)organizing internal procedures as well as arranging networks of organizations, based on business process specifications." The authors also mention in their abstract that while the methodological support for business process specifications is important the success of an approach also depends on tool support. Metasonic [15] provides such a tool with its suite.

The methodology is based on the natural language communication that is based on the structure of sentences in the form *Subject*, *Predicate* and *Object*. Krauthausen [13] gives a good summary for that:

- subject (the agent who is acting)
- object (the aim or outcome of an action or activity)
- predicate (what is done to the object)

S-BPM provides a specification language that allows to specify the communication between subjects. It also provides language features for specifying the behavior of subjects.

In this paper we will focus on the five main graphical elements of S-BPM specifications. They are shown in Fig. 1.

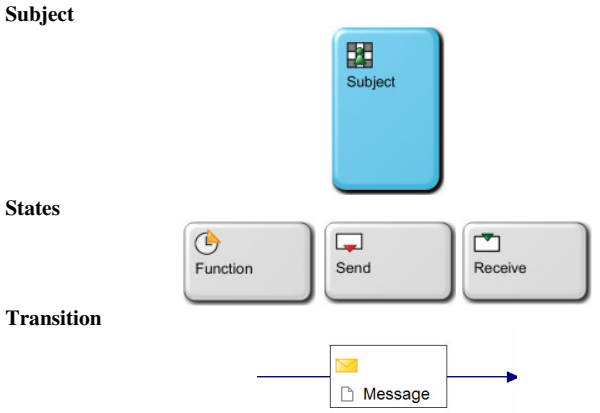

Fig. 1. Five main language elements of S-BPM

We will recall an example given by [9] for a business process that describes the procedure of an employee asking for a vacation in a company. For that process, three subjects were identified. The first subject is of course the employee who wants to ask for a vacation. Other subjects are the corresponding manager and the human resources administrator.

Fig. 2 presents a specification for the communication between those subjects.

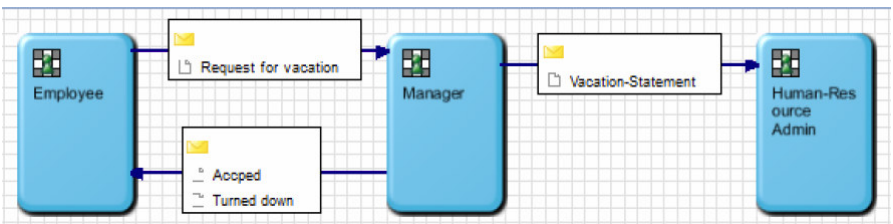

Fig. 2. Example of message exchange between subjects (from [9])

The specification of Fig. 2 is based on the following natural language description:

"An employee fills in a holiday application form. He/She puts in a start and end date of his/her vacation. The responsible manager checks the application and informs the employee about his/her decision; the holiday request might be rejected or get approved. In case of approval the holiday data are sent to the human resource department which updates the days-off in the holiday file." ([Fleischmann , Schmidt, Stary 2011] p. 220)

There seem to be no further comments necessary for the diagram of Fig. 2. It provides possible channels of interaction between the identified subjects.

For each subject the behavior has to be specified. This can be done by the specification of an abstract machine notated in the graphical language of S-BPM. In this way for the example of Fig. 2 three further specifications are necessary. It has to be specified how the subjects Employee, Manager and Human Resource Admin behave. The specification of the subject Employee is given in Fig. 3.

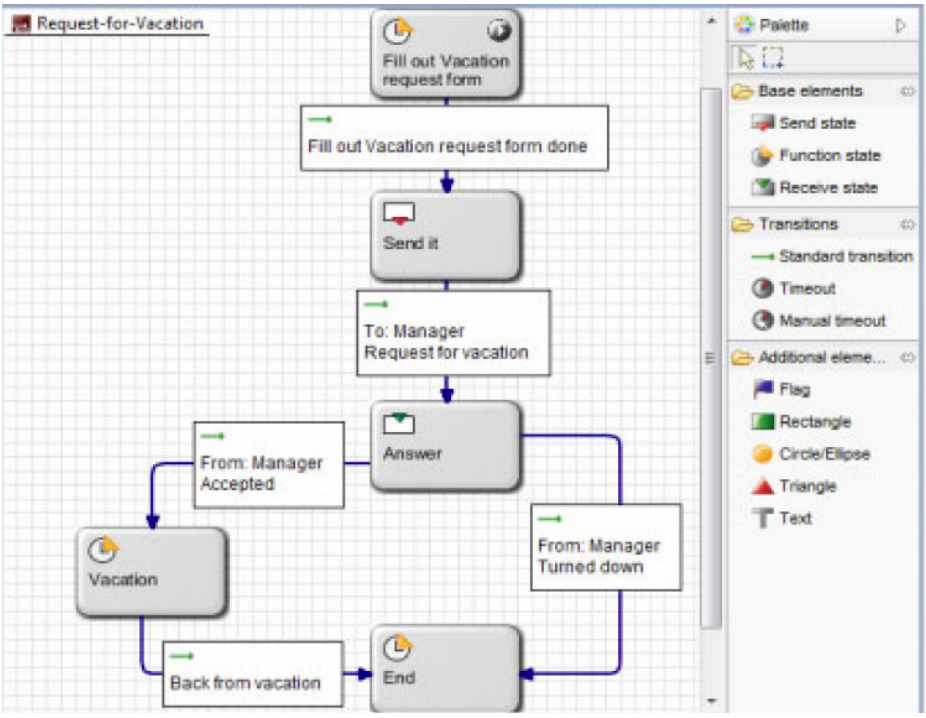

Fig. 3. Example specification of the behavior of subject *Employee* (from [9])

The specification of Fig. 3 characterizes the business process from the perspective of the subject *Employee*. It is specified how the communication with the *Manager* is performed. However, there is nothing mentioned that is related to the *Human Resource Admin*. This is obvious because according to the specification of Fig. 2 there is no message exchange between the subject Employee and the subject Human Resource Admin.

It can be seen from this specification in Fig. 3. that a function in a function state (e.g. “Fill out Vacation request Form”) leads automatically to a message that informs about the ending of the performance of the function (e.g. “Fill out Vacation request form done”).

During Execution the workflow does not last long in a send state like *Send It* (better *Send vacation request*). It is immediately left and one or more messages are sent. In the example of Fig. 3. only one message is sent to *Manager*. This sending of

a message results in a transition to the state *Answer* (better *Waiting for Answer*). It depends now on the message received from the manager whether state *Vacation* (better Enjoying *Vacation*) or state *End* is reached.

The suggested notation for S-BPM is easy to learn. It seems to be a result of the combination of the notation for EPCs [7] and for BPMN [3]. It is much simpler than BPMN because it drastically reduces the number of elements and provides a nice combination of overview diagrams and detailed diagrams that are reduced in their complexity. The idea to have always messages after activities is similar to the events in EPCs that have to occur after functions.

We will have a look at notations in UML to get an impression how the idea of subject-oriented specifications can be expressed in this context.

2.2 Business Process Modeling with Activity Diagrams

UML provides activity diagrams which give the possibility to specify processes that consist of actions. Lanes represent the responsibility of certain roles while the communication between different roles is specified by object flows and control flows. A special symbol is used for decisions. Outgoing transitions of actions have to be transformed in parallel. This is the reason for having a special symbol for decisions. The special symbol of a bar for splitting control flows or object flows into parallel transitions is available due to historical reasons. The bar is not necessary anymore but might support readability.

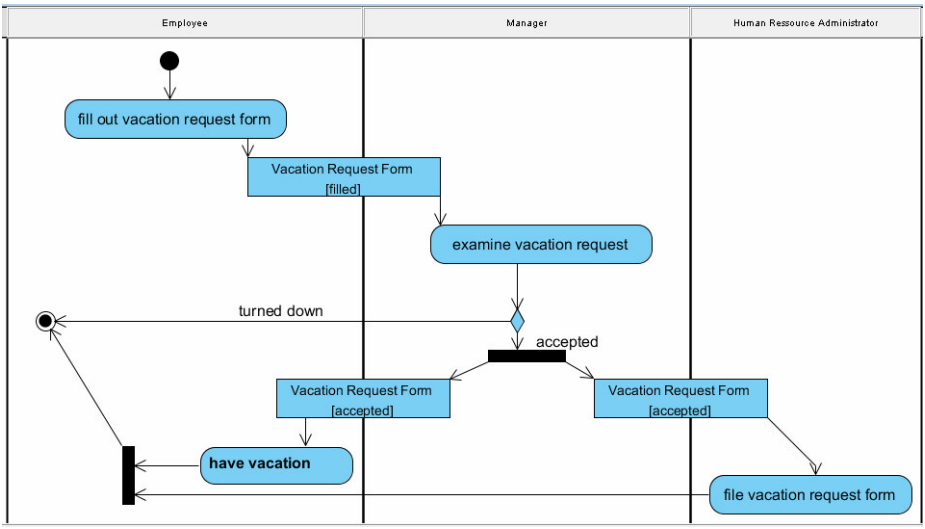

Fig. 4. Activity diagram for a vacation requests

The request for a vacation starts with filling a form. In its state filled, the form is sent to the manager that examines the vacation request. It might be turned down or accepted. In case of an accepted request the form is set in the state accepted and two

copies are sent by the Manger, one to the Human Resources Administrator that files the form and one to the Employee that goes on a vacation. After both actions, the parallel executions are joined and the process is finished.

The perspectives of S-BPM and activity diagrams do not differ a lot. Activity diagrams can be used without specifying explicitly the sending of messages (have a look at Fig. 4). The message exchange is specified more indirectly by flows of objects and events. There is also no explicit event specified that signals the end of an action.

The explicit specification of sending and receiving of objects and events can be formulated for UML activity diagrams as well.

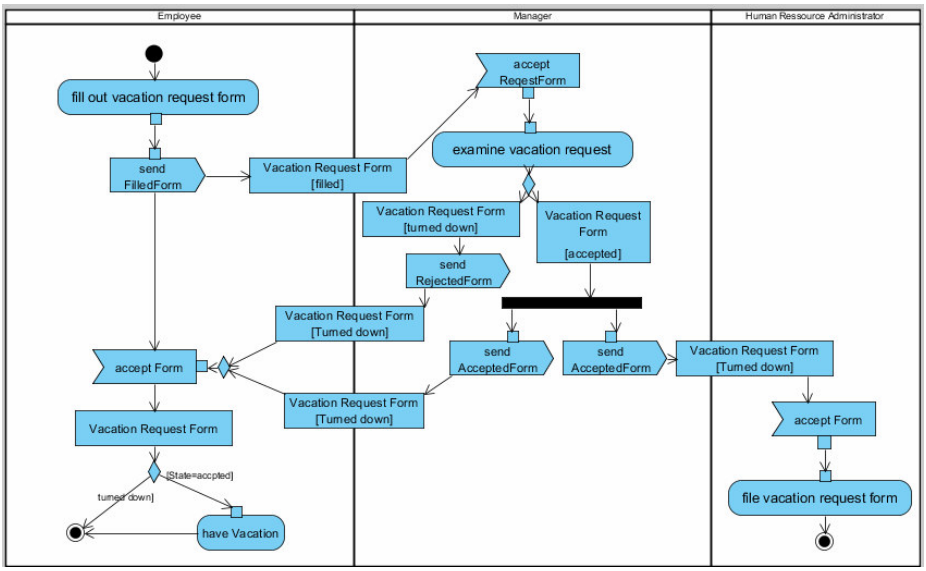

Fig. 5. Activity diagram for a vacation requests with sending specifications

The specification of Fig. 5 describes our business process example by explicitly expressing the sending and receiving actions. Since UML distinguishes between object- and control-flow connections, object symbols and pins have to be used to specify connections that follow the rules of UML. This specification is very similar to the specification of S-BPM. However, the strict rules of UML force the usage of some symbols that might not increase the usability. On the one hand readability might be decreased , on the other hand a lot of detailed information like the state of objects is available.

S-BPM distinguishes between messages with only control information and those with object information in the message exchange diagram but not within the detailed specifications. In activity diagrams there is a difference between object flow and control flow. There are also constrains to the elements that are connected by such a

flow. The symbols for actions have sometimes to be used in connection with pins if an object flow is involved.

Activity diagrams can be used in the simplified way of the S-BPM example by only using control flow as well. If object information is eliminated the diagram looks much simpler as can be seen in Fig. 6.

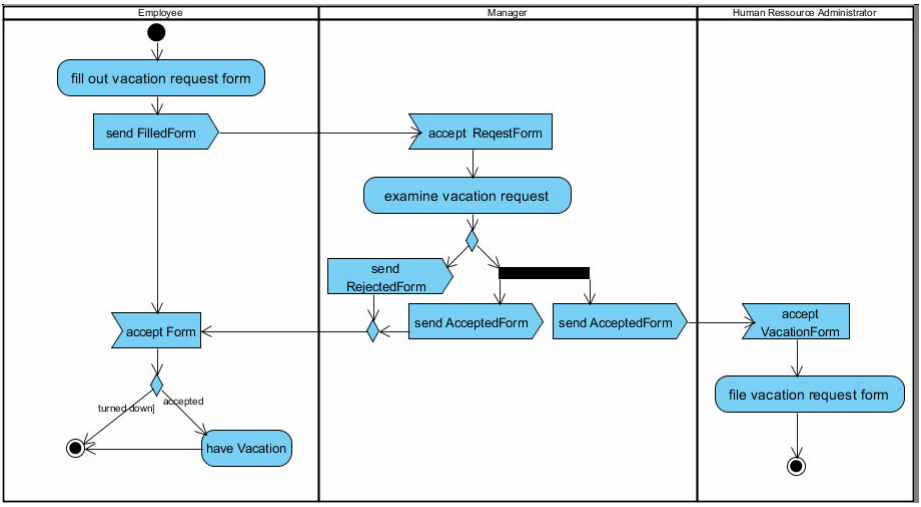

Fig. 6. Activity diagram for vacation requests with control flow only

The activity diagram looks now very similar to the S-BPM example that was the starting point of the business process specification for a vacation request. The activity diagram does on the one hand not always need an action followed by a sending of a message. On the other hand there is a need for a fork if two messages have to be sent.

In some way, one can conclude that readability might be better for activity diagrams while the idea of capsulation and communication via services is better expressed for S-BPM.
At the moment there is also no communication diagram for swim lanes. UML has a communication diagram but this directly fits only to state charts. (We will have a look at this notation a little bit later.) At least it had to be slightly adapted to be applicable for activity diagrams.

A version similar to S-BPM that distinguishes between sending messages with object information and messages with events only might be useful. This extension can be helpful in the context of S-BPM as well.

2.3 Business Process Modeling with Communicating States

State charts are often used to specify the dynamic behavior of classes. However, this formalism can be used to specify business processes as well.

The specification of S-BPM in Fig. 2 is very similar to state charts. In fact the idea of S-BPM is based on abstract state machines. There are of course different ways to specify our example of requesting vacation. However, there is one possibility that is very similar to the specification for S-BPM.

State charts provide states and transitions. Action can be performed within states or during transitions. A transition is started if the corresponding trigger occurs. Such a trigger can be a message, an event, a specific condition, etc. During a transition it is possible to send messages to specific automata or to broadcast them to the environment. In our example, messages are only sent to specific destinations.

Similar to the S-BPM specification, for each subject an automaton is used to specify the corresponding behavior. Please have a look at Fig. 5 which provides the corresponding specification.

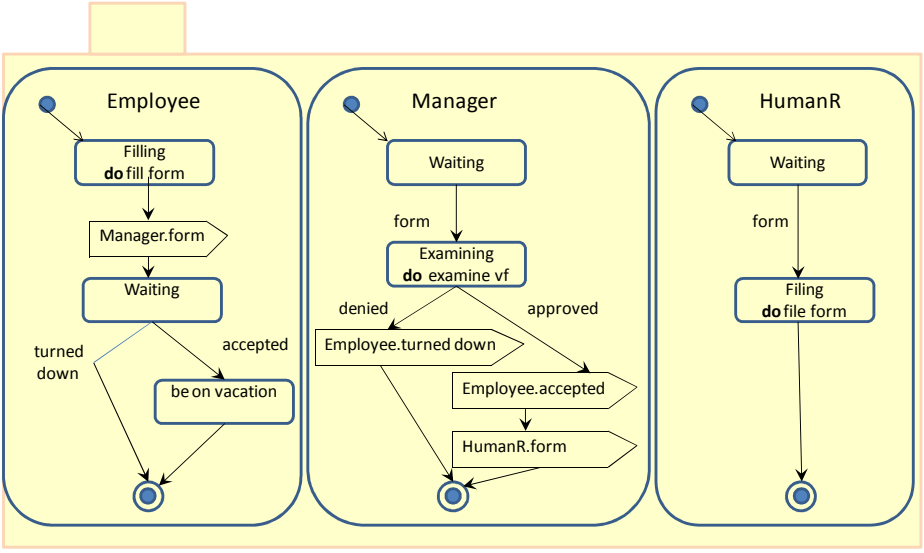

Fig. 7. UML-State Chart Diagram

After filling the vacation request the message form will be sent by the *Employee* to the *Manger*, which is expressed by `Manager.form`. A Manager object changes its state from Waiting to Examining and checks the vacation request. The state is left neither via the transition labeled denied or accepted. In the first case only the *Employee* gets a message while in the second case, both the Employee and Human Resources Administrator (HumanR) get a message.

It is important to note that in S-BPM messages are only accepted from specific senders. There is no special language construct for state charts for that purpose. It is possible to express such a constraint in a guard but a language feature like `Form` **`from`** `Manager` for transitions might be a useful extension to specify the message is only accepted from certain senders.

As already mentioned above, communication diagram (previously called collaboration diagrams) can be used to specify message communication. Such diagrams look very similar to S-BPM communication but are different in detail. Let us have a look at the diagram presented in Fig. 8.

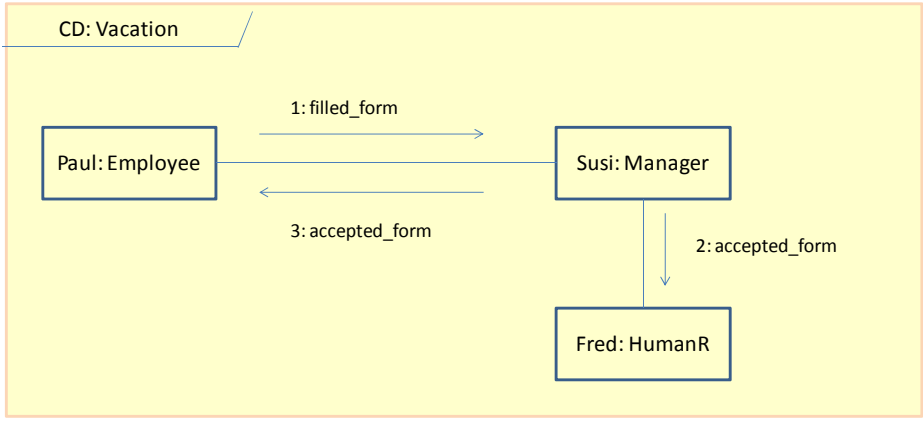

Fig. 8. UML-Communication Diagram

Objects are represented as rectangles. The name of an object can be followed by the class it belongs to. Messages are numbered. These numbers represent the sequence of appearance in a timeline. Communication diagrams are intended to specify scenarios or in other words instances of processes. In this way, in Fig. 8 only the scenario for an accepted request is presented. There has to be another diagram for the case in which the request is rejected. Combining both diagrams and leaving out the numbers for specifying the sequence of appearance would result in a diagram that is similar to the one which is suggested by S-BPM.

2.4 Discussion

Having a look at the different formalisms specifying the business process of requesting vacation gives an impression of the strengths and weaknesses of the different notations. While the concept of roles and actors exists in BPMN, EPC and UML the formalism of S-BPM especially focuses on a subject-oriented or in other words stakeholder-oriented specification of business processes. However, this approach is not new. In task modeling [1] or activity theory [14] models are specified for specific users and generalized to a group of users playing one role. Such task

models are represented by hierarchical structures having temporal relations between tasks at the same hierarchical level. The specific notation of CTT [16] distinguishes between human tasks, interactive tasks and system tasks (it would be better to call it system functions). There are also abstract tasks that are specified if the sub-tasks are of different categories. Fig. 9 gives an impression of this notation by specifying the task model of an *Employee* that has to be performed to require a vacation.

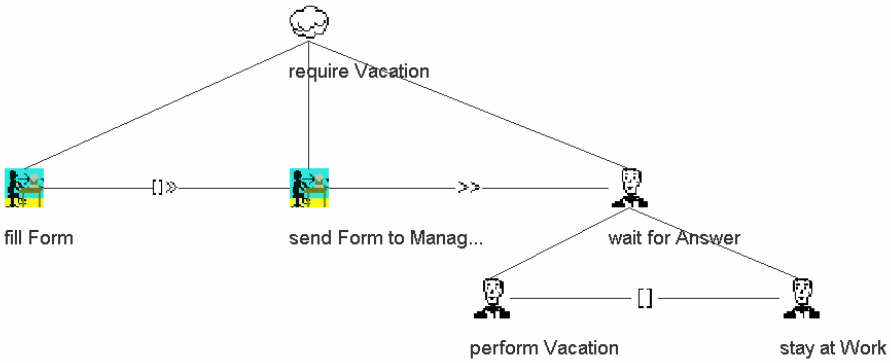

Fig. 9. Task Model of an Employee for requiring vacation,

An *Employee* has to fill a form ([]>> enabling with data exchange) and afterwards he/she hast to send the form to the Manager. Afterwards (>> enabling) the employee is waiting for an answer. He/she can either ([] choice) perform the vacation or stay at work. For a choice there has always to be an alternative. That is the reason for the task "stay at Work".

In [4] it was shown that task models can be presented as activity diagrams. Corresponding tool support was provided that allow to see a flat activity diagram containing all tasks or to see activity diagrams for a certain level of abstraction, which means a certain hierarchy level of the task model.

Different approaches for specifying cooperation of task models exist. Because of lack of space we do not discuss the details here. The interested reader is referred to [8].

In some way the subject-oriented or stakeholder-oriented approach is a special kind of aspect-oriented specification. The specification focuses on a special aspect which is the business process seen from the perspectives of stakeholders. The specification of the interaction of the different models is specified by a special model focusing on message exchange between subjects.

BPMN provides message flow between swim lanes. However, the provided overview like in S-BPM is missed. For UML, a new kind of communication diagram for state charts and for activity diagrams would be helpful. Additionally it would be good to have the opportunity for state charts that certain events are only accepted from specific senders. Additionally, it might increase readability of S-BPM specifications if messages are not always necessary and can be omitted in case they are obvious. It might also be useful for S-BPM to have hierarchies of states (representing tasks) like in task models.

The strength of S-BPM is its strict encapsulation of actions for subjects. Therefore, S-BPM seems to be especially helpful for SOA-applications. Börger presents in [2] a nice model of maturity for S-BPM. Fig. 10 presents this model.

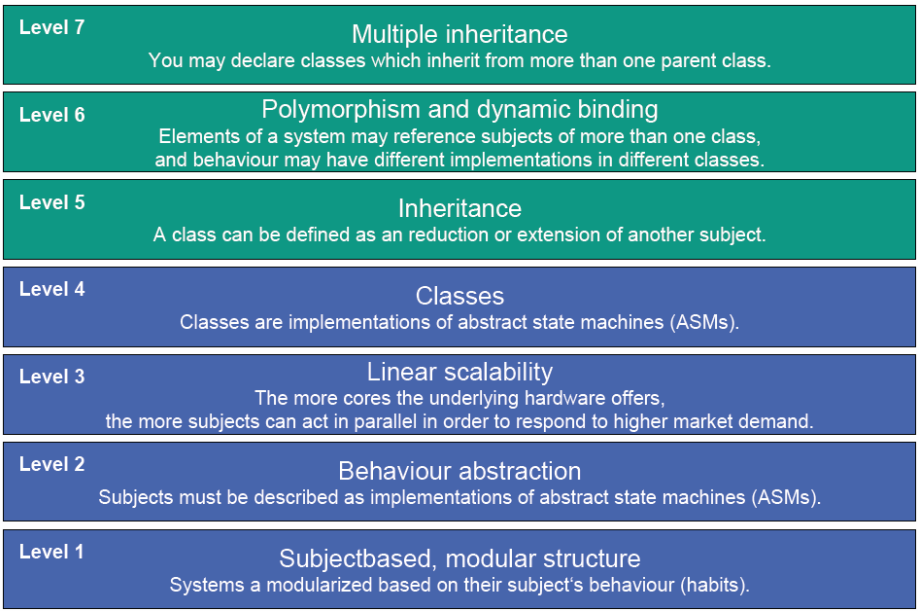

Fig. 10. S-BPM Maturity Levels (from [2])

The maturity levels of Fig. 10 were specified according to the same levels of object-oriented specifications. It shows that S-BPM specifications are useful for classical applications as well.

3 Summary and Outlook

The idea of subject-oriented business process specification was presented together with the S-BPM notation. It was shown that this methodology can be followed as well with other specifications. Different approaches using activity diagrams and state charts were presented.

It was also shown that the different notations can cross-pollinate each other. New versions of communication diagrams would e.g. be helpful for UML.

Future applications have to show how feasible the subject-oriented methodology is. It might be useful to extend task models by the concept of sending messages like in S-BPM. S-BPM considers business processes as cooperating workflows. It is postulated that no central workflow specification is necessary anymore. However, it might be helpful if such a central specification can be generated based on the subject-oriented specifications.

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Knowledge Management Systems in SME - State of the Art

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Abstract. Knowledge Management (KM) and their technical implementation as Knowledge Management systems (KMS) have been of interest for many years now, however among success stories mostly bigger companies show how they developed their individual approaches. Yet the situation in small and medium enterprises (SME) differs from the ones in bigger companies especially with regard to the available resources. Time and money are sparse for SME, so they ask for well established solutions allowing them fast success in the field of KM. As it should be part of the scientific work: allowing KM for all kind of enterprises the main question of interest for this paper is: what is the state of the art in KM for SME according to scientific literature.

1 Motivation

KM is about supplying the right knowledge at the right time, which is a well established idea by now. However, different user groups have different access to the results which could be gained so far in the field and in a region with mostly SME the user group has different demands towards KM than big enterprises owning the resources to implement very individual solutions to cover the topic. Yet being confronted with the challenge of the retiring baby boomers even SME are highly interested in keeping their knowledge in the enterprise.
This paper is about to investigate what the recent state of the art is in the scientific community. We wanted to find out how much research has been done on KMS in SME, leaving out the most general well accepted facts on how to implement KM within a organization. We wanted to see whether there were more articles as [SFS05], deepening their investigation on the level of KMS.

1.1 Research Questions

Following the approach of a systematic literature research few facts have to be clarified before any results can be gained. With regard to the availability we decided to conduct the search across six publication series. These were:
- ECIS (European Conference on Information systems)
- EJKM (European Journal on Knowledge Management)
- HICSS (Hawaiian International Conference on System Sciences)

- PAKM (Practical Aspects of Knowledge Management)
- JoKM (Journal of Knowledge Management)

Within these journals and conference proceedings we expected to find results on the topic of KM and KMS and therefore chose them to see what results can be gained specific to the field of KMS in SME.
To avoid uncoordinated search on the topic we searched focusing on answering the following research questions:

- RQ1: Which activities on the field of KMS in SME have been documented since 2006?
  We chose the time from 2006 on since we started in 2011 and the initial idea was to focus on results from the last 6 years since those were not to far back in history. This question was posed since we looked for answers on following points:
  Which applications were implemented to be used in SME? How have the applications been implemented? What to SME expect when implementing KMS and which specifics do they have on the field?
- RQ2: Who is active in researching the field? And when were they active?
  Here we aiming at finding the possible community supporting research around the field of KMS and SME. This includes the question for universities, research facilities or industrial partners working on the field.
- RQ3: Which approaches are in use for research in the field?
  This question aims at showing with how research around the topic is committed as there might be literature work, case studies, surveys or purely theoretical work.

These 3 questions were to be answered with the help of the results of the systematic literature research. To illustrate the process and the results gained from it the paper is structured as follows: section 2 provides the general background on the topics of KM and KMS as well as SME, as they are known from literature. Section 3 will present the process and results of the committed literature search and finally section 4 will provide some prospects on how what the results could imply for further work within the field.

2 Theoretical Background

This chapter presents theoretical backgrounds used for this paper, as there are KMS, as well as some general remarks on SME.

2.1 Knowledge Management Systems

Definitions of the term KM in literature vary widely [PRR10], [NTM95] However, two main focuses can be identified. [Mai07] The human-oriented approach focuses on the transfer of knowledge between individuals or groups of employees and does not necessarily contain a technical component, whereas the technical-oriented approach focuses on supporting the process of KM by means of ICT. As

this paper focuses on the use of KMS and falls into the line with the technical orientation. Following this idea a KMS can be defined according to Maier([Mai07], p.86):
"A knowledge management system is an ICT system in the sense of an application system or an ICT platform that combines and integrates functions for the contextualized handling of both explicit and tacit knowledge, throughout the organization or that part of the organization, that is targeted by a KM initiative. A KMS offers integrated services to deploy KM instruments for networks of participants, i.e. active knowledge workers, in knowledge-intensive business processes along the entire knowledge life cycle. Ultimate aim of KMS is to support the dynamics of organizational learning and organizational effectiveness."

Having a closer look at the given definition it should be recognized, that Maier assumes KMS as an integral part of a KM initiative. Consequently, the implementation of such a KMS should be part of the overall implementation process of KM in an enterprise. This can be assured e.g. by aligning the KMS to the KM goals. The definition of these goals is according to [PRR10] a prerequisite for a successful KM initiative.

2.2 SME

Though having no standard definition EU guidelines [SME03b] distinguish SME with the help of two characteristics. These two attributes in use are number of employees and annual turnover. With regard to the annual turnover it is stated that the value of the balance sheet can be used instead, and consequently one or the other has to be fulfilled. However, one of these two and the amount of employees must be met, one attribute of these does not suffice. Accordingly, an enterprise with less than 10 employees is a micro enterprise. Moreover, the enterprise's turnover is not larger than 2 million Euro per year. This indicates that an enterprise with 10 to 49 employees and a turnover of 10 million Euro (same value holds for the balance sheet) is considered a small enterprise. Moreover, a SME with 50 to 249 employees and an annual turnover of 50 million Euro (balance sheet: 43 million Euro) is a medium enterprise. In Germany additionally the term "Mittelstand" exists, which also counts enterprises with less than 500 employees into the group of medium enterprises, as long as their annual turnover does not exceed 50 million Euro.[**?**]

3 Literature research

This chapter is about to present the process of the systematic literature research committed to create valuable results and afterwards provides the results answering the research questions posed.

3.1 Methodology

When committing a literature research valuable results are gained by using a process which can be repeated and is fully transparent in its choices. Our process consisted of 4 different steps, presented in the following paragraphs.

Population Before entering the different search engines available for the individual publication series, we had to become aware of what we are really looking for. First, we decided to search within the title and abstract of the publications only, since not all publication supported the search of keywords. Moreover this was due to the fact, that terms like "knowledge" and "management" are rather common within texts, yet they may be of different importance with regard to our topic.
Since the population step aims at providing the initial base for selecting relevant articles from it we furthermore had to decide which should and could be our initial search terms. As mentioned above we were facing rather frequently used terms, however most often not related to our field of interest. After consulting various dictionaries for possible synonyms we can state that there is no such thing for the term "knowledge management" and consequently we decided to make this our initial search term.

Intervention The step of intervention concentrates on refining the search results gained from the population step. In our case we wanted to filter the articles gained for KM for those relevant for SMEs and accordingly made SME our term for refinement. Yet due to the different options offered by the search engines we had to realize that we had to be more precise and had to allow for "SME", as well as "SMEs" and if the author decided for the long version we also included "enterprise".
The final search term after these two steps looked as follows:

$F =$ ((Abstract Knowledge Management $\vee$ Title Knowledge Management) $\wedge$ (Abstract SME $\vee$Abstract Enterprise$\vee$Abstract SMEs $\vee$Title SME$\vee$Title Enterprise$\vee$ Title SMEs)) $\wedge$ Date Range (2006-2011)

The actual search With the search term as provided above a fully supportive search engine would allow entering the term accordingly and provide the results.

Article Selection After having gained the results from the automated search the manual process was to scan the papers for their relevancy. By a closer examination of the title and the abstract, or in case we were still unsure the introducing paragraph, we decided which papers finally really were relevant for answering our research questions and which were merely results containing the search terms without being related to our field of interest. We identified three reasons for excluding papers:

1. the article is KM related only and does not cover KMS by a certain degree
2. the article does not cover SME though maybe mentioning it
3. the article might be concerned with Enterprise Systems (ES) and KM but follows the approach that it is only to be understood what influence KM might have on already existing ES. Accordingly, the article is not concerned with a KMS as indicated by Maier [Mai07]

3.2 Searching process

When starting to search we first determined how many papers were available to search through in total and in the individual conferences, the according result is presented in Table 1. With about 1400 paper in total which might be related to the topic a sufficient basic population was provided.

Table 1. overall amount of papers

	PAKM	JoKM	ECIS	EJKM	HICCS	total
papers total	33	407	498	119	329	1386
issues	2	36	6	24	6	

Within this amount of papers the initial population step was taken resulting in 370 papers from the different publication series as shown below.

Table 2. Population

	PAKM	JoKM	ECIS	EJKM	HICCS	total
papers	33	156	37	100	44	370

Finally, Table 3 shows the result after the invention step. This already shows that SME and KMS are not in the main center of attention for the KMS community. Based on these steps we started to read the gained articles to further decide what is relevant for our research questions and what could be neglected. After this step we had a closer look at the papers reading them to exclude further articles manually. However this reduced the number of relevant paper even further to 14. The final papers of relevance are presented in section 4.

4 Results

Table 3. Intervention

	PAKM	JoKM	ECIS	EJKM	HICCS	total
papers	1	19	3	8	6	26
final	1	6	-	1	2	10

4.1 Answers on the research questions

Being confronted with a rather limited set of 10 articles relevant for the topic [SD06], [BVF08], [CCC09], [Gra09], [MRGMMR11],[MK10], [EELR10] [KV10], [Jud07] we concluded that there is no real answer on RQ 2. The researcher come from all over the world, which could be expected since the publication series were chosen to offer this possibility and none of the authors appeared twice. However, there were two times authors from Spain. In addition, the relevant papers were published in different years, with a slight rise of publications in 2011, where 3 of them were published.
The answer for RQ 3 looks as follows: the articles cover case studies as well as surveys or literature, usually a practical aspect is combined with theoretical approach which is introduced or should be evaluated.[SD06] The methods of research are therefore various and often very extensive as well as specific. Due to this their reuse might be difficult. When considering the empirical viewpoint we found two categories classifying the evaluation methods: objective and subjective. Whereas objective methods are based on indicators related to the activities under evaluation (usually monetary) the subjective one rely on individual ratings gathered by surveys or interviews. It could furthermore be found, that some articles tried to provide a general approach for designing a KMS in SME recognizing the need for such.

With regard to RQ 1 we found that through the relatively few papers published in total only few applications were covered in details, as e.g. [Gra09]. More often the papers were concerned with the general networking thought [BVF08], [KV10] and accordingly gave no precise suggestion on what to use where. It was more often assumed that a central information system should be in use [MRGMMR11], [BVF08], [CCC09], [Jud07]. One paper even asked for the content provided[Jud07] and whether there is a tipping point of knowledge necessary for a full acceptance of a system for a community. What was interesting to read was that some articles even stated, that KM is beneficiary for the applying companies in total and can lead to real benefits in the companies [MRGMMR11]. All this shows, that the main focus lies on KM, KMS are just the medium for realization. The emphasis remains that a central point in KM is the organization culture which is supposed to provide a supportive framework for KM initiatives. Only one paper focussed on the full implementation of a KMS as such to the point of productivity in a SME [SD06].

4.2 Critical remarks

Though the process seems to be rather trivial from the description we found that in practice the wast variety of search engines with all their different possibilities and limitations makes a systematic literature research a rather time consuming process. The main problem with the search was that though we came up with a suitable search term for our purpose most of the search engines did not allow for using it. Accordingly, we were forced to adjust to every single engine and probe the results gained during the process. For instance we had to discover, that the AIS Electronic Library search engine for the ECIS articles ignored the third part of the search term when it was connected with a "or". The search engine for SpringerLink did not allow to search in abstract and title only, and in the meantime cut search terms after a limited amount off characters. This problem was however solver when contacting the operators.
Consequently, it is still best to download all papers and search them offline, but taking the initial amount of articles into consideration this would be an extremely time-consuming work, which might not pay off though it guarantees a valid search result. It would therefore be more desirable to have equal search engines or at least maintenance that reacts on demands as did SpringerLink.

5 Prospects

When looking at the gained results we found that there is only little material available on KM or KMS in SME though a lot of articles have been published on the topic without being restricted to SME. Compared to the numbers of the European Commission for Enterprise and Industry showing that more than 99% [SME03a] of all enterprises are SME this leaves room for speculation.
On the one hand we could see that only little effort was made to document case studies in enterprises and accordingly to prove whether general ideas hold for SME as well as for any other enterprise, e.g. barriers to be found in the process of implementing KMS. Contributions from the field of case studies are of value for comparative issues. The barriers themselves are well known from literature but to which extend they can be verified in practice still remains open, especially with regard to SME.
Considering the availability of articles on how to chose a suiting KM application KMS for an SME and the "right way" to implement it can be stated that the material does not provide decision support in that field. Here we can identify two related issues : first there might be the lack of interest from the scientific community in the real practical issues on KMS and second the big variety of available solutions and SME has not been addressed by creating a general approach yet. The articles we found did not document the decision making process only how the already chosen solutions were put into practice. From our viewpoint it is interesting to evaluate how already existing technologies can be used optimally for SME. With this the issue arises which is a valid way to evaluate which this. As already shown in [Bor11b], [Bor11a] we therefore suggest the establishment of a value-oriented framework. As such this would address the need for specific

decision support without neglecting the non-monetary character of knowledge management as indicated by [DM03] and [Jen04]
Finally, another issue is whether the results hold for small scale business units as they have been published for SME. From the general point of view this would hold at least with respect to the manpower available for certain tasks and especially when considering the time resources available. On the contrary these units are part of larger companies being able to cover for the expenses, and the individual units therewith being able to rely on support within the development of new solutions.

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Role of Business Plan and Market Analysis Tools in USO's Start-up Process

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Abstract. The third mission of universities, the one that allows the commercialization of research results, has assumed a strategic role and primary importance in government policies, in Europe as well as in the rest of the world. Although this attention has raised interest around topics such as technology transfers and university spin-offs, the scarcity of available resources and the conventional university culture still did not allow us an optimal use of the opportunities related to this type of activity.

It is necessary to develop a network among university, business and finance to create value and transform into business projects the result of years of academic research. The aim of this work is to analyzed USOs start-up phases through troubles and instruments that are necessary to define and understand the business idea. We want to suggest, through the Tuscia University USO's, a model of process creation and instrument for the market analysis that can support promoters in the start-up of business idea.

Keywords*:* spin-off; technology transfer, market analysis, value creation.

1 Introduction

Industrial society is nowadays oriented towards an economic system based on information and knowledge so that business success is increasingly related to innovation and technology transfer that are therefore strategic levers for economic development [8]. It is in this context that, in recent years, the world has witnessed a growing interest in the search results and especially in their possible uses in the industrial field. Thus were born the USOs, firms with the objective to commercialize and implement the results of years of studies and discoveries in the universities. The complexity of the phenomenon is widely investigated in the literature [7] [20] [21] [22] [23]. The USOs should not be considered a separate reality in relation to universities or to the market but they are instead an integral part of it and, for their growth and achievement, they need an environment rich in links,

contacts and opportunities. This requires in our view that universities consider, among their strategies, the possibility of creating a network that links universities, businesses, local authorities and funders [12]. A close collaboration between funders and universities is especially important in this context because, as we shall see in the work, the greatest obstacle to the development of business projects in the university sector derives from the lack of financial resources and managerial skills.

2 Research questions and methodology

The aim of this work is to analyze the phenomenon of university spin-off (USOs) and define a standard process to create spin-off and describe their market in the start-up phase. The importance of USOs as a vehicle for the realization of university research results is underlined by the development that this kind of company have had in Italy in recent years. The study is led both through literature and the qualitative description of some cases, emphasizing the process of creating [6] [24]. The reported experience is about the USOs of Tuscia and allows to highlight how the beginning of a USOs is a complex process that often must overcome many obstacles as in management, in corporate governance and above all in financial, because of the difficulty in finding economical resources. So, the use of normal instruments of market analysis, management control it can make easier the start-up of these companies contributing to the creation of a clear organizational structure.

3 University Spin-Off

Universities have always been considered important players in the process of transferring knowledge and technology to the industrial sector especially for their contribution to regional development [17]. This role has historically been dominated by the granting of patents by universities to outside parties, but this is not the only way to gather benefits from commercial exploitation of academic discoveries; the USOs may indeed be considered an alternative, surely efficient, way of exploitation of scientific research. [16] In Europe, the attention to this type of technology transfers is found both in regional politics that perceive the USOs as an important mechanism of development of university-industry relations and creation of jobs and wealth, both in academic circles whose aim is to obtain the best results out of university research. The significant increase we have witnessed in recent years in these realities is due primarily to the new role that universities are taking about commercializing their researches or in other words to their new, more entrepreneurial, approach. Secondly, it is linked to the lack of stable positions in universities, a factor that pushes the researcher-entrepreneurs to expand their possible range of activities beyond the mere academic role and, finally, it is important to underline that the increasing autonomy of

universities will enable them to decide freely whether to endorse and support the development of USOs [18] [19]. When we speak about USOs, we refer to those realities in which we find the following features [9]:

- a new company: an entity independent from the university;
- a separate legal identity;
- created by the university, thus excluding all other research organizations or institutions;
- for the exploitation of results arising from the academic activity (not just patentable results, but also all technical and scientific knowledge acquired during the academic activity);
- whose aim is to obtain profits (this then allows us to exclude all non-profit activities).

The fact that we consider only those businesses spun from universities allows us to develop the right framework of reference of the USOs, excluding all other contexts (technical schools, departments of R & D laboratories and private research institutes) for whose is preferable to speak of research-based USOs [4]. In Italy the USOs of research essentially arose in the first half of the nineties, when in other contexts, in the United States for example, the phenomenon was already in full development. Compared to other European countries such as France, Italy has always been characterized by a smaller total number of USOs, often because we are more focused on quality than quantity, trying to create realities that have a real and effective growth potential. The market of research exploitation is therefore a very dynamic environment although mainly composed of small and very committed firms engaged in consulting activities and R & D with a limited number of employees and a very small initial capital. The majority of those firms operate in IT. In recent years, we have seen a development in the field of life science, with particular attention to energy and environment related activities. The USOs of research, therefore, tend to be small businesses constantly worried about their own survival, and while a small part is transformed into large high-tech companies, most survive without significant improvement throughout their existence.

4 The USOs of Tuscia University

University of Tuscia in Viterbo starts to create spin-offs in 2007 with the support of a project draws up between University and Ce.F.A.s[1] to improve the creation of new

[1] Ce.F.A.s is a company in partnership with the Chamber of Commerce that provide the creation of new firms with different services: management services, advertising, human resources development.

companies. The aim of the project (named *"Skill's match for the USOs's start-up"*) is to achieve a specific guidance and support to start-up of USOs from the being to the commercialization of the results. In two years Tuscia created a lot of different USOs; we want to focus our attention on: BioforItaly Ltd, a company involved in development of process in forestry and agro-environmental inventory; Sea Tuscia Ltd, to use of renewable energy and biomass; Tusciazyme Ltd, that use a patented enzyme for the production of paper; Tecnelab Ltd, a consultancy for management and organization of archives. Firs of analyze the USO's process and the case we have to explain the steps that USOs's idea has to pass in order to be approved. In the preliminary phase we can find three different promoters: USOs's Academic Commission, Academic Board of Governors and Academic Senate. First of all, Commission analyses and selects all the USO's proposals in order to establishes which one could became a company and if university will has a equity in this. Second, Commission submits all ideas that passed the first step to both Academic Board and Academic Senate; they will approve conclusively only the more interesting ideas and they'll book these in a USOs's register. Lastly, University stipulates an academic convention with the approved USOs in which it regulates all the partnership's details and also the possibility for the USO's members to use the university's brand. Hence the USO's process starts and it is constituted by three phases[2]: pre-incubation phase; incubation phase and post-incubation phase. The Pre-incubation phase is focus on organization of support activities and on all the fundamental information for development of an action plan. The *Incubation phase* is the central step of process and it is the important one. In this phase staff develop the activities with business plan and It appears strategic the link between USOs and University, in particular with Faculty of Economic. Lastly, in the *Post-Incubation phase,* USO is ready to start its activities and to sell goods and services. The most important step is the central one because it is characterized from the business plan development. Business plan is the only document that shows the capability of USO and it can explain at the same time financial and managerial perspectives; so it is analyzed by Academic Board and Academic Senate for the final approval, and it is also the way to achieve funding from banks or other bakers

[2] These are the three phases established in the project "Skill's match for the USO's start-up" and these are inspired to Clarysse and Moray's process [4].

5 Evidence from the cases: role of business plan and market instruments for USO's start-up

As we can see from the case analysis, USOs need some instrument to plan and solve the many problems that its have in the initial phase. A set of market and strategic analysis instrument can help USO's to define and solve this problem that we already describe and to understand the potentialities of business. The first instrument is certainly the business plan; it is necessary to explain and show the market aspects in which USO's will work [2] [13]. In particular, the first part of business plan is fundamental to define target market and focus on customers that we can achieve with USOs's business idea. Second most important statistical tools to develop the market analysis in Tuscia USOs are to segmentation of consumers / potential customers and analysis of product positioning in the market [3] [5]. Currently companies operate in a market complex and heterogeneous. Consequently, a winning strategy is to choose to focus their energies on a specific customer segment. In this way, companies can better meet the needs of those customers. To define the business objectives and implement their strategies, each company must know the characteristics, needs and the likely behavior of potential customers. The behaviors and characteristics are different for each customer. Consequently, the firm must develop different strategies, specifically targeted to different types of potential customer (market segmentation). Then companies need to compare the ideal product for the target segment with what is currently proposed by them, so you can make appropriate changes and improve it (product positioning in the market). The statistical techniques that can help define the segmentation of the clientele are mainly factor analysis to reduce the number of variables and cluster analysis to delineate the various groups [1]. As regards the positioning of the product, the techniques most commonly used are discriminant analysis, the correspondence analysis and multidimensional scaling, each of which considers a different type of input data. The term market segmentation is the process by which firms divide the question into groups of potential customers. The groups are characterized by a high homogeneity in their interior and high heterogeneity outside them. The goal is to group sets of individuals characterized by demand functions as similar as possible, differentiating marketing strategies [10] [11]. The benefits that derive from a correct segmentation strategy are six:

1. It helps to define the market in terms of customer needs and business objectives to be pursued;
2. Strengthens the company's ability to perceive changes in the needs themselves;
3. Allows to evaluate more effectively the strengths and weaknesses of their tender against competitors;
4. It may create a barrier to more competitors;

5. It allows measuring more accurately the effects on sales and profits of specific marketing campaigns.

However there are some prerequisites that a segmentation strategy can be really feasible. They are:

- The segments must be homogeneous and inhomogeneous within them externally;
- The segments must be relevant in terms of size and profitability in order to achieve significant return on investment needed to implement differentiation strategies;
- The segments must be accessible;
- The segments must be significant in terms of duration, i.e. the time span in which the characteristics of the segment itself remain stable.
- The basic steps of a segmentation are the following:
- Definition of segmentation criteria;
- Selection of variables useful for constructing and describing the segments;
- Choice of the segmentation;
- Choosing the most appropriate quantitative methodology;
- Evaluation of results and choice of the segments on which to concentrate resources.

Regarding the first point, the segmentation criteria consist socio-demografiche/anagrafiche characteristics, or behavior from the opportunities for use and purchase of the product / service, the needs / desires / benefits sought. From the application point of view it is possible to identify two modes of segmentation: segmentation for homogeneity and segmentation for objectives. However, market research it is usual to apply the segmentation for consistency with classical approach [14] [15]. The classical approach is based on a combination of factor analysis and analysis cluser. The classic approach provides, therefore, the use of the techniques of analysis of the groups, possibly preceded by a factorial analysis in order to synthesize in macro elements of choice observed variables. The product placement is a decision closely intertwined with the selection of market segments in which the firm decides to compete. Basically, the market positioning of a product or brand is the perception that the product or brand customers have, relative to the potion of the products or brands of competitors. Construct a positioning requires first understanding the motivations and expectations of customers who represent the various segments. For this reason it is difficult to take that decision in the absence of a clear definition of the segments that make up the market. It is evident that the positioning of a product is always defined in terms relative to that of the competitors, identified, these, by reference customers. From a business perspective it is possible to distinguish two phases on the decision of placement. The analytical phase. The enterprise recognizes the current

positioning of your product, product line or brand, within the target market; The decision making itself, where the company decides to consolidate its position, if this is consistent with the objectives established market, or change it in case it is not over. The decision making is very important. The company in fact, to win the preference of customers and achieve sales and market share, customer must provide the same justifications for their preferences. Only a product offering a product different from that of competitors the firm can generate interest in potential customers and give them a reason to prefer their product to that of competitors. The dimensions on which is typically constructed placement are:

- the attributes of the product;
- the benefits sought by customers;
- the opportunities and methods of use;
- the positioning of competitors.

Statistical techniques used in the analysis are mainly three: discriminated analysis, correspondence analysis and multidimensional scaling (MDS). The first two are attribute-based positioning techniques, their applicability being restricted to the choice, as the first step of the analysis, the attributes and characteristics of 'objects' under investigation upon which to build the same position. [14] The third technique is a non attribute based positioning: the input needed for the construction of maps consists of simple evaluations of mutual similarities attributed to the 'objects' to be placed. So, the accelerated dynamics of the competitive environment, the increasing globalization of markets and faster and faster rate at which successive technological innovations, sometimes radical, make it much more difficult for the company to know what the customer wants. This explains why these techniques of market analysis are of significant importance. Especially when it intends to bring to market an innovative product.

6 Conclusion

The benefits of innovation processes have an impact, with positive effects both on subjects directly involved in the ideal network analyzed and on society and economic system. As for the USOs and institutional investors we would have benefit in terms of economic returns, i.e. the ability to reinvest the profits of a business in further research; brokering of scientific knowledge innovation; internationalization. The fallout on the entire economic system and the territory, in which this network develops and operates, can be expressed in terms of cultural growth and prestige, just for the key role that universities have in the social context. On the enterprise system,

the strong innovative capacity of USOs can contribute to the development of skilled and emerging sectors such as the one related to IT or to biotechnologies, and thus creating new jobs and new professional opportunities for specialists and researchers. The innovation and the link between research and business world are then the best answer to the problem of competitiveness on markets and the need for internationalization. Through the case analysis we can see that is fundamental improve a model to define the start-up phase of USOs. (We understand that main problem of this work is the lack of empirical finding that we are collecting for improve in the future our research). University have to plan different step to help researchers from the business idea to implementation of enterprise. The essence of the knowledge based economy is exactly expressed through technological transfer and exploitation of university research; the network between universities, markets and investors, nor are the primary vehicle for contributing to the economic development and to the overcoming of moments of crisis and difficulty of the market.

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Russia's Position in the International Coordinates of Information and Communication Business-Environment Readiness

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Abstract. The most well-known international indices of states ranking according to the e-business environment readiness have been studied in the article. The main evaluated rates of indices have been analysed, Russia's weak points in ratings have been revealed.

Key words: readiness indices, an information-oriented society, e-business environment, e-business.

The so-called "digital gap" or "information inequality" has been becoming the mankind's new issue as not all the society's members have an equal access to possibilities left by the up-to-date information and communication technologies in order to achieve social, economic and other targets as well as they are differentiated according to the level of handling skills to use digital techniques. The "digital gap" problem is tested not only on certain individuals' level. It is typical for different regions and countries. The consequence of its worsening is the differentiation intensification of the developed and developing countries as well as the economic and social inequality increase.

Recently a number of international organizations and analytical companies have made attempts to construct composite indices of countries and communities' readiness to become a part of an information society as well as to develop the important area of the ICT usage like e-business and e-government. Such indices are necessary to carry out reliable international comparisons, to take decisions concerning the reliability degree of possible investments, etc. When developing these indices, the approach impartiality and calculations reasonableness are very important. That is why governments of countries and entrepreneurs do not take part in assessing the indices values; they only submit the necessary information or estimations for calculating on demand [4].

Every of the composite indices are calculated as the arithmetical or harmonic means based on dozens of initial indices which are grouped and weighed up beforehand in accordance of their relevance to receive the particular index that characterizes this or that side of the information process. Such models and programs of indices forming are the intellectual property of the corresponding organizations and are not distributed by them.

The most well-known and authoritative indices are the Networked Readiness Index which is prepared annually within the framework of the Global

Information Technology Report together with the World Economic Forum (WEF) and the International Business School INSEAD.

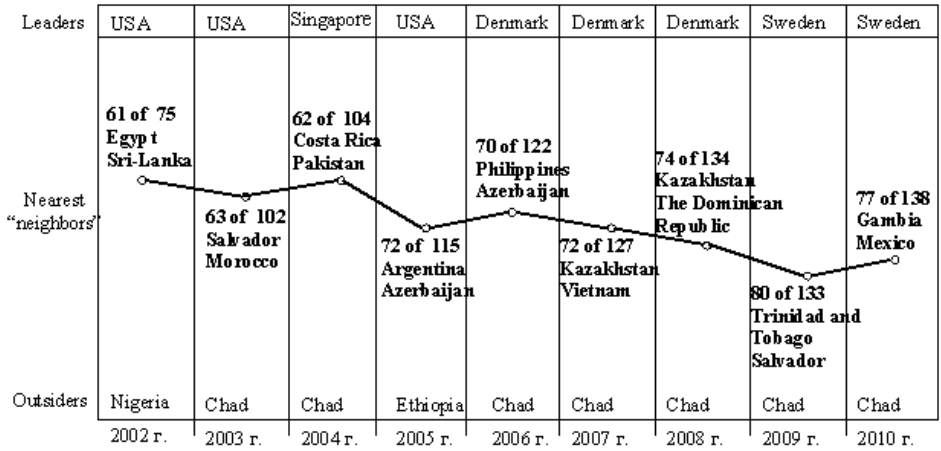

Fig.1. Russia's position in the rating of the world countries according to the networked readiness over the period of 2002-2010.

In the WEF report over the period of 2010-2011, that includes 138 countries of the world, the first ten places of the most developed states belong to Sweden, Singapore, Finland, Switzerland, the USA, China, Denmark, Norway, Korea (see fig. 1). According to the WEF rating Russia occupies the 77th place (the year later it occupies the 80th one) between Gambia and Mexico [7]. The strong points of the country are the positive environment to develop the ICT infrastructure (the 42nd place) as well as rather high levels of the population's readiness to use ICT (the 59th place) and the direct usage of the ICT by the population. According to the business readiness to use the ICT Russia occupies the 90th place and as for the level of the ICT usage in the commercial sector it is on the 72th place. Also the undeveloped market (the 118th place) and legislative regulation (the 111th place) impede the ICT distribution. For example in comparison with the USA, which are the e-business leader, the lag is especially high according to the level of the new technologies development and the ICT participation when creating new organizational models, products and services (see fig. 2).

The invariable leadership of the Scandinavian countries over the last years in the NRI rating is connected by some analyst with the high quality of their information and computing infrastructure, the wide Internet distribution and convergent services together with the favorable political and legislative climate. The constant increase of private companies and state institutions employees' qualification contribute greatly to these countries' success (especially Finland and Denmark).

In the e-readiness rating the Scandinavian countries occupied the first places in 2010. But Denmark gave the 1st place to Sweden which had occupied the 2nd position the previous year. The USA was on the 2rd place (see table 1). Finland had risen from the 10th place to the 4th one. That country had recently been the first one to

accept on a legislative base the right of its citizens to have a broadband access to the Internet. At the end of the first five places there was Holland [8].

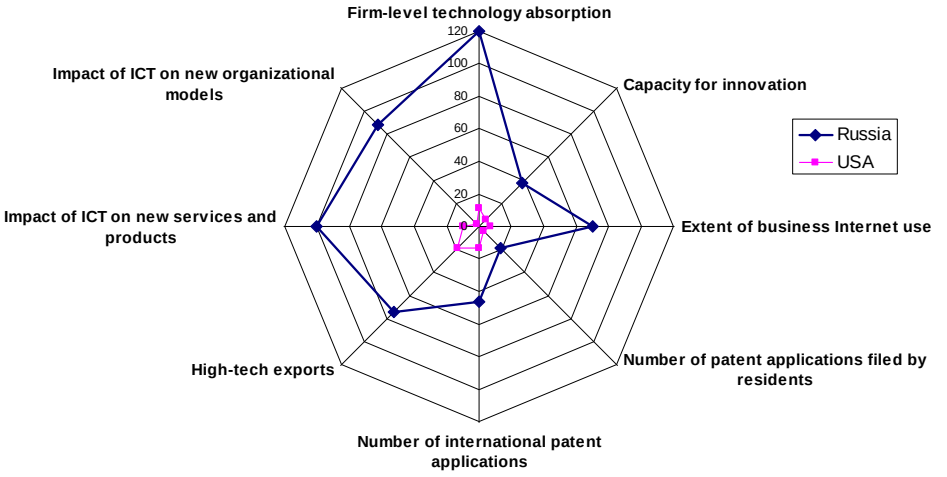

Fig.2. The ranking of Russia and the USA according the subindex "the ICT usage in business"

As opposed to Russia, which had kept the invariable 59th place over the last 3 years, the Asian countries were able to rise in the list considerably. The high indices of the broadband networks service and the mobile Internet quality were marked in comparison with the other countries of the world. South Korea, Taiwan and Japan had even got ahead of the European Union countries.

Table 1. The countries rating according to the e-readiness index.

Country	2010	2009	2008	2007	2006
Sweden	1	2	3	2	4
Denmark	2	1	5	1	1
USA	3	5	1	2	2
Finland	4	10	13	10	7
Netherlands	5	3	7	8	6
Norway	6	4	11	12	8
Hong Kong	7	8	2	4	10
Singapore	8	7	6	6	13
China	56	56	56	56	57
India	58	58	54	54	53
Russia	59	59	59	57	52

We have marked that the Internet is becoming more and more accessible. In 49 countries of 70 ones, which had taken part in the poll, the monthly user charge for using the Internet do not exceed 2% of the average family's income. But a year ago

such numbers were pointed in 42 countries of 70 ones and the previous year they had been met only in 33 countries. The indices of the Internet accessibility have considerably increased in Vietnam and Nigeria.

Being the UN's leading institution in the sphere of information and computing technologies and the world coordination centre for governments and private sectors in developing networks and services, the International Telecommunication Union (ITU) calculates the ICT Development Index (IDI) annually. This index has been calculating since 2008. The index combines 11 indicators into the whole one which can be used as a means for carrying out a comparative analysis on a global, regional and national level. These indicators are connected with the access to the ICT, their usage as well as the practical knowledge of these technologies including the penetration of fixed telephone communication, mobile cellular telecommunication and the Internet (especially the broadband one), the access of households to other computers and the Internet, the level of grown-ups' competence and the youth's involvement to education, etc. [1].

Following the "Measuring the Information Society in 2011" report the constant expansion of the ICT services area and the acceleration in the rates of their adoption has been taking place over the last year in the whole world. The published data, that observed the period of the post-economic crisis after 2008, proved a stable increase of the telecommunications and Internet market as a whole though there were some departures. Over the last five years the number of the Interned users has doubled and exceeds 2 billion people. The acceleration rates on this area in the developing countries are rather high and account for 14% a year at an average. At the same time the main factor of the growth in absolute figures are the big countries as Brazil, China, India, Nigeria and Russia. At the end of 2010 approximately 30% of the world population was the Internet users in comparison with 12% in 2003 and 6% in 2000.

Over the period since 2008 to 2010 Russia along with Azerbaijan, Armenia, Byelorussia, Vietnam, Georgia, Iceland, Qatar, Kenya, Cyprus, Macao, Morocco, Moldavia, Oman, Portugal, Saudi Arabia and Finland had achieved the substantial improvements according to the index both in absolute terms and in relative ones and it had reached the 47^{th} place from the 49^{th} one between 152 countries. Following the ITU conclusion in these countries the high and more than average acceleration rates had been observed both according the accessibility subindex and in the usage one what points at the development of the information society in them.

According to the ICT development index Korea, Sweden, Iceland, Denmark, Finland, Hong Kong, Luxemburg, Switzerland, the Netherland and Great Britain have become the leading countries. It is mentioned in the report that the level of the mobile communication penetration in the developed countries exceeded 100% and the growth of this sector slowed down. In the developing countries the number of the concluded contracts for mobile communication using has been increasing with a rapid speed (over 20% a year). The broadband Internet sector has been increasing; in the developing countries the number of the broadband wireless access had increased by 160% since 2009 and 2010.

Besides the development index the information concerning the price basket per information and computing services, or the index which is based on the fixed telephone communication, cellular communications and fixed broadband access to the Internet, is mentioned in the report.

In the end of 2010 Russia occupied the 32nd place according to this index. It means that the access to the ICT services cost the Russians 1.1% of GDI (in comparison this index was at the level of 1.3% in 2008), at the same time the expenditures for the fixed telecommunication service were 0.8 of GDI (it remained at the level of 2008), for the mobile telephone system services these expenditures were 1.2% of GDI (in 2008 this indicator was 1.6%), the costs for the fixed broadband communications accounted for 1.3% of GDI (against 1.7& in 2008). To compare in Monaco, that is the leader country following the index, the ICT access costs its population 0.2% of GDI at the average. Kazakhstan was on the on the 50th place, Byelorussia occupied the 56th place, Ukraine was on the 69th position and Moldavia occupied the 101st position.

The Cyber Power Index rating is devoted to the electronic safety estimation. This rating is prepared by the project cyberhub.com of the British media group "The Economist". The criteria of the so-called cyber poser are 40 parameters which allow defining the G-20 countries' ability to resist cyber attacks and establishing the IT infrastructure that is necessary for the safe economy. The indicators are divided into 4 main groups including the cyberspace normative legal regulation, economic and social context, technological infrastructure and its usage in the economy.

In this rating Russia occupies the 14th position collecting 31.7 marks and leaving ahead Turkey, South Africa, Saudi Arabia and Indonesia. The first places in the Cyber Power Index belong to Great Britain (76.8 marks), the USA, Australia, Germany and Canada.

In the Boston Consulting Group (BCG) report, which is devoted to the analysis of the role of the Internet economy in the G-20 countries, in 2010 the share of the Internet economy in Russia's GDP amounted 1.9% or 835 billion rubles money. And by 2016 the share of the online business in GDP ought to increase up to 2.8% and accounts 2.3 trillion rubles. It will allow Russia to increase its position in the rating up to two lines from the 18th place to the 16th one leaving behind South Africa, Turkey and Brazil. At the same time according to the authors of the report the Internet economy in Russia is growing faster than in other G-20 countries, i.e. in 18.3% a year in comparison with the average 17.8%. Besides it if in 2010 76% of the G-20 Internet economies fell to the share of the developed countries so by 2016 these countries will have only 66%.

Following the BCG analysis results the Internet active small and medium companies use the Internet mainly for advertising in search systems and direct e-mailing. 10% of the companies sell abroad, 50% present in several regions. The comments placement of the clients on the company's site is becoming more and more popular.

In the rating of countries' readiness to "the e-government", which is made by the Department of the UN Department of Economic and Social Affairs, following the aggregate estimation of such indicators as the development of the human's potential, the ICT infrastructure condition, the e-government services (or web-presence) condition Russia grew up from the 59th place in 2010 to the 27th one in 2011 among 193 countries by having shown the best result over the rating existence since 2003. [2] [6].

According the rating data in 2011 the average world e-government development index amounted approximately 0.49. The leading position was held by

South Korea where the e-government index development index was almost twofold than the average world one - 0.92 (see fig. 3). The Russian e-government development index exceeded the average result on the world countries mainly thanks to the human capital level at the expense of a comparatively high population's literacy level and a high percentage of entering institutions of secondary and high education.

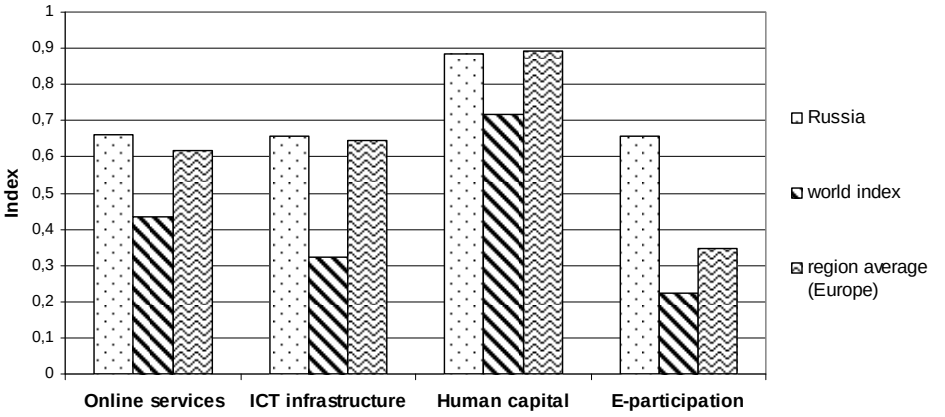

Fig. 3. Russia's basic indices comparison with the average world in regional indicators, 2011 г.

Russia's place in the countries rating, that is based on the ICT development indices, the network readiness and to readiness for e-government, is reckoned with the number of benchmarks of the Information Society Development Strategy in the Russian Federation and the State Program "The Information Society in 2011-2020" (see table. 2).

Table 2. The target indices and factors of the State Program "The Information Society in 2011-2020" in the Russian" [5]

Index item	2008 (base meaning)	2011		2015
		plan	fact	
The Russian Federation's place in the international rating of the readiness index for a network	74	among the 70 leading countries of the world	77	among the 20 leading countries of the world
The Russian Federation's place in the international rating of the information technologies development index	50	among the 50 leading countries of the world	47	among the 10 leading countries of the world
The Russian Federation's place in the international rating of the e-government development index	60	among the 60 leading countries of the world	27	among the 40 leading countries of the world
The number of households which have a broadband access to the Internet (per 100 households)	26	45	37	55
The unit weight of the information technologies sector in the Gross Domestic Product of the Russian Federation	4.1	4.5	–	5.9
The growth of the investments volume into using the information technologies in the national economy in comparison with	1.1	1.2	–	not less than in two and a half times
The share of the placed orders for goods delivering, work producing and servicing for state and municipal needs with the usage of electronic trading facilities in the total volume of the orders placed	–	10	–	100
The share of the federal state services that the population can gain in an electronic type	–	39	26,6	100
The EDM share between the state authority bodies in the total volume of the documents circulation	–	10	–	70

The analysis results of the conditions and forecasts of the information society development in Russia, that was held by the experts from the Information Technologies Institute, shows the following: Russia's lag from the leading countries according to the e-readiness index is approximately 15 years, according to the information infrastructure accessibility and the Internet and broadband access availability this period is 10-11 years; though if all the Russian indices excluding the mobile communication prevalence in accordance with the forecast for 2015 will cut

the existing gap but at the same time it will be behind the low limit of the corresponding indices of the top 20 countries in 1.5-1.6 times depending on the index; according to the mobile phones availability Russia will have become the world leader by 2015 exceeding the current leaders indices in approximately 1.4 times.

In the studied ratings Russia's lowest estimates are connected with such an important factor influencing the information society development as the business environment, the business climate or the economic situation. These factors are the barriers in case of business setting up and dealing, the judicial system independent level, the effectiveness of the legal system when protecting the rights of business in case of its arguing with the government. The second set of indices is connected with the governmental policy in the sphere of ICT development and usage, in the sphere of the information society development. In spite of a rather great amount of executed actions of the authority body's sides, that started with adopting the information society development strategy, the national plan development, a big quantity of steps aimed at the e-government development, state programs in the area of e-education, e-health care, state policy estimation following the IT sector development stimulation and the ICT usage to increase Russia's competitiveness, are rather low.

The globalization processes is turning the e-business into the most important factor of the regional development without which the full-fledged integration of business agents into the whole information space is impossible. The necessary component of the organization and economic model of the regional e-business is the appearing mutual integration of the traditional business activity agents within the virtual space. So by actively developing interconnections they form the regional e-business structure. On the one hand it is integrated with the external environment and on the other hand it is characterized by specific features on the regional level by providing the formation of flexible internal combinations of the interconnection between the partners based on the factors standards and rules (institutes) record that are traditionally formed on the given territory.

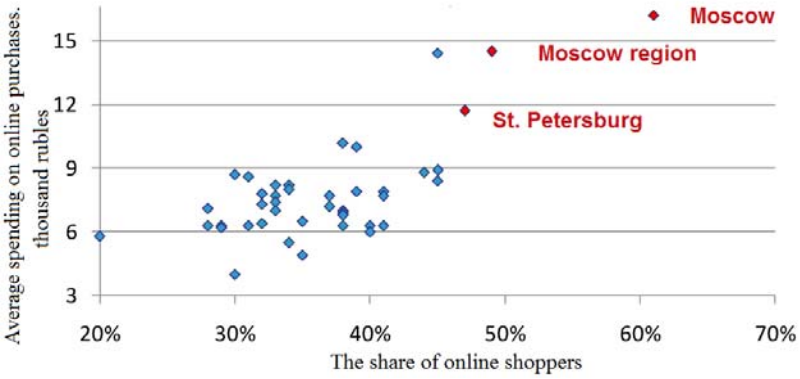

Fig.4. The share ratio of the online buyers and average expenditures size

The researches point out the high activity irregularity on the Russian e-business market. Nowadays 46% of the Internet buyers live in cities with the

population more than 1 million people (or 28% of all the Internet audience of Russia). At the same time 60% of the total e-commerce turnover falls to their share. The gap in the types of the e-commerce markets is mainly explained by the lower income level and relatively small experience of the Internet usage in regions. Thus the average bill of a user from Moscow was 15.8 thousand rubles in 2010, in Saint Petersburg it totaled 11.7 thousand rubles, and it the regions it accounted 6.7 thousand rules (see fig. 4).

Outside Moscow and Saint Petersburg the leaders in terms of the Internet buying are Yekaterinburg, Novosibirsk, Nizhny Novgorod, in terms of online buying the top cities are Tomsk, Yekaterinburg, Khabarovsk, in terms of average expenses for online purchases such cities as Surgut, Vladivostok, Yekaterinburg are the leading ones. At the same time the differences between the regional centers are less sizeable than their total lag from Moscow and Saint Petersburg. For example Yekaterinburg is worse than Saint Petersburg in terms of the market volume in 4-5 times. But in the developed countries the lag of the e-commerce development in cities and regions is considerably less. Thus in Great Britain London exceeds all the other regions of the country only in 20 %.

The regions go behind in those commodity groups, in which there is a shortage of local online shops because of complex logistics. In the regions the most popular segments are those that exist in the Internet and have a rather wider range as well as the strong positions of the federal Internet shops (see fig. 5).

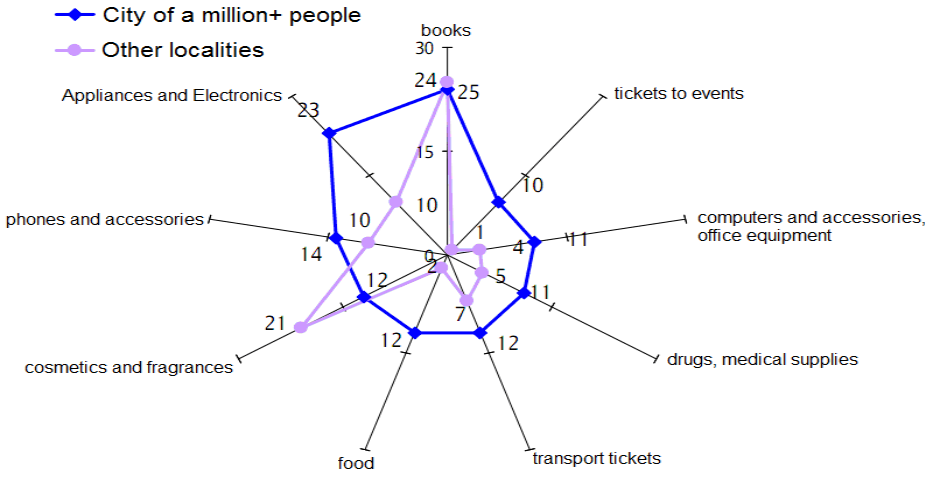

Fig.5. The regional differences of the Russian e-commerce market (% of the number of buyers in groups) [3]

The cluster analysis carries out in the Statgraphics packet on 35 different indicators that characterize the involvement level of business, population and state authority bodies into the e-business environment allowed revealing 5 groups of the regions united into the well observable clusters (see fig. 6).

As the nearness measure the Euclidian distance has been chosen, which is the most applicable for the general case. It is the simple geometric distance in the multidimensional space:

$$d_{E_{ij}} = \sqrt{\sum_{l=1}^{m} (x_i^l - x_j^l)^2} \quad (1)$$

In order to unite the researched objects into the clusters the Furthest Neighbor Method has been used, the criterion is the distance between the most remote objects of classes:

$$p_{\max}(K_i, K_j) = \max_{x_i \in K_i, x_{ji} \in K_j} p(x_i, x_j) \quad (2)$$

From the point of the enterprise financial soundness analysis some additional effects from accessing the e-business environment can be created at the expense of overhead charges cutting when decreasing transaction and managerial expenditures and speeding up the funds turnover when cutting middlemen's chains. According to different estimates business electronic technologies allow companies of different branches cutting costs from 2 to 50%.

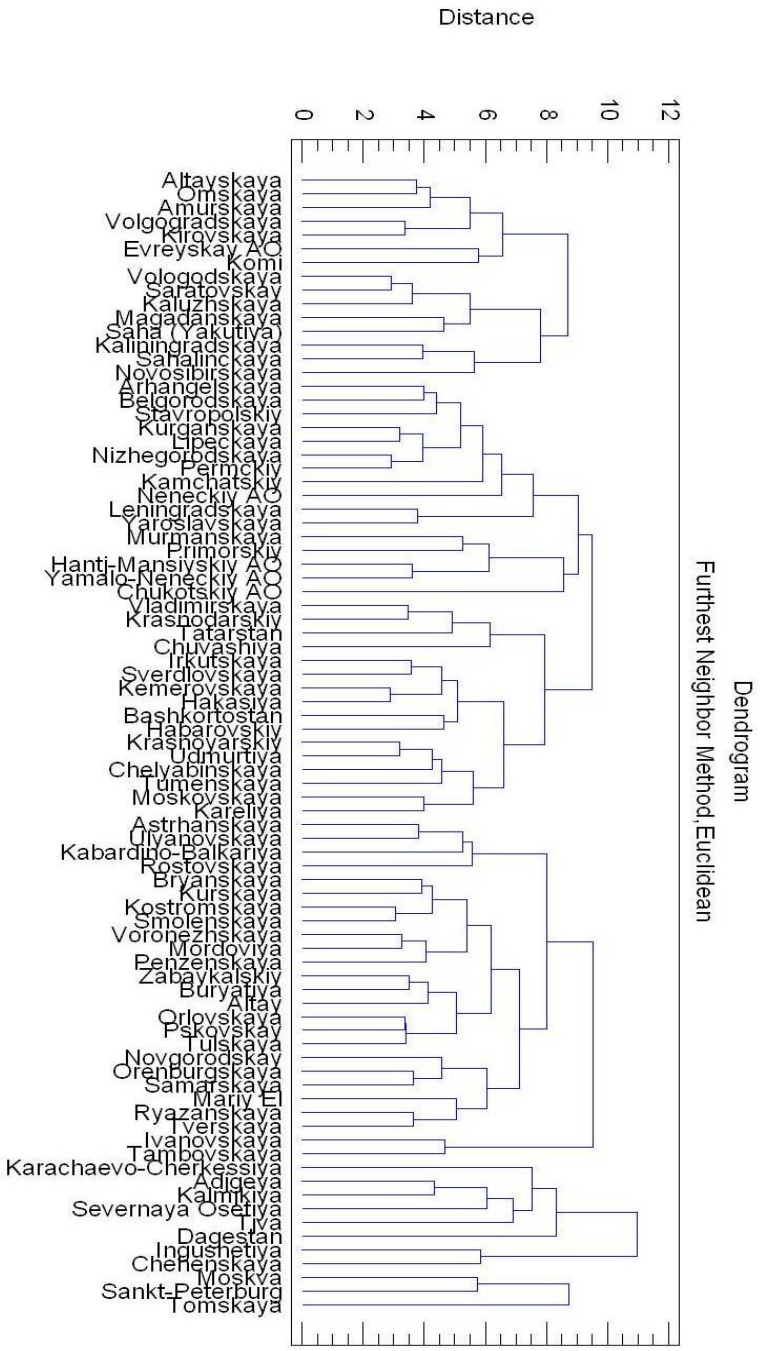

Fig.6. The regions distribution dendrogram in terms of indices of the involvement into the e-business environment

In order to estimate the e-business efficiency the additional income change function should be introduced, which is formed as a result of undertaking electronic component influencing, to the total costs to carry out the e-undertaking:

$$q = \frac{\Delta P}{C_{ЭБ}} = \frac{\Delta N_{Э} \cdot (p - (1-\kappa) \cdot c)}{\gamma \cdot C} = \frac{(\eta - 1) \cdot (1 - (1-\kappa) \cdot \mu)}{\gamma \cdot \mu} \qquad (3)$$

where $\eta = (N + \Delta N_{Э}) / N$ – the sales volume increase factor that is subject to the additional sales by using the e-channel;

c – the total specific cost;

k – the costs cutting factor when choosing the e-business system;

$\gamma = \frac{C_{ЭБ}}{C}$ – the e-business costs share in the company's total costs;

$\mu = \frac{c}{p}$ – the specific cost share in the product price.

Table 3. The values of the additional income to the e-business costs q ratio at μ =0,85 and k =0,05

γ \ η	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9
1,1	0,23	0,11	0,08	0,06	0,05	0,04	0,03	0,03	0,03
1,2	0,45	0,23	0,15	0,11	0,09	0,08	0,06	0,06	0,05
1,3	0,68	0,34	0,23	0,17	0,14	0,11	0,10	0,08	0,08
1,4	0,91	0,45	0,30	0,23	0,18	0,15	0,13	0,11	0,10
1,5	1,13	0,57	0,38	0,28	0,23	0,19	0,16	0,14	0,13
1,6	1,36	0,68	0,45	0,34	0,27	0,23	0,19	0,17	0,15
1,7	1,59	0,79	0,53	0,40	0,32	0,26	0,23	0,20	0,18
1,8	1,81	0,91	0,60	0,45	0,36	0,30	0,26	0,23	0,20
1,9	2,04	1,02	0,68	0,51	0,41	0,34	0,29	0,25	0,23

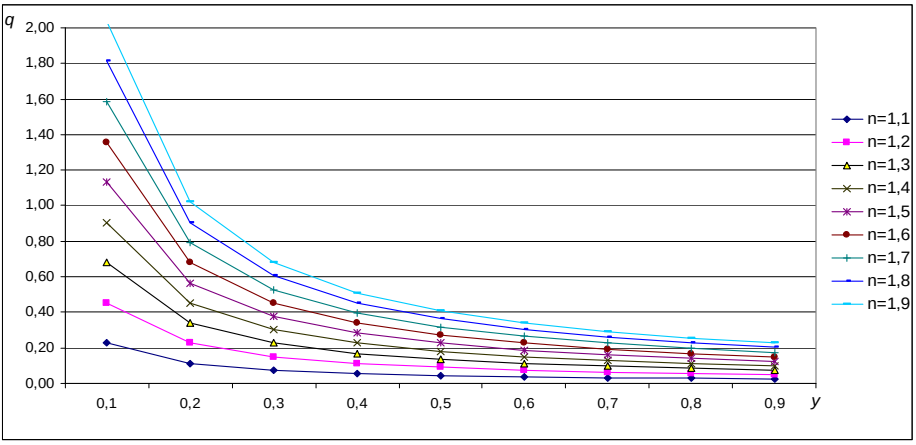

Fig. 7. The types of the curves of the additional income to the e-business costs q ratio values

The drawn corresponding types of the curves of the additional income q function based on the table 3 data with the help of the parameters of sales volume growth factor η allow defining the e-business efficiency for the chosen costs level to carry out the e-business.

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IT and Corporate Governance: the Case of Continuous Monitoring of Internal Controls Over Financial Reporting in an Italian Medium-Sized Company

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Abstract. This paper aims to analyze the academic and professional utilization of continuous monitoring (CM) with subsequent tentative implementation in a medium-sized Italian company. Recent regulatory changes in corporate governance have led to a growing attention to audit work, with new levels of responsibility for auditors and the need for effective corporate internal control. In general, however, this statement applies to large public companies. This research focuses on the possible role of CM in private small and medium-sized enterprises (SMEs) given the current social and corporate culture, which has been influenced by recent developments in information technology (IT). In the Italian institutional setting, the study focuses on the possible role of CM techniques in the system of internal controls over financial reporting. The primary research questions are as follows: (1) Are recent regulatory changes related to corporate governance creating opportunities to implement the CM approach? (2) What are the obstacles to applying the CM techniques in the Italian corporate governance model and the market for audits of accounts? and (3) What is unique about applying CM to small and medium-sized organization in the current IT environment? Using a case study method can provide initial answers to those questions and indicate possible firm-level benefits of CM (i.e., efficiency, better decision making, and cost savings) as well as benefits for stakeholders (i.e., more reliable financial reporting).

Keywords: Continuous monitoring, internal control systems, accounting information system, financial reporting; continuous auditing, corporate governance, SMEs.

1 Introduction

It is widely accepted that business organizations are affected by their environment. The term "environment" includes various aspects, including political, cultural, social, economic, financial, regulatory, and technological dimensions. From the corporate law perspective, it is significant that the regulatory context is essentially constantly evolving through European Union directives and recommendations and through

reforms of domestic legislation that are intended to improve corporate governance and protect the interests of different stakeholders: shareholders, employees, and creditors. Some of the recent changes emphasize the role of the "internal control system" in the process of producing financial reporting (e.g., in the U.S., the Sarbanes Oxley Act of 2002, section 404). We focus on this factor in evaluating the framework for more effective corporate governance, including internal and external monitoring actors (boards of directors, boards of statutory auditors or supervisory boards - *collegio sindacale*, internal auditors, and external auditors). Among these actors is information technology (IT), including both its technological and informational aspects. In combining the legal requirements regarding internal control systems with the benefits offered by IT, a business organization can effectively react to the information age.

In fact, business organizations and internal communications are inevitably immersed in a process of change that derives from the opportunities offered by IT resources (e.g., enterprise resource planning – ERP – or the Internet). In general, large companies are interested in this change process, which also has consequences for the role played by financial and management accountants in the profession and in the relevant research [14]. The process of wealth creation is also affected by IT, which affects production, financing, distribution, and human resources. A wide array of examples of companies who manage key processes in real time are reported in Vasarhelyi, Alles, and Williams [15]. These authors also show that internal control systems for financial reporting, whether simple or sophisticated, are an example of this trend. Corporate control systems for production, marketing, and research and development have also been developed and automated. As the latter change has occurred[1] and most corporate control systems have become less directly observable, the need to monitor these systems has emerged. This monitoring[2], a progressively important activity, is now called continuous control monitoring (CCM) [1].

The case study that we present in this paper is a good experimental setting for at least two reasons. First, this company (Ceramica Catalano S.r.l.) has recently invested in developing an automated production process, with a strong emphasis on the quality of the end product. This cultural and technological emphasis allowed us to focus on additional aspects of the firm that were linked to operational and financial monitoring. We intend to explore the specific impact of continuous monitoring (CM) technology for internal control systems as a means of obtaining better-quality information, improving management accounting tools, and consistently taking advantage of IT innovations. However, such systems may be risky if these internal mechanisms are not fully integrated (or accepted) into the corporate culture. This lack of acceptance would reduce the advantages of the flexibility derived from IT innovation.

The second reason is the shift in interest from large corporations to small and medium-sized enterprises (SMEs). The latter are important in the European Union (EU) and in the economic context of Italy. More than 99% of all European businesses are, in fact, SMEs. Such firms provide two out of three private sector jobs and

[1] Configurable controls in large ERPs can involve tens of thousands of basic actions, many of which users can adjust.

[2] Such monitoring is intended to ensure that the control systems are active and effective.

contribute more than half of the total value added created by businesses in the EU. Moreover, SMEs are the true backbone of the European economy, as they are primarily responsible for wealth and economic growth and also play a key role in innovation and R&D[3]. The literature has revealed that SMEs address IT in specific ways depending on the organizational context [11]; moreover, the acquisition of IT in SMEs mainly occurs through program management outsourcing and depends heavily on external expertise [9].

The case study is founded on the view that the role of human resources inside an organization remains crucial in helping the firm to manage the transition to a dynamic information system and a CCM approach. Any IT innovation requires high-quality labor, regardless of the company size. The fundamental concept is that labor and IT tools work together to improve business performance. The CM of internal control systems for financial reporting is an extension of the changes to other business process (e.g., automated production), and those that have occurred in other spheres of human activity. As Brynjolfsson and McAfee [3] put it, "in medicine, law, finance, retailing, manufacturing, and even scientific discovery, the key to winning the race is not to compete against machines but to compete with machines. While computers win at routine processing, repetitive arithmetic, and error-free consistency and are quickly getting better at complex communication and pattern matching, they lack intuition and creativity and are lost when asked to work even a little outside a predefined domain".

One of the objectives of this research is to explore the benefits of CCM for business processes. Just as the quality of a product depends on the process used to eliminate defects before the product is finished, the quality of financial information depends on the internal procedures used to generate the data. CM is one of the elements of an overall management control system package. In this context, the primary research questions are as follows: (1) Are recent regulatory changes related corporate governance creating the opportunity to implement the CM approach? (2) What are the obstacles to applying the CM techniques within the Italian corporate governance model and within audits of accounts? and (3) What is unique about the application of CM in SMEs in the current IT environment? Using a case study method can yield initial answers to those questions and indicate the possible benefits for organizations using CM (i.e., efficiency, better decision making, and cost savings) and their stakeholders (i.e., more reliable financial reporting).

The remainder of the paper proceeds as follows. Section two describes the Italian institutional framework, considering the role of accounting and the possible contribution of CM in this regard. In this section, we also present the governance model for a private limited liability company in the Italian context, providing a tentative answer to the general question of whether there is space for CM in the Italian

[3] See http://ec.europa.eu/small-business/index_en.htm
According to the European Commission Recommendation of May 6 2003, the category of micro, small and medium-sized enterprises is made up of enterprises that employ fewer than 250 persons and that have an annual turnover that does not exceed EUR 50 million and/or an annual balance sheet total that does not exceed EUR 43 million. Within this category, the Recommendation provides specific definitions of small and micro firms.

regulatory system. In Section three, we present the case study, which allows us to analyze the steps involved in introducing CM procedures and a CM program into the information system at the company that is the object of our research. In this section, we analyze internal control, CM and corporate governance, CM and just-in-time inventories, CM and dashboards, corporate performance reporting, balanced scorecards, online/real-time alerts that allow firms to take timely, efficient action during their operations, and the reliability of the resulting financial reporting. Our conclusions are presented in the last section.

2 The Italian Institutional framework: are there opportunities for CM and CA?

The prospect of implementing the continuous auditing (CA) and continuous monitoring (CM) as part of the corporate governance of SMEs is problematic within the Italian institutional framework for several reasons. CA is assumed to be a continuous verification process for which auditors are responsible, whereas CM is assumed to be a continuous process that is intended to monitor the internal control system used by a firm's management.

One issue, then, is what conditions make these control processes applicable in the context of small organization given that control monitoring does not necessarily require an auditing process but instead could be used regardless of whether there is an external verification process. It is also important to note that the concepts underlying control activities are the same across companies of different sizes, although the documentation can be presented in a simplified form for SMEs [5] [18].

The monitoring of control systems by management is often achieved through the close involvement of the management or the owner-manager in operations, which allows the individual in question to identify any significant weaknesses in the internal control system. An auditor is then required to reveal the main activities used by the company to monitor its internal control system in preparation for financial reporting [5].

The process of applying CA within SMEs requires a clear definition of these systems of corporate controls. Legislative Decree No. 39 of 2010 has unequivocally confirmed that the "control" is an audit process (i.e., a full audit) within all companies. If SMEs did not require "audits", we could not logically discuss CA as a variation on the traditional audit for SMEs.

CA involves the automated, continuous collection of evidence to evaluate the entire system of business transactions rather than to conduct random 'spot checks.' It is obvious that the proper monitoring of internal control systems by management should result in less effort on the part of the auditor. Given these requirements, a precondition for continuous monitoring is the existence of an adequate information system and specifically the administrative and accounting procedures involved in producing financial reporting, which is highly automated.

The Italian regulations (art. 155 Legislative Decree No. 58/1998 and art. 2409-ter civil code) regarding the frequency (at least quarterly) of inspections during the

accounting period are reasonably designed to inform the management and corporate governance bodies of unintentional errors, fraud, and deficiencies in a timely manner and as prescribed by international auditing standard no. 260. The aim is for the firm to be able to take the necessary remedial action before financial statements are involved, thus making the entire audit process proactive in a sense. This periodic verification is consistent with the CA process [16]. However, the implementation of CA and CM requires mostly automated environmental controls that are not always found in SMEs [20].

2.1 Oversight systems in Italian limited liability companies

Following the reform of corporate law, limited liability companies can opt for one of the following three administrative and oversight systems: the traditional (or Latin) model, the two-tier model, or the one-tier model. Within the three models, the oversight function is subdivided into two areas: administrative oversight and accounting oversight. In this paper, we consider the traditional model because it is the most often used by Italian companies[4], including our case study company. We consider unlisted companies to be subject to the regulations of the Civil Code (c.c.).

Italian law permits the so-called two-tier and one-tier models as an alternative to the traditional one only if company statute requires it. If the statute does not stipulate otherwise, art. 2380 c.c., paragraph 1 requires that *administrative and company oversight* be regulated according to the traditional model. Thus, the traditional model seems to be the one preferred by Italian legislators.

Although the administration (the administrative body in this model) also conducts oversight in a broad sense as well as managerial activity, the subjects that are institutionally delegated to supervise the firm are the board of statutory auditors (the internal company body or "*Collegio sindacale*") and the auditor (normally an external body)[5]. In private limited liability companies, the board of statutory auditors is a monocratic internal body called the "*Sindaco unico*".

The former, pursuant to art. 2403 c.c., has the task of controlling "*observance of the law and statute, respect of the standards of correct administration, and in particular the adequacy of the organizational, administrative and auditing structures adopted by the company and its actual functioning*". This is what is referred to as *administrative oversight or substantive legitimacy oversight*. The auditor, pursuant to art.14 of Legislative Decree No. 39 of 2010, is responsible for the auditing, the

[4] See *Il Sole 24 Ore Norme e Tributi* of June 16, 2008 n. 165, which used as its source InfoCamere data as of June 9, 2008.

[5] Unless auditing is by law entrusted to the board of statutory auditors, it is conducted by an external body that, depending on the situation, can be an individual auditor or a registered auditing firm. The statutory board of auditors can also perform the audit in addition to providing administrative supervision according to art. 2409-2, paragraph 3 when the following conditions apply: there is an explicit statutory provision that assigns the responsibility for auditing to the board of statutory auditors, the company does not make use of the regulated equity market, the company is not required to publish a consolidated balance, and the statutory board of auditors is composed only of certified financial auditors.

ultimate aim of which is to evaluate the consistency of the financial statements with the most current auditing standards.

It is therefore clear that one feature of this model is the separation of the auditing function from the so-called administrative oversight function. In fact, the Italian legislation has sanctioned the separation of administrative oversight from accounting oversight (financial auditing). The auditor's report must now, in fact, include the auditing standards used and must describe the nature and extent of the audit, indicating that it has been performed according to auditing standards. It is now certain that the content of the audit is consistent with the international auditing standards (art. 11, Legislative Decree No. 39 of 2010). If the board of statutory auditors at an unlisted company (a *collegio sindacale or sindaco unico*) is in charge of auditing the accounts, the board will be required to perform a full audit[6].

3 The implementation of continuous monitoring procedures in an Italian medium-sized manufacturing company

Continuous monitoring and continuous auditing are emerging in Italy as potential tools that managers and auditors can use to manage their responsibilities within corporate governance [10]. This interest is a function of (1) the development of a culture that is oriented toward improving internal controls and risk management [6][7] and (2) a progressive regulatory push toward ensuring the effectiveness of control activities by supervisory boards (*collegio sindacale*) and statutory auditors.

In particular, in the last decade, a *culture of internal control* has become widespread in listed companies, which have been called upon to comply with certain rules to regain and ensure investor confidence, especially with regard to system management risk and internal controls over the financial reporting process. In fact, the corporate governance standards of Italian listed companies [2] in terms of internal control are consistent with international best practices [4], [7]. In unlisted companies, however, there is an awareness of the issues regarding internal control that have been generated by the introduction of laws regarding administrative liability for firms (Legislative Decree No. 231 of 2001). This particular law requires the development and adoption of a model of risk management for preventing crime, including financial infractions (e.g., fraudulent financial reporting). However, the constant improvement of internal controls has become standard even in unlisted companies, as administrators need to be familiar with and assess the components of internal control within their organizations.

Regarding the *effectiveness of control activities*, it is important to note that for unlisted companies, recent regulatory changes have imposed a new framework of internal controls that influence the corporate responsibility of supervisory boards (*collegio sindacale*) and statutory auditors. In particular, as part of its administrative supervisory function, the supervisory board (*collegio sindacale*) is required to monitor

[6] In the other corporate governance systems, the actors that are institutionally required to conduct the financial audit are always represented by the appointed external auditor.

and release periodic reports on the reliability of the organization given the size and the complexity of its business. The parameters on which the organizational structure of the company is evaluated are accountability, separation of duties, checks and balances, the security and functionality of the information system, and monitoring mechanisms for internal control activities used to oversee the company's accounting system.

The new statutory audit regulations make it mandatory to carry out audits based on the principles of review; the evaluation of the internal control system during each phase of the audit process (planning, performing verification, opinion) is required. Continuous monitoring and continuous auditing could therefore be helpful for Italian unlisted companies; in these firms, strengthening the understanding and evaluation of internal control systems is an ongoing challenge for both boards of directors and auditors.

To analyze the potential of continuous monitoring and continuous auditing in unlisted Italian SMEs, we have used the case study method [17] [23] [24]. The case studies analyzed in this paper originate from a research project entitled "Process innovation and continuous monitoring" that was launched in early 2012 by the Department of Economics and Management at the University of Tuscia - Viterbo and the company Ceramica Catalano S.r.l.

For several years, the Department of Economics and Management has tried to develop models of control of production processes that make it possible to monitor costs simultaneously and thus determine the relationship between the yield and the profitability of production processes and products, particularly in the ceramic industry [12].

Ceramica Catalano S.r.l. is an Italian bathroom furniture industry that was founded in 1967. The company sells its products in more than one hundred countries around the world and stands out compared to its competitors in terms of the quality and design of its products [8]. The project is intended to analyze how ceramic production processes interact with a highly automated information system and accounting system and to evaluate the potential to develop a flow of information that would be typical of continuous monitoring.

In addressing what is unique to the use of CM in SMEs in the current IT environment, we have asked the following detailed questions:

(1) What are the conditions that make it possible to begin a continuous monitoring process in an Italian manufacturing SME?
(2) What are the steps in the technical implementation of continuous monitoring, and what management areas are involved?
(3) What opportunities for continuous auditing may also be related to the financial reporting process? [13]
(4) Who could benefit from the use of the information provided by continuous auditing?

We have conducted our research by analyzing the company's internal control system, gathering evidence, analyzing databases, conducting observations, asking questions and conducting case reporting. Our findings and analysis are summarized in the subsequent sections.

3.1 Conditions for the adoption of CM in Italian SMEs

Regarding the conditions that allow the introduction of continuous monitoring, in addition to those described in section 2, we should also comment on specific issues that affect Italian manufacturing SMEs. The governance of these companies is characterized by poor separation between the owners and the administration or management [21], a strong link with local industrial district, a control environment in which the opposition between managers and controllers is limited, and weak formalized systems of internal control and risk management exist.

Continuous auditing techniques can be adopted by firms characterized by the following:

- A corporate culture that extends beyond "family" relationships between owners, managers and employees and an internal control environment characterized by ethical values and rules that ensure professional governance and performance evaluations, transparent operations and a robust financial reporting system;
- A corporate information system that is able to collect, store, process and distribute data using an advanced computer system that can conduct continuous monitoring. Such a system will allow the management to continuously analyze their compliance levels and the performance of their business processes with reference to their expected levels of efficiency and effectiveness.

For these reasons, it was appropriate for us to select Ceramica Catalano S.r.l. as our case study firm. With regard to the firm's corporate governance and control environment, the following information is relevant:

The firm is a limited liability company whose administration is entrusted to a board of directors that consists of three members and delegates authority to a single executive director, the CEO. The CEO is a minority shareholder of the company. The control function is entrusted to a supervisory board (*collegio sindacale*) that is also in charge of the statutory audit process. There is no an audit department. The company is owned by 25 share holders, all of whom are employees or ex-employees of the company; no one directly or indirectly holds the majority of the shares. The company's production site is in Italy, in the ceramic district of Civita Castellana in the province of Viterbo, and the firm employs a highly automated production process. The company has developed a quality manual and uses processes that are ISO 9001:2008 certified. The firm also constantly attempts to ensure the environmental sustainability of its production processes and its products.

In recent years, in developing its corporate information system, the company has invested significantly in production technology by developing industrial synergies with major production facilities in the ceramic field. These investments have resulted in the highly organized, automated processes that the firm uses today, which are supported by software programs that can generate both qualitative and quantitative information for each individual phase of the production process.

The company has not yet adopted an ERP solution [19]; it relies on a management reporting system that is based on database processing according to the information needs of the individual management areas (production, sales, administration, and payroll). At the end of 2011, the company had approximately 270 employees and had

annual sales of approximately € 400 mln., selling its products in more than 80 countries. This productivity has made Ceramiche Catalano S.r.l. the largest exporter of bathroom fittings made in Italy.

3.2 Steps for developing a continuous monitoring approach

In this sub-section, we analyze the phases of development for CM. The starting point for our research is the analysis of production processes (I), from raw materials to finished products, including the design phase. The analysis process, when carried out in a timely manner, can determine the performance of each process relative to the resources utilized. The analysis makes it possible to link the results obtained during the individual steps in the production process to the different types of costs (direct and indirect) of the product. Generally, in traditional accounting systems, indirect costs are charged to cost centers in aggregate and are assigned to specific activities within the production process.

After the above analysis, one can continuously identify the trends in the process (II) with reference to production and costs. In this context, it is necessary to identify the key controls, both in terms of the yield of the production process (the quality of the product in the processing phase) and the efficiency of the activities (the cost during the processing phase). This analysis will make it possible to develop a CM system that can improve planning and control.

The monitoring system should be based on a reporting system (III) that is capable of measuring the previously identified indicators. These include

- the cost of the product and the batch according to the ABC method [22];
- the number of non-conforming products (defective products, repaired products, II choices) in each stage of processing;
- the cost of non-compliance in each stage of processing;
- deviations from the standard costs and budget; and
- financial analysis scenarios.

It is then necessary to identify the users and to determine the format and frequency of the reported information. The purpose of reporting within information systems is to provide analytical documentation on meaningful activities. Such disclosures should be as updated and correct as possible and therefore should not generate inconsistent interpretations.

After the above activities have been completed, the aim is to re-design the IT system (IV). In this way, for "every point in time," the company can identify the cost of each product and its contribution to the operating results in all phases of the process, taking into account deviations, the causes of variations, and the impact on the marginal product.

The start of CM is linked to an architectural approach within the information system. The firm must consider the following questions:

- What database (DB) should be used? In our case study, the company uses a transactional database that can, in turn, be used to develop an analytical DB or ERP system, possibly supplemented by external data sources and processes (associations, institutional databases, market analysis, or others).

- What tools provide the information? CM requires a firm to use the reports prepared by the transactional database as well as new forms of communication through reports, dashboards for workstations and mobile devices, or multidimensional cubes processed by analytical databases or data warehouses.
- What security and assurance systems should be used for the data? Data security is a significant challenge: more information generates more value for those who use it, but confidential data also generate risks and have legal implications. To ensure the reliability of the data, CM must be supplemented by data validation mechanisms that can provide an adequate level of assurance. In addition to periodic checks that indicate the reliability and security of the software, warning indicators can be provided for continuous data assurance.

Once the system is in place, CM will allow the company to constantly monitor the system of production and will provide dynamic information on compliance with production standards and budgets. The benefits of implementing the continuous monitoring approach for Ceramica Catalano S.r.l. could include the following:

- leveraging technology and automation to identify and quantify the risks associated with the process;
- creating dashboards for monitoring risk and performance;
- taking immediate action in high-risk areas to achieve planned levels of performance;
- improving internal controls by using continuous dynamic information rather than static analysis;
- performing targeted testing to assess the effects of risk processes;
- communicating the results of the monitoring process within the organization to raise awareness among employees and suppliers about the characteristics of specific manufactured goods.

Strengthening the above knowledge will also allow significant improvement in existing products and processes. This procedure is therefore intended to help firms design, establish and apply a model of internal control for their industrial processes that allow effective monitoring and efficient performance. This management tool can be considered an innovation in the management of production systems in the ceramic industry.

Consistent with this statement is a recent document released by the *Consiglio nazionale dei dottori commercialisti ed esperti contabili* (the Italian CPA institute) on "The application of international auditing standards to SMEs" [5] that addresses evaluation and monitoring tools adopted by audited companies. In particular, regarding the planning of statutory audits and the assessment of control risk, the document indicates that "*the monitoring of controls is a process over time to evaluate the effectiveness of internal control system. This activity consists in the timely evaluation of the effectiveness of controls and in taking the necessary corrective actions. The management is monitoring of controls through ongoing activities,..... The auditor obtains an understanding of the main activities used by the company to monitor the internal control over financial reporting and writing in particular those concerning the control activities relevant to the review, and includes how the company takes corrective action with respect identified weaknesses in their controls*".

Document [5] indicates that, regarding compliance procedures, "*the auditor may obtain audit evidence to determine whether changes were made to the automated control that affect the continuous and effective operations*". Clearly, continuous auditing is not directly referenced here, but it is recognized that CM could be a significant element of the internal controls used by SMEs. Another useful document is a questionnaire that auditors used to address internal control systems, no.10 [5], which determines whether there is a series of internal controls in place to oversee the reliability of financial statements.

Table 1 indicates that in the case study analyzed, some controls can be effectively made automatic. However, this is not the case for others because of concerns regarding continuous monitoring; for now, only the accounting related to the production areas (passive cycles, fixed assets and inventory) can be addressed in this manner. In the last column, we indicate the frequency of the checks.

Table 1. Applicable automatic controls according to the CDNC questionnaire on the internal control systems for statutory audits in SMEs

Control activities	Automatic key controls	Frequency report
PROCURE TO PAY		
• All purchases are authorized	applicable	daily
• We accept only the goods and services ordered	applicable	daily
• The receipt of goods and services is adequately monitored	applicable	weekly
• Returns and claims against suppliers are monitored	applicable	weekly
• Invoices are properly reviewed and approved	applicable	weekly
• All purchase transactions made are recorded	applicable	monthly
• Purchases are recorded as they are received	applicable	monthly
• Payments to providers are properly authorized and recorded in a complete and accurate manner	applicable	daily
FIXED ASSETS		
• The existence of fixed assets and their physical and operational status are periodically checked	applicable	½ annually
INVENTORY		
• Work in progress is monitored	applicable	quarterly
• Inventory that is obsolete, slow moving or overstocked is identified	applicable	quarterly
• The unit costs of the inventory are properly determined	applicable	quarterly
• Inventories are valued correctly	applicable	½ annually

Obviously, the use of automatic controls and their reliability is linked to the risks associated with IT systems. For this reason, systematic assessments of the reliability

of the IT environment are required. Relevant considerations include whether off-the-shelf software is used, how data and systems are accessed (authentication and credentials), the appropriateness of the authority levels assigned to various users and of their roles and responsibilities, and the physical security of the servers. Understanding these issues is essential to understanding and evaluating the reliability of an IT system.

Finally, it is important to consider the corporate actors that can benefit from the CM approach. The *board of directors and CEO*, who will have access to an immediately usable tool for firm governance, are among these actors. Other affected actors include *departmental managers*, who will have the real-time information that they need to act in critical business areas and an information system accepted by the entire organization, as well as the firm's *supervisory board (collegio sindacale)*, which evaluates of the functioning of the internal control system and the evolution of the firm's performance management. Because this board is in charge of the statutory audit process in our case study firm, it may enjoy a higher level of confidence in the accounting information used in the budget management process, undoubtedly influenced by the controls used in CM.

4 Conclusion

In addressing the impact of recent regulatory changes on corporate governance and the creation of opportunities to implement the CM approach, we have focused on two main issues: a) the new statutory audit law (Legislative Decree No. 39 of 2010) and b) the increase in the responsibility of managers for the actual functioning of the internal control system (Legislative Decree No. 231 of 2001). Overall, the Catalano S.r.l. case study shows the relevance of CM. Managers understand the need for CM and its potential benefits as well as the main key risk indicators related to operations management.

The case study shows that the most significant challenge to the application of CM within the Italian corporate governance model is the level of informatization of business processes. The investments in innovations in production processes that the company made in recent years have allowed CM techniques to be used that otherwise could not have been. Moreover, CM is perceived by the management as a tool for corporate governance that can also improve competitiveness.

Regarding what is peculiar about the use of CM in SMEs in the current IT environment, the case study shows that only certain conditions allow the implementation of CM processes. The firm must have an adequate "corporate culture" and "information system," as described in section 4.1. In Catalano s.r.l., CM will be actively used to assess production, control product quality, and evaluate the economic performance of the related process. (These are key performance indicators.)

The case study confirms that CM could be used in the financial reporting process. In particular, CM should improve the reliability of the financial data related to the production process.

Because this research is in the initial phrase, this subject will require further analysis. At the end of the CM project focused on Catalano s.r.l., off-the-shelf software could be developed that would be useful to other companies in the ceramic production industry.

This research (1) contributes to an initial discussion of the potential implementation of CM in SMEs given the Italian legal framework and the links with the traditional management control systems; (2) discusses the operations management tools for SMEs and their possible benefits for firms, as well as how a culture of CM and performance measurement can be generated within the ceramics industry in the province of Viterbo; and (3) provides evidence of the possible benefits of CM and thus encourages government policies that would incentivize the use of new IT tools by SMEs in management and control processes.

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Special Economic Zones in Russia as an Instrument of IT Potential Enhancing

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Abstract. This article is dedicated to the analysis of effectiveness of special economic zones (SEZ), a rather new, but promising phenomenon in Russian Federation economy. It includes general analysis of SEZ, its reaction to the world financial crisis, analysis of innovation implementation SEZ (II SEZ), and, in particular, its IT-potential. At the end, the cases related to IT products realized in these zones are described and some economic and financial indicators suitable to describe the dynamics of development of these agglomerations of IT enterprises are given.
Keywords: Special economic zones, innovation implementation special economic zones, innovation, information technologies, high-tech, investment.

1 Introduction

The worldwide economic crisis in late 2007 is still going on in many countries. It has made more acute the problem of the relationship between innovation, economic growth and the impact of economic recessions. Known theories of economic growth [32, 35] deliver different hypotheses on the impact of economic crises on innovation; on the one side economic recession have a negative impact on innovation activities in firms by decreased demand and complicated access to capital and other resources. On the other hand, economic recessions might also represent new opportunities and a fertile environment for innovation. The economic crisis in general represents both destruction of an established techno-industrial paradigm and new opportunities and new solutions through adaption to new contexts and markets. It is possible to realize growth through crisis, amongst other through creating favorable conditions for innovation. But at the same time, crisis represents a high degree of uncertainty and instability that might deter firms from investing in innovative activities [33, 34].

Characteristics of the national innovation system of many European countries explain the serious impact of the economic crisis on innovation in its beginning. Policy responses were concerned with supporting innovation systems and developing innovation capacity, such as improving infrastructure, public investments in R&D and innovation, investment in education and training at all levels, as well as demand oriented innovation policies, including public procurement, financial support to

SMEs, venture capital and, an important factor, policies aimed to enterprises agglomerations development. They are seen as a part of the national strategy for coping with the effect of the financial crisis in many countries, partly because the industries involved in such programs represent industries oriented towards global markets that were most affected by the crisis.

This article is dedicated to the analysis of effectiveness of special economic zones (SEZ), a rather new, but promising phenomenon in Russian Federation economy. It includes general analysis of SEZ, its reaction to the world financial crisis, analysis of innovation implementation SEZ (II SEZ) and, in particular, its IT-potential.

2 Special Economic Zones in Russia

Special economic zones in Russian Federation started its development since the approving of the Federal Law about SEZ N° 116 (22.07.2005). According to this law, a special economic zone is defined by the Government of Russian Federation as a part of territory of Russian Federation which provides special conditions for economic activity conducting. These conditions include tax benefits and various preferences (for example, "one window" principle), well-developed infrastructure, location (for II SEZ, for example, it is very necessary to be close to universities, research institutes and, as a result, to have highly skilled workforce).

Today in Russia 25 SEZ of four types operate: industrial and manufacturing SEZ (4); tourism/recreation SEZ (14); port SEZ (3); innovation implementation SEZ (4). They host 308 resident companies [1], which distribution is represented below.

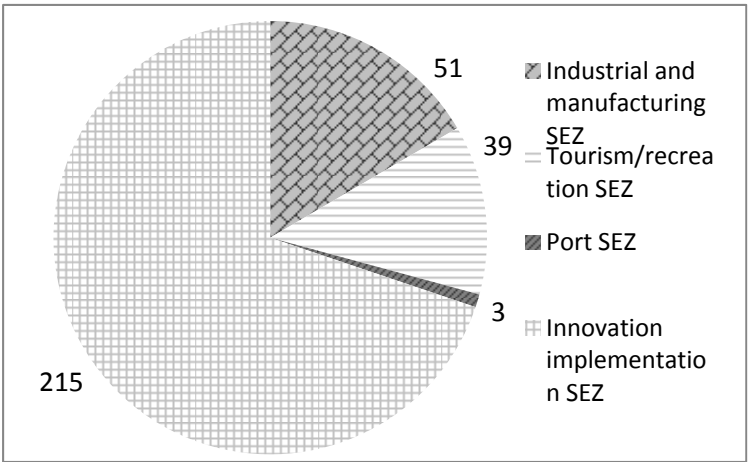

Fig 1. Distribution of residents by SEZ

In the first three years 143 resident were registered and since the end of 2008 to the middle of 2010 102 new resident companies (81 of them only in II SEZ) were registered which represents a positive trend. It means that despite the crisis, residents decided to continue to operate. Nowadays 44 residents operate with foreign

investment from 20 countries [3]. It is vital to add that most of all residents are working now in innovation implementation special economic zones. To sum up, the dynamics of arriving residents, the amount of financing (by government and private investors), continuous presence of companies with foreign capital allow to affirm that SEZ were not seriously subject to effects of financial crisis.

Table 1 [2]. Dynamic of main indicators of functioning of SEZ in Russia from 2006 to 2011 and a forecast.

Year	Residents (new residents per year)	Volume of investment of residents, million USD	Work-places in SEZ	Total value of realized products and services, million USD	Volume of planned government investment, million USD	Volume of realized government investment, million USD
2006	9 (9)	0	400	0		
2007	39 (30)	~ 308	1200	~ 38,6		
2008	120 (81)	~ 700	5800	~ 467		
2009	178 (58)	~ 946	10024	~ 980		
2010	236 (58)	~ 1145	16098	~ 1538		
2011	308 (72)	~ 1872	21603	~ 1958		
2012	308 (0)	-	-	-	~ 4266[1]	~ 1400[2]
2025[3]	> 1500	~ 28700	>195000	> 167000		

3 Innovation implementation special economic zones

Innovation implementation special economic zones are located in the cities Dubna, Tomsk, Zelenograd, and Saint-Petersburg.

3.1. Special economic zone “Dubna”

Innovation implementation SEZ “Dubna” is located in Dubna (about 100 km from Moscow). It is the large science city of Russian Federation. The total area of SEZ is 187,7 ha and it is divided into two parts: Russian center of programming – 135,7 ha and the new industrial zone – 52 ha. The priority spheres of SEZ functioning are given by information technologies, nuclear physics and nanotechnologies, bio- and medical technologies and complex technical systems design.

According to [4], partition of resident companies (82 in total) in accordance to the priority spheres of development is as follows:

[1] Except tourism and recreation SEZ

[2] Except tourism and recreation SEZ and port SEZ

[3] Forecast values

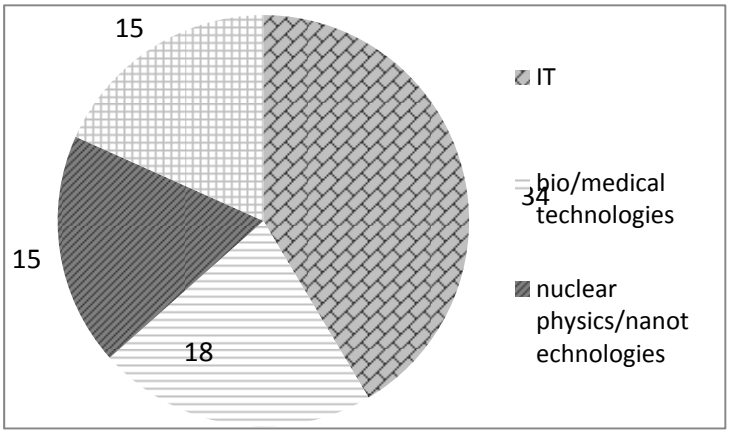

Fig 2. Partition of SEZ "Dubna" residents by spheres

The dynamics of "Dubna" residents is shown below:

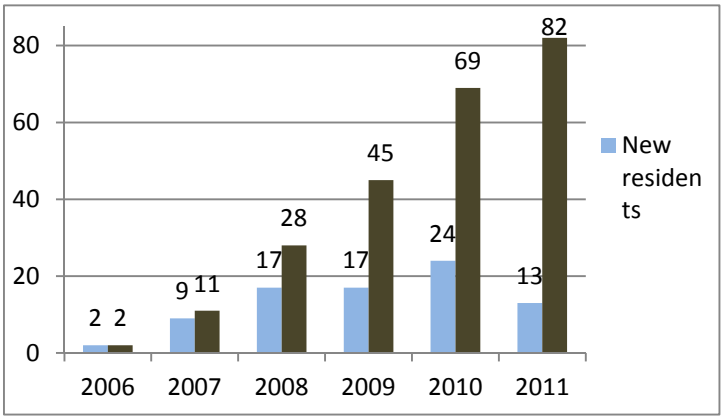

Fig 3. Dynamics of residents in the ZES "Dubna".

Dubna is one of the most important science cities in Russia. For this reason there is a good opportunity for residents to hire qualified staff, for SEZ to develop. 13 000 people of 70 000 (entire population of Dubna) are university graduates. About one-third of economically active population works in science and industrial sphere [5]. Besides, in Dubna the Joint Institute for Nuclear Research (JINR) is active. It is the world's most famous research center which collaborates with universities and scientific organizations all over the world. The system of higher and professional education is represented by International University of Nature, Society and Man "Dubna", Moscow State Institute of Radio Engineering, Electronics and Automatics (Technical University) (Branch in Dubna), University of the Russian Academy of Education (URAO) and Institute of Nuclear Physics, Moscow State University.

SEZ in Dubna represents a perfect environment for realization of ideas from research institutes and universities of one of the best science cities of Russia. At the

moment there are 82 companies and it is the highest number of residents in all Russian SEZ. If investors prefer to invest there, it means that there are conditions required for successful entrepreneurship. This SEZ is really close to Moscow and for this reason both advantages and, unfortunately, defects of such a "neighborhood" are being observed. By defect we mean an unpleasant episode occurred in this SEZ and taken under control by government bodies: the Management Company of SEZ "Dubna" (joint stock company "Special Economic Zones") placed elevate volume of financial means on deposit under the bank interest which was much lower than the average indicator for such activities. It demonstrates that geographical nearness of economic activity to the capital is not always a positive issue but may also contain negative sides.

3.2. Special economic zone "Tomsk"

This SEZ is located in the geographical center of Siberia and it is very important for regional economy, for transition from a centrally planned economy, when common economical activities took place mostly in European part of Russia, to a more balanced economy and as a result more harmonious regional development. The territory of SEZ is divided into two parts: "Severnaya" ("Northern", 14,6 ha) and "Yuzhnaya" ("Southern", 192,4 ha). The priority spheres of activities are represented by information technologies and electronics, medicine and biotechnologies, nanotechnology and new materials and energy-saving technologies.

According to [6], the partition of resident companies (60 in total) in accordance with the priority spheres of development is as follows:

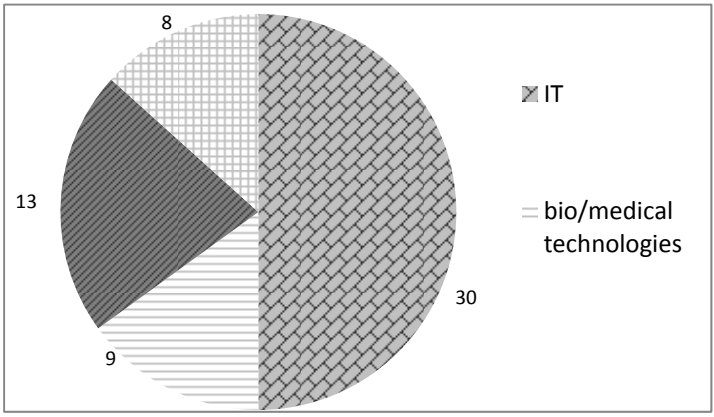

Fig. 4. Partition of SEZ "Tomsk" residents by spheres

The dynamics of "Tomsk" residents is shown below:

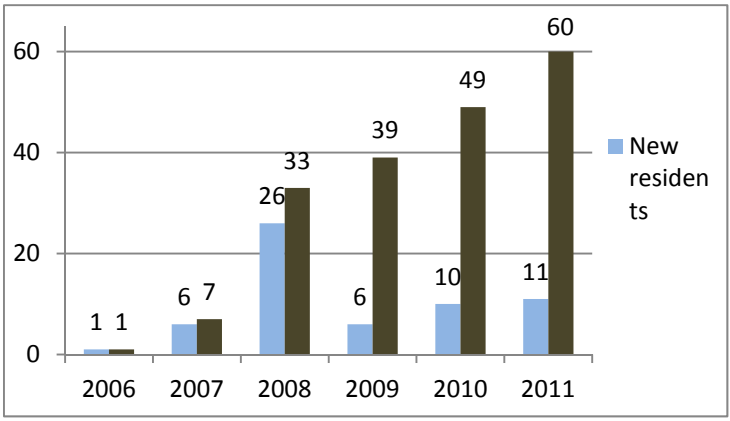

Fig. 5. Dynamics of residents in the ZES “Tomsk”.

Tomsk is a large educational and innovative center of Siberia region characterized by the access to highly qualified workforce thanks to the presence of Tomsk State University, State Medical University of Siberia, Tomsk Polytechnic University and Tomsk State University of control systems and radioelectronics. Tomsk region leads in the ranking of innovative activity realized by fund "Petersburg politician", the Russian Academy of National Economy and Public Administration under the President and the newspaper RBC daily. Percent of researchers among the economically active population in Tomsk (150 people for every 10 000 of working population) is higher than the average indicators not only in Russia (69), but also in countries such as USA (61) and Japan (102) [7].

“SIBUR Holding” invested in the largest in Russia research center for chemical technology Limited Liability Company "Scientific research organization TomskneftehimSibur" (NIOST) within 6 years about 1,3 billion rubles (43,5 million dollars). In this case, saving is more than 400 million rubles (13,5 million dollars) (about 30%). NIOST is a resident company of SEZ “Tomsk” [8]. It shows once again the effectiveness of tax benefits and preferences which are taken place in SEZ.

Actually, there are 60 resident companies in “Tomsk” SEZ [10]. Only in SEZ “Dubna” the number of residents is higher, but the average number of employees in companies registered in “Tomsk” is higher than in “Dubna”. The amount of financing is high and the number is not a maximum this zone can absorb. However, nowadays potential of this zone is really high. Besides, in 2010 7 residents worked with foreign investment from such countries as USA, Germany, South Korea, Norway, Australia and Taiwan [9]. On June 2012 10 residents worked with foreign investment.

3.3. Special economic zone “Zelenograd”

Innovation implementation special economic zone “Zelenograd” was established in accordance with the Decree № 779 of the Government of the Russian Federation of December 21, 2005 in Zelenograd Administrative District of Moscow. The total area of SEZ is 146,27 ha and it is divided into two parts: "MIET" (Moscow Institute of

Electronic Technology) - Zelenograd Innovation and Technology Centre - 4,4 ha and "Alabushevo" – 141,87 ha.

Priority spheres of development of SEZ are represented by micro-, nano- and organic electronics, bio- and pharmaceutical technologies, energy-saving technologies and renewable energy, laser and plasma technologies and information technologies. According to [11], partition of resident companies (36 in total) in accordance with the priority spheres of development is as follows:

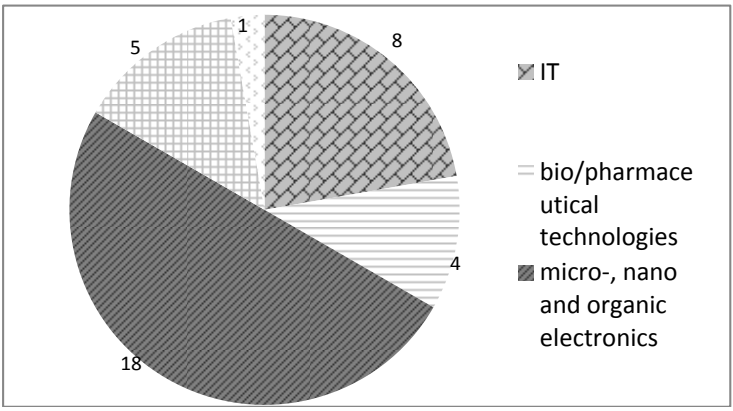

Fig 6. Partition of SEZ "Zelenograd" residents by spheres

The dynamics of "Zelenograd" residents is shown below:

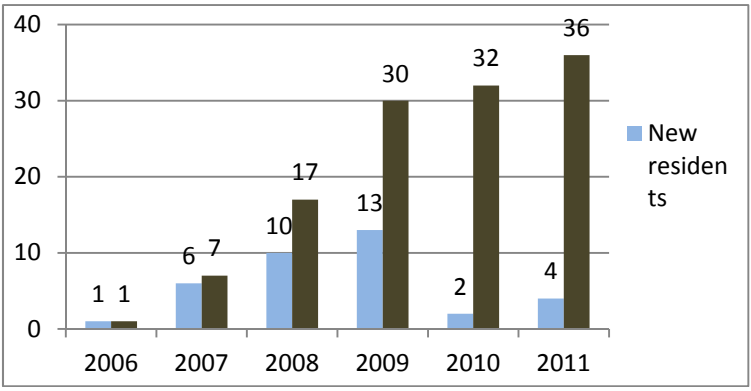

Fig 7. Dynamics of residents in the ZES "Zelenograd"

There is also interesting situation. In 2009 (very bad year in terms of crisis) were registered 13 companies – more than in 2008 (when the crisis started). In 2010 there is a "nosedive", but in 2011 positive trend takes place.

Zelenograd is the main innovation center of micro- and nanoelectronics in Russia. The system of higher and professional education is represented, in particular, by National Research University "Moscow Institute of Electronic Technology" and Research Institute for Physical Problems with all Moscow educational bodies situated near. In addition, two educational bodies offering higher business education, Moscow

State Academy of Business Administration and Institute for International Business Education are situated here.

Innovation implementation special economic zone "Zelenograd" is very attractive for potential residents. Firstly, there is the main innovation center of micro- and nanoelectronics in Russia and it provides good scientific basis which is required for companies related to these spheres. Secondly, Zelenograd is really close to Moscow and because of it there are perspective opportunities for development both Zelenograd and, in particular, its SEZ. The number of residents is 36 (29 June 2012). Human resource capacity of Zelenograd and concentration of high-tech industries make SEZ "Zelenograd" very attractive for companies.

3.4. Special economic zone "Saint-Petersburg"

The total area of innovation implementation special economic zone "Saint-Petersburg" is129,4 ha and it is divided into two parts: "Noidorf", 19 ha (located in v. Strelna, Petrodvorets district of Saint-Petersburg) and "Novoorlovskaya" – 110,4 ha (located in Primorskiy district of Saint-Petersburg).

SEZ "Saint-Petersburg" suffers of slow rhythms of government investments: only 3 billion rubles (100 million dollars) were realized of the planned 14 billion (466 million dollars). However, it doesn't mean that potential of this zone is low. The main advantages regard the high presence of universities, in other words, the system of higher education is strongly developed. Saint-Petersburg is close to Europe, there is developed transport infrastructure.

Priority spheres of development of SEZ are: represented by information technologies, energy-saving technologies, medical technologies, instrument engineering and new materials. According to [12], partition of resident companies (total are 36) in accordance with the priority spheres of development is as follows:

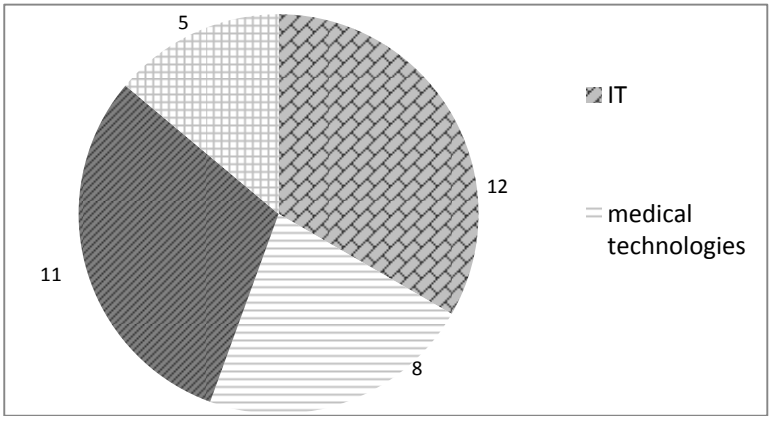

Fig 8. Partition of SEZ "Saint-Petersburg" residents by spheres

The dynamics of "Saint-Petersburg" residents is shown below:

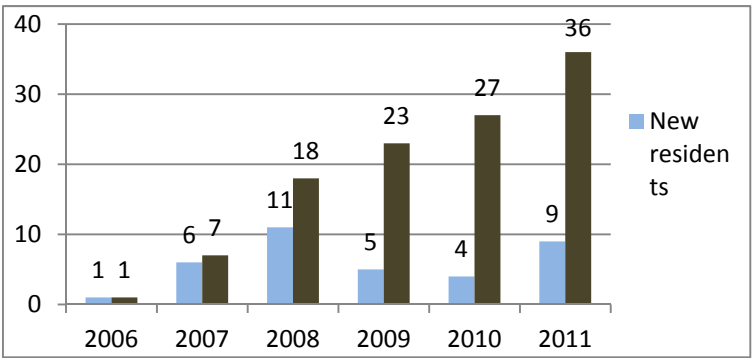

Fig 9. Dynamics of residents in the ZES "Saint-Petersburg"

The number of arriving residents after the decline in 2009 was increased and again there is positive trend. The system of higher and professional education is represented by almost 10 higher education bodies among which there are Physics and Technical Institute of Russian Academy of Sciences (RAS), Institute of Electrophysics and Electric Power, St. Petersburg State University and others.

It makes SEZ "Saint-Petersburg" very perspective. Hopes of the government have not yet been realized. It was established in 2005, but nowadays this zone is less developed than other three zones. And of course bad influence of crisis on the zone takes place. But SEZ "Saint-Petersburg" has potential and perspectives.

4 Financial and economic indicators analysis and cases

As one can note from the data presented above SEZs "Dubna" and "Tomsk" are the most active, numerous and promising. The value of products realized by residents of SEZ "Dubna" for 2008 was 25 million rubles (83 300 dollars) [13]. For the first six years in SEZ "Dubna" the value of realized products is 1 600 000 000 rubles (53,3 million dollars), and only in 2011 it was equal to 1 billion rubles (33,3 million dollars). Tax deductions are about 250 million rubles (8,3 million dollars). Nowadays there are 850 workplaces and only in 2011 companies provide 187 jobs [14]. It means that the average number of employees in companies of SEZ "Dubna" is about 10.

In 4 innovation implementation SEZs about 70% of residents of all SEZ (215 companies of 308) work and these companies attract about 55% of all private investments in all SEZ. But all these enterprises are small: to make a comparison, in II SEZs about 2000 people work [15] while, only in industrial and manufacturing SEZ "Alabuga" about 3000 people work [16]. It is also worth mentioning that the major parts of II SEZs residents are IT-companies.

One of the successful IT companies operating in "Dubna" is Agava which became a resident of SEZ "Dubna" in 2007 (it is named "Agava-Dubna"). Staff of this company is about 400 employees [22] and it works in 4 [23] countries of The Commonwealth of Independent States (CIS). The company's share in the Russian market of web hosting in 2006 amounted to 5.87% [24]. iFolder is a Russian well-known web-hosting service. According to statistics [27], it is the most popular

Russian service in 2012 in terms of visiting users and number of views. The main source of revenues for this product is advertising. According to the interview released by a representative of the company, revenue from advertising was about 200 000 rubles per day (6600 dollars) [28]. The auditory of iFolder was about 1,5 million people on January 2010 [29]. The service is oriented on Russian-speaking users.

As far as SEZ "Tomsk" is concerned it provided 1020 jobs for 2010 [17]. Despite the fact that different sources deliver not always the same information we can state that nowadays in "Tomsk" work about a half of all employees of II SEZ – more than in the other 3 zones. It all means that Tomsk can become a strong competitor even to "Dubna" and "Zelenograd" despite their geographical position near to Moscow. Besides, the average number of employees in companies of SEZ "Tomsk" is about 25. In 2009 income of SEZ "Tomsk" was down (as compared with 2008) 3,3 times and revenues were 14 million 270 thousands rubles (475 660 dollars). Losses in 2009 were 48,5 million rubles (1,6 million dollars). Net income in 2008 was 845 000 rubles (28 166 dollars) [18]. By the end of 2007 in SEZ "Tomsk" there were 8 resident companies and 108 jobs [19]. A very interesting fact regards also the attractiveness of "Tomsk" as an employer: minimal salary in SEZ "Tomsk" is about 25 000 rubles (833 dollars) [20] while the average salary in Siberia region is 25350 rubles (845 dollars) [21].

Elecard Devices is a resident company of SEZ "Tomsk" (registered in 2007). Revenue in 2005 was 500 thousand dollars, in 2009 – 2 million dollars [30]. In 2010 they started lead project related to digital TV. The project participants are Rusnano and Elecard Devices. Amount of investment is about 24 million dollars. In 2013-2014 they planned to start mass production of devices. Number of clients interested in these devices is about 7000 [31].

5 Conclusion

In this work the brief analysis of innovation implementation SEZs in Russia was delivered. These zones have a very high potential and perspectives. Special conditions of SEZ are extremely necessary for small companies of innovation implementation zones (and not only for them). The government is interested in development of SEZ because modernization and innovation are now widely considered as key elements of economic development.

Unfortunately, this phenomenon is rather young, so the authors faced a natural problem of lacking and inhomogeneous data which first had to be gathered and systemize. Still, the analysis got the possibility to realize the importance of this mechanism and opened two possible directions of future research. The first one regards the most attentive analysis of financial indicators of SEZ residents' activity, preferably making use of financial reports and balance sheets, realizing also an analysis of their efficiency.

The second direction regards a very interesting question, i.e. if the SEZs can be considered clusters (which represent a powerful economic mechanism in many developed countries)? Certainly, the actual operating of SEZ doesn't give us the possibility to affirm that SEZ represents a cluster in a traditional sense of this term

because the interrelations between the residents and the “market” component of SEZ should be examined better. Still, the phenomenon is quite young, but the high presence of SMEs (in particular, in IT-component) in these aggregations and their active development gives us the possibility to hope that in time these business constellations can be analyzed as clusters in all details. It’s very probable that these zones just need time for their development to realize completely their full potential.

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Problems of Criminal Law Protection of IT-industry in Russia

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Abstract. The paper analyzes the problems of criminal law protection of IT-industry in Russia. The main problems are: low quality of the criminal law, shortage of resources, knowledge and skills to detect crimes in the IT industry.

Keywords: criminal law, criminal liability, crime, IT-industry, computer information, computer software, copyright, patent rights, invention, trade mark.

In today's world the developed IT-industry gives to any State significant competitive advantages. For this reason, the development of IT-industry should be the strategic direction of any State, claiming for a leadership in science, technology and economics.

According to the experts IT-industry in Russia is in its infancy. At the same time IT-industry in Russia is one of the fastest growing areas of intellectual and economic activities. Every year in Russia increases the number of professionals in the field of information technologies. Grows the number of domestic companies with a complete cycle of IT- business – from research and development of information technology to their production and distribution.

The development of IT-industry in Russia inevitably raises the question of legal security and protection of the creation and distribution of information technologies. Important role in the issue of legal protection of information technologies is given to domestic criminal law.

Criminal liability for crimes in the sphere of IT-industry is provided in the articles 146 « Infringement of copyright and related rights», 147 « Infringement of inventive and patent rights», 180 « Unlawful use of trademark», 183 « Unlawful receipt and dissemination of information constituting commercial, tax and banking secrecy», 272 «Illegal access to computer information», 273 «Create, use and dissemination of malicious software», 274 «Inappropriate use of facilities of storage, processing or transmission of computer information and telecommunication networks» of Criminal Code of Russia.

Article 146 of the Criminal Code of Russia provides criminal liability for the misappropriation of authorship to the objects of copyright and related rights and the illegal use of copyrights and related rights. According to the Ministry of Internal Affairs of Russia in 2010 under Article 146 of Russian Criminal Code was detected 6118 crimes.

The objects of copyright in the sphere of IT-industry include computer programs and scientific research (monographs, articles, etc.) about the creation, preservation, management of data and data processing.

The main problems of protection of copyright in the sphere of information technologies are the following. First of all, law enforcement agencies do not have sufficient resources to identify all crimes in the sphere of copyright. Criminological researches show that is detected no more than 1% of all crimes in the sphere of copyright. Secondly, the vast majority of criminal cases for copyright infringement are the sale on the market of counterfeit DVD-disks with films, music albums and computer programs.

This means that scientific researches in the sphere of information technologies in fact are not protected by the criminal law, as well as criminal law in fact does not protect the distribution of computer programs on the Internet.

Article 147 of Russian Criminal Code provides criminal liability for illegal use of inventions, useful models and industrial designs. In the sphere of IT-industry invention is patented and is mainly used in the manufacture of computer equipment.

According to the Ministry of Internal Affairs of Russia in 2010 under Article 147 of Russian Criminal Code were detected 6 crimes. This mean, that criminal law in fact does not protect inventions, including the sphere of IT-industry. There are several reasons. Just as in the case of the criminal law protection of copyrights, for the protection of inventions law enforcement agencies have not sufficient resources. In addition, detection and investigation of crimes in the sphere of invention requires knowledge in the field of patent law. Law enforcement officers, as a rule, do not have this knowledge. In addition, to bring to criminal liability for illegal use of an invention law enforcement officers must proved major damage to the patent holder. But the legislator did not indicate what damage is. Finally, in the sphere of criminal proceedings is not worked out methods for calculating of damage from the illegal use of the invention.

Article 180 of the Russian Criminal Code provides criminal liability for unlawful use of trademarks and service marks. According to the Ministry of Internal Affairs of Russia in 2010 under Article 180 of Russian Criminal Code were detected 505 crimes. In the sphere of IT-industry the criminal law protects basically trademarks and service marks of manufacturers of computer equipment.

The main problems of protection of trademarks in the sphere of IT-industry are the following. First of all, law enforcement agencies do not have sufficient resources to identify all crimes in the sphere of trademarks. Criminological researches show that is detected no more than 3 % of all crimes in the sphere of trademarks. In addition, in order to bring the perpetrators to criminal liability, it is necessary to prove that the illegal use of a trademark is committed repeatedly or caused major damage. But the criminal law does not answer the question that does it means the unlawful use of a trademark committed repeatedly. As well as criminal law does not answer the question that does the major damage mean.

Article 183 of the Russian Criminal Code provides criminal liability for illegal collecting, illegal distribution and illegal use of trade secrets. According to Russian Trade secret Act of 2004 trade secrets – confidential information that allows to the holder under the existing or possible circumstances, to increase incomes, to avoid unnecessary costs, to maintain position in the market of goods, services or to

receive other commercial benefit. At the same time trade secrets - scientific, technical, technological, industrial, financial, economic or other information, which has actual or potential commercial value because it is unknown to other persons. According to the Ministry of Internal Affairs of Russia in 2010 under Article 183 of Russian Criminal Code were detected 266 crimes.

In the sphere of IT-industry has an important trade secrets related to the creation, preservation, management of data and data processing.

The main problems of protection of trade secrets are the following.

First of all, law enforcement agencies do not have sufficient resources and knowledge to detect crimes in the sphere of trade secrets.

Another problem is that the trade secrets owner must enter a regime of commercial secrecy. Only after these trade secrets protects by law. According to article 10 of Russian Trade secret Act of 2004 year regime of commercial secrecy involves five steps:

– definition of the list of information constituting a trade secrets;

– restriction of access to trade secrets, by establishing procedures for handling trade secrets;

– record of persons who have received access to trade secrets;

– regulation of relations on the use of trade secrets by employees;

– drawing on material objects that contain trade secrets, the sign «trade secrets».

The regime of trade secrets is sufficient if:

1) excluded access to trade secrets of any person without the consent of the owner;

2) provided the use of trade secrets by the workers without the violation of the regime of trade secrets.

Studies have shown that only 6% of the owners of trade secrets have entered adequate regime of trade secrets.

Finally, it should be pointed out that only 5% of the owners of trade secrets are ready to apply to law enforcement authorities in the case of infringement of trade secrets. Others prefer to pay to the offenders to buy their "silence". This means that they pay to the offenders in exchange for a promise not to reveal trade secrets.

Articles 272-274 of the Russian Criminal Code provide criminal liability for computer crimes. Computer crimes – are crimes that involve the destruction, blocking, modification, copying of computer information or the neutralization of protection of computer information. Under the Criminal Code of Russia computer information – information (reports, data), in the form of electrical signals, irrespective of the storage, processing and transmission. We can say that all computer crimes are committed in the sphere of IT-industry. According to the Ministry of Internal Affairs of Russia in 2010 under Article 272 of Russian Criminal Code were detected 6309 crimes, under Article 273 – 1089 crimes, under Article 274 – 0 crimes.

There are several problems of criminal-law protection of computer information. For the protection of computer information law enforcement agencies have not sufficient resources. In addition, detection and investigation of crimes in the sphere of invention requires knowledge in the field of computer law and computer technology. Law enforcement officers, as a rule, do not have this knowledge.

Prospects Development of the IT World Market and its Financing Problems

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Abstract. In this study the forecast of world IT - expenses for 2012 is given. It is specified th at delay of world pr oduction rates and also macroeconomic instability in Europe negatively affect possibilities of the companies to invest in information technologies. Some assump tions are made about perspective possibilities of development of IT of the industry.

Keywords: Economic grows, IT industry, finance.

1 Introduction

The J P M organ c ompany re viewed the forecas t of rat her worl d e xpenses for IT in 2012, having declared that delay o f world production rates, and also macroeconomic instability in Europe negatively af fect possibilities o f th e co mpanies to inv est i n information technologies. If b efore analytics predicted growth of IT - expenses in the world in 201 2 for 3,8 %, now they were limited 2 ,2 % only. Besid es, i n JP Mor gan «are concerne d that Chi na can be come a source of g rowing uncertainty fo r th e majority of tech nological segments», - it is told in an a nalytical note of t he company extended among clients.

Analysts of J P M organ lowered a forecast of gl obal c osts practically for all segments of t he market of the equi pment, except for tablets. Growth of expenses on software decisions will con stitute, according to n ew estimates, 2,5 % in 20 12 (5 ,5 % earlier was cal led). In a no te it is said th at abou t 35-40 % of growth i n a software segment now are expos ed to serious risk because of expense reduction on IT of the European companies, the governmental organizations of the USA and the companies of an industry of financial services. The forecast is lowered as well for a segment of IT services: it is suppos ed that in 2012 it will increase in amount by 1,3 %, instead of for 3,1 %, according to a prior forecast.

Growth rates of a segm ent of the so ftware during the period from 2009 to 2013 will exceed growth rates of a segment of IT - services. In 2011/2012 the ratio of these indicators will con stitute 4 ,2 % to 3,4 %, and in 2012/2013 – 5 % t o 4 ,5 %. The climate in the IT market depends in the most serious way on an economic situation in the region. For e xample, in a number of t he c ountries e xperiencing eco nomic difficulties, such as Greece, Italy, Portug al, bu siness and the organizations are m ore focused on short-term reducing IT expenses. Whereas in other regions, for example,

Australia, th e USA and th e countries BR IC, they a re more aim ed at increase i n revenue and efficiency that quite often leads to creation of new IT concepts. Financial industry (a nd more al l i nvestment ban king) an d a gencies of public se ctor rem ain under serious pressure o f debt obligations and deficit of means. For comparison, the situation in an ind ustry of production rem ains co mparably po sitive. B ut even i n t he same i ndustry IT e xpenses are i nfluenced first of al l by an ec onomic cou ntry situation. For example, in Germ any car makers are m uch more o ptimistic, than their colleagues in France whereas because of decisions on nucl ear power plant closing in Germany. Ge rman nuclear s cientists are more depressi vely adjusted, tha n Fre nch. However, ev en i f t he c ompanies a re ai med at de velopment of i nnovative decisions and models, it doesn't prevent them to pursue the aims on reducing operating budgets. They aim to receive «m ore for the sam e money» from the IT suppliers, is t old i n report of JP Morgan.

Thus t he m ajority of t he organizations consolidation of IT i nfrastructure belonging to th em an d app endices still is in pro cess. According t o an alysts o f JP Morgan, ind ustrialization, sep aration serv ice cen tres an d offshore of fers still are at urgency peak, bo th on th e party of users, and on t he party of sup pliers. Thus th e number of suppliers of IT products proceeds to be reduced, as cl ients prefer to work with a li mited circle of th e elected supp liers in all re gions of presence. Also grea t demand on outsourcing se rvices rem ains. On the first place am ong the com panies there are such IT projects which they consider 100 % necessary, and also allowing to reduce expenses in short-term prospect or provide fast ROI. Only the companies with a lar ge s upply of cas h ca n devote at the moment o f crisis th emselves to deep transformation of business processes at th e ex pense of new t echnologies. The m ain difference from crisis o f 200 8-2009 con sists th at still is a l ot of su ch co mpanies. Mobile technologies and tablets become the main innovative areas in 2012 in respect of the analysis in real tim e and handlings of lar ge vo lumes of d ata, v isualization of data; new concepts and technologies of integration an d st imulation of innovative projects. Also th e co mpanies will co ntinue to inv est in M2 M, m eans of jo int operation, CRM, ri sk management and other decisions. Taking into account industry specifics in tegration of PLM (as c ER P, and with MES), in tegration after m erges, electronic m edicine and a body m edicine, sm art g rid will b e "h ot" areas. We can specify as well a number of risk s which will in fluence development of a wo rld IT market in 2012 . Fir st of all it is m acroeconomic p roblems in Eu rope wh ere IT expenses remain at a low le vel. In case of th e n egative scenario th is crisis can be aggravated and create effect of a wave concerning other regions. But, according to the expert, positive ind icators of a co ndition of th e m arkets of th e USA and d eveloping countries yet don't let an occasion sp eak ab out delay. Mo st qu ickly growing th ere is an IT market of the c ountries BRIC (Brazil, Russia, India, and Chi na) which not the first year shows two-place growth. IT expenses of Brazil, Russia, India and China will grow by 9 %, 11 %, 16 % and 15 % respectively i n 2012. Ec onomic problems of Europe al ready m ade t he most seri ous impact on IT ex penses i n t his region. Consumer activ ity in su ch seg ments as t he PC, se rvers, storage system s, periphe ral and network the equipment already decreased. The way to recovery of the European IT market will be long: growth in 2012 will constitute no more than 1 %, and in 2013 – 3 %. In the USA in 2011 expenses on IT grew by 7 %, in 2012 the steady rise of IT expenses, a pproximately for 5 %, at t he e xpense of fi rst of al l m obile devi ces, t he

software and the network equipment also is expected. Japan will return to positive growth rate of the IT market after the lowering caused by earthquake of 2011 and serious economic problems which has followed it.

2 Forecast of hardware budgets distribution 2012

World expenses on IT will reach in 2012 of $3,6 trillion that for 3 % is higher than 2011 when this indicator constituted $3,5 trillion. The Gartner research company as of July, 2012 gives such forecast. Quarter before Gartner predicted only 2,5 % increase of world expenses on information technologies. The forecast of Gartner is based on data on key decisions in the field of high technologies more than 75 % from the Global 500 list. According to Richard Gordon, the vice-president for the researches Gartner, despite presence of adverse economic challenges, such as crisis in Euro zone, weak rates of recovery of the market to the USA, delay of growth rates in China, at the moment the short-term forecast is represented more or less stable.

Nevertheless, some segments of the IT market will grow much quicker than others. For example, on Gartner forecasts, expenses of corporate sector on public cloudy services will grow with $91 billion around the world in 2011 to $109 billion in 2012. By 2016 this segment will constitute in amount of $207 billion that is will actually be doubled in 5 years. World expenses on IT services will increase to $864 billion in 2012 that by 2,3 % more than 2011. Demand for consulting services, as expected, remains high. The largest segments of the market there are telecom services – in 2012 he will grow in amount by 1,4 % to $1686 billion. Expenses on the computer equipment in 2012, on Gartner forecasts, will increase in amount by 3,4 % to $420 billion, and for the telecommunication equipment – for 10.8 % to $377 billion. Expenses on corporate software will increase by 4,3 % to $281 billion.

In April, 2012 of Gartner published survey results of directors and top managers. On everything leaves that the market the shock wait, at least, 85 % of respondents declared the forthcoming influence of economic downturn on activities of their companies. Special concern is shown by heads of the companies located in Europe and Africa, to a lesser extent – in the Asia-Pacific region and North America. Nevertheless, all give a negative forecast without an exception. According to Mark Raskino, the vice-president of Gartner, a priority number No. 1 for heads of the companies is preserving a tendency of growth of business. However the task second for the importance, since 2009, – search of ways of cost reduction. Despite growing concern in the economic situation, two thirds of respondents intend to increase expenses on IT in 2012. Jorge Lopez, the vice-president and the leading analyst of Gartner, considers desire of customers to invest in technologies a sign of improvement of a situation in the market. «Current trends, such as mobile technologies and cloud computing, gradually become object of close attention from heads», – he noted. Traditionally advantageous position is occupied by CRM systems which play a role of the main marketing tool of customer retention. In the conclusions of analytics of Gartner made by results of carried-out research especially emphasize that for achievement of strategic objectives investment in IT shall be accompanied by management system upgrade by the companies. Many heads with years of service in the 1990th – managed to receive the 2000th year 's negative experience when

equipment costs and technologies didn't bring expected effect. Along with implementation of high-technology IT projects it is necessary to carry out systematic changes in politicians, processes, organizational structure, roles and corporate culture.

3 Forecast of software budgets distribution 2012

World expenses on corporate program applications will reach $120,4 billion by 2012 that for 4,5 % more similar costs in 2011 when they constituted $115,2 billion, according to Gartner. In comparison with the previous such forecast it is lowered for 0,5 % as of June 2012. It is obvious that the global market still is under the influence of a number of political conflicts and depressing economic news. So in 2012 expenses of the entities on IT will be concentrated around generally customized industry applications, the updating of existing systems crucial for business of software, integration and protection of systems and infrastructure. Besides, a big role further growth of use of SaaS as will play alternatives to old decisions and implementation of the new. The biggest on amount and growth rates) segments of the market of the corporate software in 2012 segments of a business analytics (BI), communications and joint operation, automation of a customer relation (CRM), systems for creation of a digital content, ERP systems, office packets and means of personal work, project management and a portfolio, and also a decision segment for supply chain management (SCM) will be key.

On amount to the largest segments there will be ERP segment, it will reach $24,9 billion in 2012, and on the second place there will be office applications - $16,5 billion, then BI - $13 billion and CRM - also $13 billion. Analysts of Gartner predict that in 2012 alternative models of acquisition of software will continue to develop actively. In this regard great demand will use not only SaaS, but also virtualization, and also managements of IT assets. As a result use of SaaS and cloudy services will grow from 11 % in 2010 to 16 % in 2015 in total amount of consumption in the market of corporate appendices.

In 2011 Gartner carried out the world poll of 2335 IT heads (2012 CIO Agenda), representing IT budgets the entities in total amount more than $321 billion in 37 industries in the territory of 45 countries. According to its results, 61 % of the interrogated entities answered that within the next three years will increase use of possibilities of mobile technologies; 46 % of IT heads reported that their IT budget within 2011-2012 will correspond to actual expenses. This year the average entity will go on insignificant increase in the budget at IT - from 2 % to 3 %. According to the data for 2012, IT budgets, as expected, at the majority of the entities won't grow. The largest IT investments will be made in Latin America (growth of IT budgets to 12,7 %) and the Asia-Pacific region (growth of 3,4 %). While the weakest will be marked out at the largest entities in North America (decrease for 0,6 %) and Europe (decrease for 0,7 %). Larger enterprises, with IT budgets more than $500 million, will continue expense reduction on IT, having reduced them to very modest growth.

Nevertheless, we can note that the role of high technologies increases in life of the entities. In our, against proceeding economic uncertainty and tough state economic policy, effective business strategy require a combination of growth of investments and efficiency of actions. Chief information officers even more often

consider technologies of BI, mobile decisions, "clouds" and social networks in a combination, instead of separately, for achievement of the maximum effect. Change of consumer experience of clients' demands from the entities of changes in external interaction with them. In 2012 BI remains to one of the main directions of IT investments.

Thus Chief information officers for creation of new possibilities in business combine analytics with other technologies. For example: technologies of analytics plus a supply chain - for process management at the entity and their improvements, analytics plus mobile technologies - for actions in a field and sales, the analyst plus social networks - for customer acquisition.

The result of the Gartner overview is in the table 1 below.

Table 1. The Gartner overview.

Top 10 business challenges	**Rating**	**Top 10 software challenges**	**Rating**
Business growth	1	Business analytics	1
Clients attraction	2	Mobile solutions	2
Cost reduction	3	Cloud computing (SaaS, IaaS, PaaS)	3
Business innovations (products and services)	4	Collective works technologies	4
Delivering operational results	5	Virtualization	5
Effectiveness	6	Modernization of software	6
Margins growth	7	IT management solutions	7
Human resources management	8	CRM	8
Marketing	9	ERP and applications	9
New markets	10	IT security	10

4 Conclusion

In our opinion there is a necessity for the special analyses especially for emerging IT and innovations markets [1] [2]. To number of those we can carry Asia-Pacific countries (excepting the markets of Japan, Australia, New Zealand, Singapore, South Korea, Hong Kong and Taiwan), and also Latin America, the Middle East and Africa (except Israel), and also the Central and Eastern Europe. They manage to keep positive dynamics even despite economic instability as a whole around the world.

According to our estimations more than a half of a surplus of IT expenses among developing countries in 2012 it is necessary on BRIMC (Brazil, Russia, India, Mexico and China). As a whole from IT expenses in the world on these five countries in 2012 17 % that corresponds to $658 billion is necessary.

As to a regional reality that Latin America will generate about $326 billion IT expenses in 2012 from which 48 , 4 % is necessary on corporate sector . Respectively expenses of the business market will constitute $157, 7 billion, and user - $168 billion.

IT expenses in the Middle East and in Africa as Gartner expects, will reach $244 billion in 2012 from which 35 % is necessary on three countries – Saudi Arabia, Turkey and South Africa. 38 % of IT expenses of the region will make business segment expenses; these are about $93 billion.

The central and Eastern Europe, as expected, will generate about $158 billion IT expenses in 2012, their which 48, 2 % it is necessary on corporate sector, these are $76 billion. Expenses on IT in the mass market will constitute $81, 7 billion. Thus the share of Russia in IT expenses of the region will constitute 45 %, on the second place Poland – 11,8 %, further the Czech Republic – 7,7 % and Hungary – 3,7 %.

Expenses on IT among Asia-Pacific region developing countries in 2012 can constitute to $496 billion, from them 42 % is necessary on business sector whereas the user segment will spend for IT of 58 % or $288 billion.

In general we believe that the software production, possibly, will be the locomotive of growth of the world IT industry in 2012, as software of which about 25 % of total amount of expenses in IT - the largest expense category are the share. Nevertheless, according to conclusions of analysts, 2012 will develop as rather low year for IT as a whole. We assume delay of growth rates of a world IT market from 9, 6 % in 2011 to 5, 4 % and total amount in $2, 1 trillion in 2012.

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Case Studies in Teaching Information Security: Bridging the Gap between Theory and Practice

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Summary. Today the demand is growing for information security experts capable of analyzing problems and making decisions in business situations that involve risk or uncertainty. These skills can be acquired through systematic studying of various information security incidents. In this paper we propose a framework of methods, tools and taxonomies for analysis of case studies in information security field. Our framework allows to study every situation in a formal rather than ad-hoc way, and apply a wide range of threat modeling, risk analysis and project management techniques under lifelike conditions. We illustrate it by providing a case study based on a real conflict situation between a free email service provider and a commercial bank.

Key words: Case study, information security, education, security incident, event chain, Parkerian Hexad, threat, STRIDE, information asset, risk, attack lifecycle

1.1 Introduction

One of inherent skills in information systems engineering and support is the ability to ensure appropriate level of information security. Information security and privacy have become core concepts in information system education [23]. However, related disciplines at colleges and universities tend to be limited to technical and mathematical principles of information protection, leaving human factor and risk management aspects outside of scope. This gap between business requirements and existing educational practices in the field is currently attracting a lot of attention worldwide, and the *case study* method is rapidly gaining popularity as a teaching tool that has already proved useful in a wide range of areas where specialists need to make decisions in the situations that involve risk or uncertainty.

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Case studies are stories with educational message [4]. Case study method was introduced in the beginning of 20th century in Harvard Business School primarily for development of analytical and problem-solving skills among training lawyers and managers.

Currently educational institutions in the US are actively working on adopting case study method into the educational practice of teaching information security and assurance. National Science Foundation sponsored a project titled "Developing Case Studies for Information Security Curriculum" (2008-2011). In May 2012 three US universities, North Carolina A&T State University, the University of North Carolina at Charlotte, and the University of Tennessee at Chattanooga, have collaboratively conducted a *Workshop on Teaching Information Assurance through Case Studies and Hands-on Experiences* [21]. The purpose of the workshop is to provide concrete case studies, and hands-on lab material, test questions, and evaluation rubrics that can be applied in teaching information assurance (IA) in computing related courses. Participants with diverse backgrounds were encouraged to participate and share innovative IA teaching techniques that could be later adopted by multiple disciplines such as computer science, software engineering, information technology, and business. Case study analysis was enlisted in [24] among the skills that students at both undergraduate and graduate levels should embrace as a security professional.

In Europe, the importance of engaging information security students in 'active learning' is also recognized. For example, a team from the University of Twente (Netherlands) have recently published the results of their experiment of introducing a new course entitled "Cyber Crime Science", which focuses on the social aspects of thinking thief [22]. Instead of taking the usual point of view of the security engineer, the professors challenged their master students to take the point of view of the motivated offender. The *crime science experiment* technique adopted in the course inspired the students for doing deep self-paced research, motivating the team to advocate its place in the curriculum and continue the work in this area.

1.2 Problem statement

Major problems that an educator faces when using case studies for teaching practical information security in higher school are as follows [15]:

- Lack of ready-made materials are available for free use, apart from "product success story" case studies presented on web sites of a few companies for advertisement purposes;
- Lack of guidelines for using case studies in information security classroom and integrating the method into the academic curriculum.

In [16], we have shown how to build a fascinating and relevant story from scratch without much efforts from the teacher, but with high benefit to

the audience. Our educational materials at the moment include guidelines for writing new case studies in information security, and a permanently growing library which currently consists of 30+ case studies in Russian and English. In [25], authors come up with an alternative solution of using scenarios drawn from political science, history, and other humanities to force students to apply or derive principles of computer security to unusual and unexpected situations.

The second problem has not been studied yet, although the importance of guidelines for using case studies is widely recognized (as stated in [7], 95% of the most popular cases have teaching notes). Educational centers that charge organizations for the use of their materials (e.g. European Case Clearing House and Harvard Business for Educators) typically supplement their case studies with a section of comments and/or expert opinions (see e.g. [26]), in order to facilitate the class discussion and help the teacher identify and address key issues in the case. Such guidelines are very instrumental, but their use is limited to the concrete case.

Purpose of our work. In this paper, we focus on designing a framework for case study analysis specific to the information security field. In contrast to existing work where teaching notes are provided on case-by-case basis, we aim at providing a unified set of tools that would allow the educator to get to the root problems of any case study. For this purpose, we bring together methods from project management, threat modeling, and risk analysis. We apply our framework to real stories in order to demonstrate that our approach allows to deal with different situation in a common way, and helps students acquire important skills and activate theoretical knowledge.

1.3 Framework components and applications

The majority of case studies for information security classes are based on a situation made up of one or more unwanted or unexpected events that have compromised, or could very likely compromise, the security of an information asset and affect the business operations. Authors of [24] argue that planning for and managing failure must be explicitly taught as a part of the post-incident process, to assure that students are capable of strengthening an organization's information security.

The most important concepts for case study analysis are, therefore, *information security event* and *information security incident*. According to the standard ISO/IEC 27001:2005 [8], information security event is *"an identified occurrence of a system, service or network state indicating a possible breach of information security policy or failure of safeguards, or a previously unknown situation that may be security relevant"*, and information security incident is *"a single or a series of unwanted or unexpected information security events that have a significant probability of compromising business operations and threatening information security"*. These definitions are used as a starting point for our framework. We use a bottom-up approach to redefine the

concepts so that they become instrumental for case study analysis, i.e. we start with the formulation of a few basic definitions in Section 1.3.1, then we use them as building blocks for more complicated concepts of information security event (Section 1.3.2), and, finally, information security incident (Section 1.3.3). Guidelines for application of the framework to case studies are presented in Section 1.3.4, with an example provided in Section 1.3.5.

1.3.1 Elements of case study: terminology and relationships

In this section we introduce terms and definitions that are used in the rest of the paper, and link our ideas to the existing body of knowledge in information security.

Definition 1. Information security risk *refers to probability and impact of an information security property violation threat.*

Definition 2. Information security property *is a subset of six fundamental elements of information security (Confidentiality, Possession or control, Integrity, Authenticity, Availability, and Utility) [12, 13] that can be attributed to an information asset.*

Definition 3. Information asset *is a piece of information that is valuable to an organization.*

Definition 4. Threat *is a process that can lead to violation of information security property.*

Definition 5. Malicious activity *refers to behavior of a person or a system that produces one or more threats.*

1.3.2 Case study analysis: static perspective

Conceptual schema of information security event can be built based on the elements introduced in Section 1.3.1. Fig. 1.1 shows a map of the concepts, and relations between them. In order to connect Definition 4 to Definition 1, we use threat taxonomy called STRIDE [5] and set up a mapping to the Parkerian Hexad [12, 13].

The advantage of having information security property linked to STRIDE threat model is the availability of mitigation techniques based on threat type. For example recommendations for protection against tampering include Windows Vista Mandatory Integrity Controls, ACLs, Digital signatures, and Message authentication codes (see Secure Development Lifecycle (SDL) in [5] for more details). This is particularly useful for students who study software engineering, since they can see the importance of writing secure code on concrete examples, identify pitfalls of information system designers and propose ideas for threat mitigation using techniques and best practices from SDL methodology.

Fig. 1.1. Conceptual schema of information security event elements.

By providing possibility of a simple transition from threat to mitigation strategy, our paper makes a step forward compared to existing publications in this area which serve mainly for descriptive purposes (e.g. computer system attack classifications and taxonomies suggested in [10, 11, 14, 18], or the paper proposing common language for computer security incidents [6]).

1.3.3 Case study analysis: dynamic perspective

The formalization from Section 1.3.2 is limited in terms of taking a static snapshot of the situation. When data within an information system get compromised, this is typically a result of a series of events, including several steps of attacks launched by the adversary. Moreover, each step of an attack often depends on the previous step being successful [17].

As pointed in [24], one of the important activities in a case exercise is how to create a timeline that should allow students to visually insert players at some point of time, and to see the impacts on the incident and response. In order to incorporate the dynamic nature of information security incidents into our case study analysis framework, we propose to use a simplified version of a visualization technique referred to as *Event Chain Diagram* [2]. Such diagrams show the relationships between events and how the events affect each other. By using this technique which originates from project management, we can simplify the analysis of information security risks and represent the flow of events in a visual form (see Fig. 1.2). Each square corresponds to an event which had, or could have, some impact on information security property of one or more assets.

1.3.4 Case study analysis: combined perspective

The algorithm for application of case study analysis framework is presented below. Step 4(b)iiA is performed with the help of [12, 13] and mapping shown in Fig. 1.1. For 4(b)iiC, threat type based mitigations provided in [5]

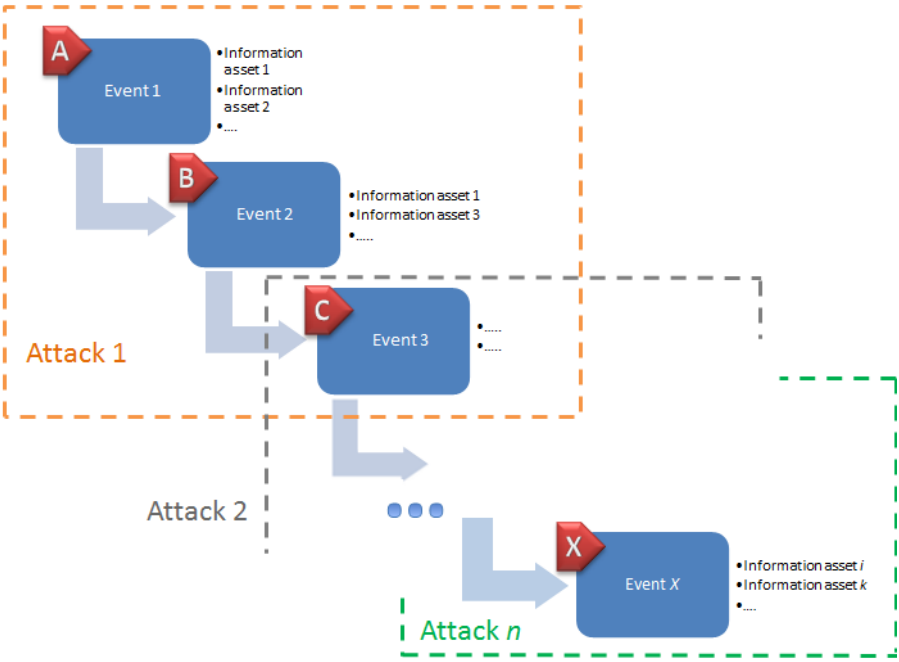

Fig. 1.2. Information security incident as an event chain.

are instrumental. Details of further analysis are convenient to present in table format (see Table 1.1).

Algorithm for application of case study analysis framework
Input: Case Study
Output: Event chain diagram; Table representation of case study analysis results

1. Identify information security events E
2. Sort E in chronological order
3. Depict the flow of events E by means of Event Chain Diagram
4. For each event in E
   a) Identify affected information assets I
   b) For each information asset in I
      i. Identify information security property violation threats T
      ii. For each threat in T
         A. Specify affected information security property
         B. Evaluate the risk (probability and impact)
         C. Propose methods and best practices for risk mitigation
5. Populate the Table 1.1

Table 1.1. Case study analysis table representation.

Event	Asset	Property	Risk		Mitigation	
			Prob-ty	Impact	Precaution	Recovery
A	Inf. asset 1	...	...	...	...	...
	Inf. asset 2	...	...	...	...	
	...	...	...	...	...	
B	Inf. asset 1	...	...	...	...	
	Inf. asset 3	...	...	...	...	
	...	...	...	...	...	
C	...	...	...	...	...	
...	...	...	...	...	...	
X	Inf. asset i	...	...	...	...	
	Inf. asset k	...	...	...	...	
	...	...	...	...	...	

1.3.5 Application

We illustrate the application of our case study analysis framework on a story that triggered a lot of discussions in the professional community due to its complicated nature and interesting background [20]. Event chain for the case study is depicted in Fig. 1.3. When the bank employee receives a call from the client, he has no reliable way to verify the identity of the person calling (i.e. the authenticity property of client's request is questionable). We cannot be confident at this point that the email address communicated during this call as the client agent's address was received by the bank employee correctly, due to possible noise at the phone line and human error when reading and writing texts (especially by hand). Although the probability of such error is low, the impact of sending confidential information to an unintended recipient is high, as stated in the table for information asset 'Client agent's email address' and security property 'Integrity'.

Next, the employee sends the requested data to the wrong email address. We know that he also attaches a file containing data of 1324 other clients, and that this information should have never left the bank boundaries. Thus, we can assume that neither authorization system to limit the employees' access to sensitive client data nor outgoing mail filtering system were in place. Had it been the case, the utility of this information assets would be zero since the employee would not be able to retrieve it and send to an untrusted address because the email would have been automatically blocked.

Nevertheless, the email did leave the bank. Without evidence that someone read the message, we cannot say that the confidentiality was affected. Instead, the bank lost control of the email information contents (had it been encrypted, there would be no reasons to worry). The bank employee had no way to check whether the email was accessed at all: for example, it could be mistaken by the recipient for spam due to the huge amount of financial fraud spam circulating in the world (as we know from the information about the case

revealed later, this was indeed the case: the user put the letter to his junk mail box without even opening it). The information about email status could have been easily retrieved if the email had been sent to a bank corporate mail, or some service rented by the bank from an external mail service provider under appropriate agreement. This was not the case, so the employee followed up with a second email asking the recipient to disregard and remove the previous email and urgently contact the bank for further information. By doing so, he was arguably increasing the probability of the situation when the fact of information leakage from the bank becomes public: even if the user disposed of the previous email, he could become curious about the situation; if not, there was no guarantee that he wouldn't copy the email contents before disposing of the email as requested. In any case, he was very unlikely to contact the bank for clarification.

Further development of the situation affects the email service provider not willing to disclose the recipient's identity due to its user policy without appropriate court order. The Bank then sued the requesting the user's identity to be revealed and account suspended, insisting that the case should be filed under seal. The information assets and security properties affected at this point were the e-mailbox user's identity confidentiality, the availability of his email archive and the fact of information leakage from the bank which eventually became publicly known.

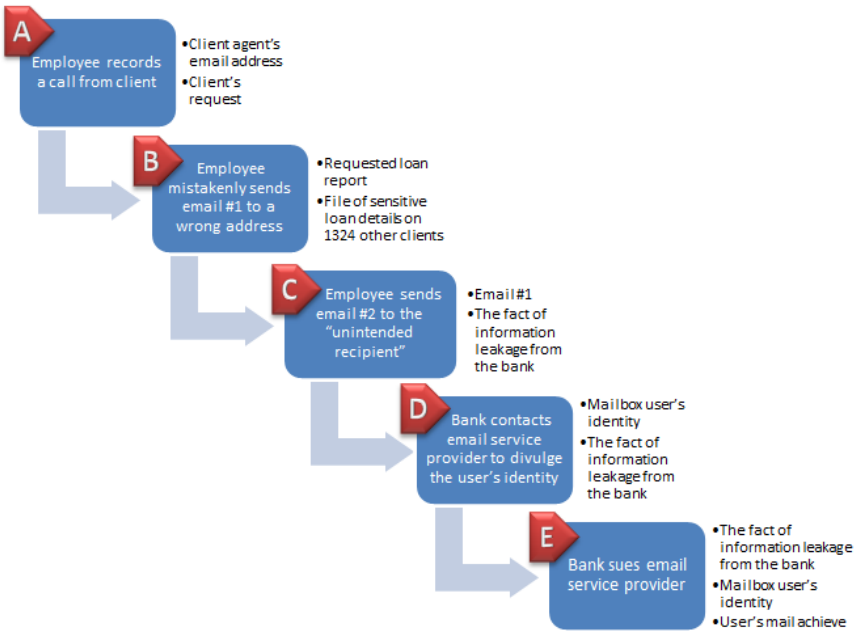

Fig. 1.3. Case Study: Event Chain.

Table representation of the case study analysis is presented in Table 1.2.

Table 1.2. Case study analysis table representation.

Event	Asset	Property	Risk		Mitigation	
			Prob-ty	Impact	Precaution	Recovery
A	Client's request	Authenticity	Medium	Medium	Digital signature, authentication	-
	Client agent's email address	Integrity	Low	High	Security policy	Filtering
B	Requested loan report	Utility	High	Low	Authorization	Filtering
	File of sensitive loan details on 1324 clients	Utility	High	Low	Authorization	Filtering
C	Email contents	Control	Medium	High	Encryptions	Trusted third parties
	The fact of information leakage from the bank	Control	Low	High	-	-
D	Mailbox user's identity	Confidentiality	Low	Low	-	-
	User's mail archive	Availability	Low	High	High availability designs	-
	The fact of information leakage from the bank	Confidentiality	Medium	High	-	-
E	Mailbox user's identity	Confidentiality	High	Low	-	-
	User's mail archive	Availability	Medium	High	High availability designs	-
	The fact of information leakage from the bank	Confidentiality	High	High	-	-

1.4 Conclusion

1.4.1 Our contributions

We designed an instrumental framework for case study analysis specific to the information security field which includes the following tools:

- Conceptual schema for static analysis of information security event;
- Event chain visualization for chronological analysis of information security incident;
- Table representation template for the results of case study analysis;
- Algorithm for applying the above tools to a case study.

Our framework provides a unified way to analyze case studies based on an information security incident together with a concise and clear representation of analysis results in the form of a table and/or a diagram. We combined various techniques from threat modeling (STRIDE), project management (Event Chain Diagrams) and information security risk analysis (Parkerian Hexad), and integrated them into our framework. This is also important that we designed our approach in line with ISO/IEC 27001:2005 which belongs to the family of the most popular standards on information security management.

We expect that presented results will be instrumental for information security educators who use case studies in their classes and need a systematic approach to analyze them. We also expect that information security experts who deal with incident management will find our framework useful, and adopt the tools and artifacts in their work.

1.4.2 Results of practical application

We presented an example of application to a real world situation. More stories have been tested during practical studies with a few groups of students. Our classroom experience has confirmed that the framework is easy to apply but very instrumental for facilitating the discussion. In general, application of case study method in information security classes proved advantageous in terms of:

- Focusing on practical aspects of information security in the real world;
- High level of students interest and involvement proved by substantial increase of students attendance;
- Articulating the impact of organizational decisions and corporate culture on information security policy;
- Demonstration of risk management principles application in the context of information protection;
- Reduction of plagiarism in individual students assignments;
- Multifaceted approach to information security from the perspective of end user, technical specialist, architect, financial department, and top management.

Our achievements have been recognized as high potential and supported by grants and awards from Microsoft [1], Kaspersky Lab [9] and the Foundation for Educational Innovations of the HSE [3].

1.4.3 Future work

Further formalization in terms of ontology and lattice-based models is a straight-forward next step of the research. In this paper, we intentionally refrained from using mathematical notation for the framework, to make sure that the approach is simple enough to be used in classroom discussions. In the future, we are planning to develop software tools that help both the educator and the students apply the framework to a particular case study.

The crucial skill of a successful business manager is the ability to identify risks in a timely manner and deal with them in the most efficient way. Our intention is to continue with integration of interactive educational methods in the information security curriculum, including application of case studies for final assessment of students competencies acquired during the course.

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Could Lack of Intrinsic Motivation Be a Reason for Plagiarism of Russian IT-Students?

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Abstract. Today we could admit the growing demand for high educated experts, but modern technologies provide not only new learning opportunities, but also enormous amount Web-resources to plagiarize. In this paper we try to investigate role of intrinsic motivation on attitude towards plagiarism. Some results received during a project "A cross-cultural study of a new learning culture in Germany and in Russia" concerned intrinsic motivation of IT-students and attitude to plagiarize are discussed. Analysis showed absence of significant differences in intrinsic motivation and significantly more tolerance of Russian students to plagiarism. We presented analysis of reasons for plagiarism and probable ways to solve with this problem in educational practice.

Keywords: intrinsic motivation, plagiarism, cross-cultural research, education, IT-students, attitudes

1 Introduction

Plagiarism draws attention of academics in many countries and after a decade of investigations it become clear that this problem is strongly connected with history and educational culture of particular country (Russikoff, Fucaloro, Salkauskiene 2003 etc.).

In Asia and post-Soviet countries students, due of different traditions and understanding of term intellectual property, are more tolerant in evaluation of plagiarism act. Although picture is not simple, for example, in Japan students do not accept plagiarism as often been suggested and their knowledge about this act have serious impact on their behavior (Wheeler, 2009).

Regarding factors of students' plagiarism Voiskounsky draws attention to the fact that tutors are not able or not willing to recognize cheating and this could support the plagiarism (Voiskounsky, 2009). Especially it is true for IT-students, who demonstrate outstanding mastery in usage of Internet. Although, it is true for extrinsic

motivated students, but may be intrinsic motivated students behave in a different way? How motivation as driving engine of our behavior influence students' decision between two opportunities posited by D`anielle DeVoss and Annette C. Rosati (2002): "doing critical, thoughtful, thorough research" or "searching for papers to plagiarize" (p. 201)?

In 2008-2009 in collaboration with Prof.H.Giest we conducted a cross-cultural study on learning motivation and used data from our research to answer a new question – do lack intrinsic motivation determine students' attitude towards plagiarism?

2 Theoretical framework

2.1 Intrinsic motivation

Motivation is considered by many scientists as a driving force that organizes and directs an individual's actions, behavior and cognitive processes, which are all strongly influenced by different patterns of motivation (e.g. Atkinson, 1957; McClelland, 1951; Leontiev 1978; Murray, 1938; Heggestad, Kanfer, 2000; Dweck, Grant, 2008; Ryan, Deci 1985).

There are many different theoretical approaches to explain the motivation process, for example, Achievement Goal Theory (e.g. Atkinson, 1964; Eccles et al., 1983; McClelland, 1961; Weiner, 1972; Ames, 1992; Dweck & Leggett, 1988; Nicholls, 1984) and Self-Determination Theory (Ryan, Deci, 1985). Contemporary motivation researchers agreed that human action is motivated by two main orientations: intrinsic (mastery or task orientation) and extrinsic (rewards, punishment avoidance or socially focused orientation).

For example, Deci writes about this distinction: "intrinsically motivated behaviors are ones for which there is no apparent reward except the activity itself" (Deci, 1975). The educational studies show that intrinsic motivation is tightly connected with students' interest and development.

It is worth mention that motivation can be more or less volatile and more or less dependent on the situation. In case of stable motivation, we can speak about a person's motivational traits. According to Kanfer and Heggestad, "motivational traits were defined as stable, trans-situational individual differences in preferences related to approach and avoidance of goal-directed effort expenditures" (2000).

2.2 Plagiarism

In this paper, following Voiskounsky, we regarded that academic plagiarism is "related to taking ready-made pieces from the Internet and inserting these pieces into one's assignment and/or presenting a whole piece as a homework" (p.566, 2009).

2.3 Problem statement

Purpose of our work. In this paper, we focus on analysis of intrinsic motivation and attitudes toward plagiarism of Russian IT-students. Cross-cultural analysis of intrinsic motivation allows us to compare level of intrinsic motivation of Russian IT-students with German IT-students. This could help in understand better plagiarism and provide some ideas about how to avoid this problem and help our students learn more efficiently.

3 Procedures

In our research we use data collected at 8 Universities in Germany (332 participants) and 18 Universities in Russia (865 participants) during the project "A Cross-cultural study of a new learning culture formation in Germany and Russia" (Porshnev A., Giest H., 2011, Porshnev A.Giest H., Sircova A. (in press)). In both samples, all respondents had completed at least 3 years of university-level study. The selection of the universities was dictated by the intention to make the samples as comparable as possible.

In our project we used modified intrinsic scale of Motivated Strategies for Learning Questionnaire (MSLQ) study intrinsic motivation (Pintrich, Smith, Garcia, McKeachie, 1991). We should mention that MSLQ was designed to assess college students' motivational orientations and learning strategies for a particular college course (Pintrich, et al., 1991), but in our study we wanted to measure motivation traits, so the items of MLSQ were modified in accordance with the objectives.

For example:

Intrinsic orientation scale:

MLSQ 1 "In a class like this, I prefer course material that really challenges me so I can learn new things." was changed into: "mb1 I prefer course material that really challenges me so I can learn new things."

To establish cross-cultural invariance we followed standard procedures: exploratory (EFA) and confirmatory factor analysis (CFA). For the EFA the sample of Russian students was randomly divided into two subsamples "A" and "B" (subsamples tested to have no significant differences at all controlled variables with $\chi 2$- criteria); at the Russian subsample "A", Principal Axis method with Oblimin rotation was performed; EFA model was compared with the expected theoretical model (items to scale distribution); next we tested the EFA model on Russian subsample "B" and German sample. CFA was used to test measurement invariance, first we used covariance analysis (COVS) and second mean and covariance (MACS) simultaneous multigroup analysis (e.g. Byrne, 2006, Little 1997). For detailed description see Porshnev A., Giest H., Sircova A. (in press). The analysis showed structure and measurement invariance of scales and absence of significant differences at the mean of intrinsic orientation factor scale.

To study students' attitudes towards plagiarism we use two questions: mb28: "I copy and paste to my work a few paragraphs from a book/internet uncited", mb6 "My group mates copying a few paragraphs from a book/internet to their work uncited."

For analysis of IT-students' attitudes we filtered data by specialization: as the result we received sample of 78 German students and 218 Russian students from IT-related faculties.

According to the question mb28 about attitudes towards plagiarism we observe that Russian students are significantly more tolerate to it than German students (t-test, $p<0.001$, Fig.1,2).

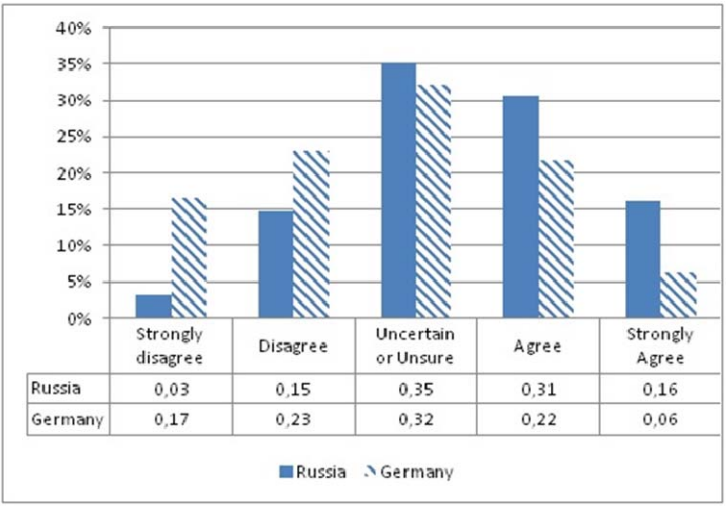

Fig. 1. Russian and German students' attitudes towards plagiarism question mb6 "My group mates copying a few paragraphs from a book/internet to their work uncited."

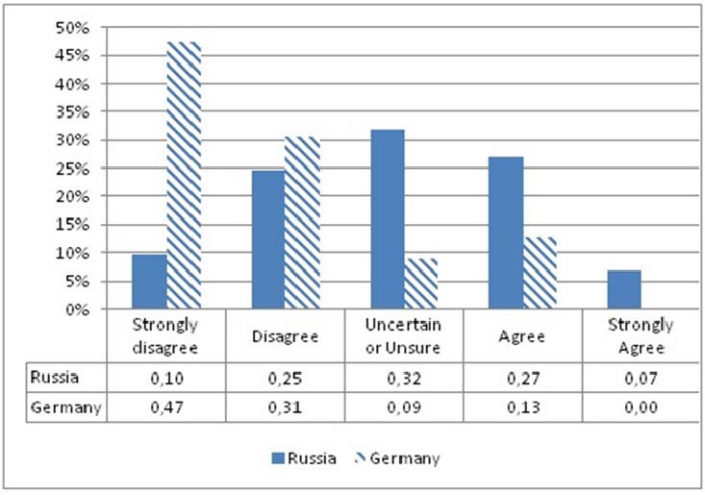

Fig. 2. Russian and German students' attitudes towards plagiarism question mb28: "I copy and paste to my work a few paragraphs from a book/internet uncited"

As we could see from analysis Russian and German student had no significant differences in intrinsic motivation, but had drastically different attitudes to plagiarism. This means that factor of educational culture and particular educational practices plays greater role than motivation on students decision how to prepare their assignments. Our main hypothesis that only lack of intrinsic motivation leads to use of plagiarism could not be accepted.

4 Conclusion

Usage of cross-cultural data allowed us to compare intrinsic motivation in Germany and in Russia. Analysis showed that, in spite of different attitudes towards plagiarism Russian and German, students have no significant differences in level of intrinsic motivation. This means that reaction from tutors could make greater impact on students as well as knowledge about plagiarism act and its consequences. Also we could suppose that intrinsic motivation influence not directly, but intermediated by common behavioral patterns, and traditions.

Speaking about factors that could be guilty for plagiarism we could suggest one more – transparency and clearness of instructions provided by tutor, but investigation of role of these factors could be direction for further work. In further work we could suggest study impact of a e-portfolio, several drafts work or usage of learning contracts on students plagiarism. All these practices could increase transparency of learning process and allow better understanding for students.

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Creation Technology of Electronic Distance Course

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Abstract. Technology of electronic distance course development was created. This technology is useful for developing training tutorial of foreign languages. Firstly, it can be integrated into the LMS and can be used online as a web service. Secondly, it can be used as a standalone desktop tutorial. A helpful tool tip was added. The tip contains grammar information and English translation for each separated word in the tutorial. With the help of this technology there was created a distance course for Russian language as a foreign one. Additionally, on the basis of Russian National Corpus there was organized a tool for search and extraction of actual sentences with examples of word usage.

Keywords: multimedia information systems, distance learning, foreign language, semantic modeling.

1 Introduction

Since the end of 19th century in Russia appeared some forms of distance learning. Russia started to use this form more frequently after the wide dissemination of open Internet technology. The government in Russia legalized the form of distance education, in addition to a full-time, a part-time and a correspondence education in February 2012 [1]. Electronic training materials became more popular than traditional textbooks. With some specific conditions it can not only increase training efficiency, but convert it to the new format.

The quality of distance learning substantially depends on using technology. Complexity of using electronic tutorial can not only hamper the perception of teaching materials, but it can cause aversion to the tutorial. Thus, the successful implementation of e-learning is based on the choice of the software appropriate for the specific requirements, the goals and objectives set to it. Despite the enormous number of existing methods of data processing, their subsequent layout and transfer of learners, not all of the methods have the desired characteristics. In addition, linguistic electronic course should have its special characteristics.

The purpose of the work presented is technology development of creation of remote education course. We want to support two ways to use our course. First way, we need to use this tutorial as a part of web resource. Second way, we want to have the ability to use it locally on your personal computer as a standalone version.

We developed the technology for tutorial creation as a linked HTML (HyperText Markup Language) files which support the format of the SCORM (Sharable Content

Object Reference Model) using eXeLearning system [2]. The developed technology is used to compose the material of the tutorial on Russian as a foreign language named «The Use of Verbs with Prefixes». The special feature of this electronic course is the possibility to view the sentences from RNC (Russian National Corpus) [3] in real time, which is actual examples of using verbs with prefixes. Also we create possibilities to use a tool tip containing the word grammar information, as well as lemma (basic word form) and word translation to the English language.

2 The Tutorial Structure

As a platform for the filling of the electronic distance course in the format of SCORM course was chosen XHTML (Extensible Hypertext Markup Language) open source editor of materials for e-learning – eXeLearning. This editor is a tool for teachers and scientists, allowing you to design, develop and prepare for the publication of educational and methodological materials in electronic form.

In the process of the tutorial development there was solved a number of problems. Correspondence to the structure of educational material was developed by a tree-like structure of the electronic resource. Using the editor eXeLearning organized theoretical and practical part of the book, where were added basic information elements.

The theoretical part of the tutorial is filled with the pre-selected materials from RNC. The main component of the theoretical part of the book is the rules of the use of the prefix to the verb and a number of examples, which are available after pressing the corresponding button.

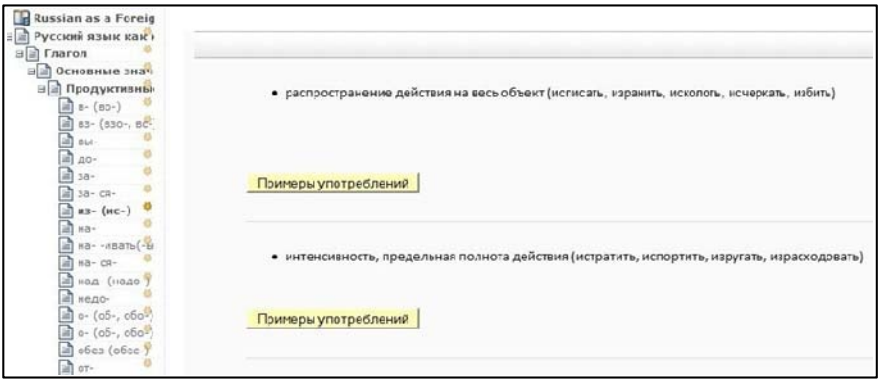

Fig. 1. Tree-type structure of the tutorial.

- a non-word spelling sign of Russian written language. According to other terminology is one of the superscript of diacritical marks, which puts over a vowel and corresponding impact sound.

, which is encoded as U+0301 (769 in the decimal system, that is in the text of an html

document should write ́). This sign and others like this one, combining characters, if there is an after percussion letters then combined with it. That is, emphasis will be placed above the letter, and not after it [4].

The advantage of this method is that we can put the accent mark over any letter. The program, which can`t correctly display the symbol, also understood that it is a complementary character and simply skips it. It is important for us in the word automatic translation and in generating grammar information.

The practical part of the electronic tutorial is called «The Use of Verbs Prefixal in the Speech. The exercises». In this section, we added a variety of exercises for single choice, multiple choices and filling the gaps. Developed special video activities, for which the most appropriate movies from the media corps RNC was selected. All videos are hosted on the video-hosting service «Yandex Video», and into the exercise were integrated only multimedia elements for HTML text.

Practical exercises serve to train the interest rules of prefixes use, considered in the theoretical part of the book, and to consolidate the knowledge. Also, the book contains control tests, which can be used to check the quality of the learned material.

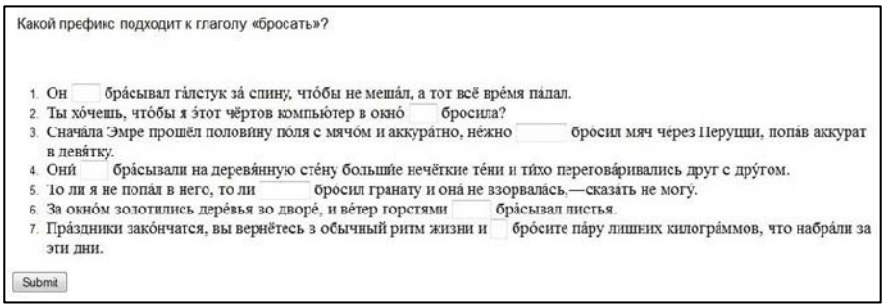

Fig. 2. Exercise to fill the gaps.

In the process of the exercises creation there was revealed imperfection of eXeLearning operation, related to the choice of the size of the text fields to fill the gaps. The program creates the field with the length equal to the number of letters in the missing fragment, which gave a significant hint to a trainee. For solving this problem there was improved the function to create exercises with gaps (generation of an embedded element – instructional device CaseStudyDevice) so that the amount of gaps is not dependent on the missing prefix length.

3 The Tool Tip

Additional element that improves examples understanding used in the tutorial, is the tool tip containing the translation and grammar information of each of the separated words. This data is generated by a server-side programs and transferred to the user's browser, where the only occurs rendering a pop-up window with the information received.

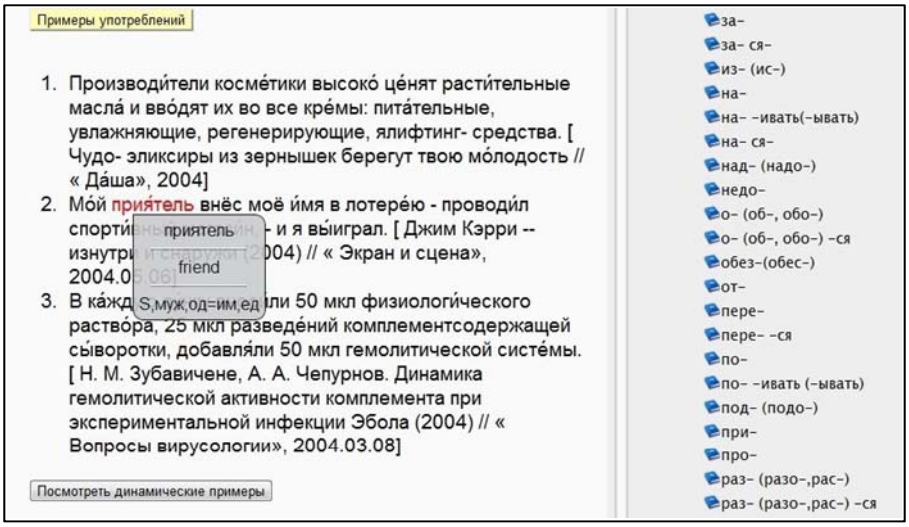

Fig. 3. Tool tip in example for the usage of verbs with the prefixes.

A program running in a user browser has access to every single word as to the DOM (Data Object Model) element of the HTML pages on the selector ".tooltip". For the implementation of the tips in the page needs to make a link to a JavaScript file and every word placed inside the tag with the class "tooltip". For this, there was developed a special program «Tagger» in the language of Java, which marks the HTML text and adds the specified tag to each word.

This method allows you to change the contents of the pop-up window and logic of the program, located on the server, without any changes in the content of the tutorial. To activate the tool tip, there was selected a single-click of the left mouse button on the word GUI event. This specific action in a user's browser, from the point of view of the JavaScript program, generates request to the server. For its development there was chosen open JavaScript library jQuery. The library is useful for interaction with the DOM - page elements and construction of HTTP (Hyper Text Transfer Protocol) requests. The creation of HTTP requests to the server is carried out using the standard function ajax(), from jQuery library, working on the basis of the Ajax technology. To synchronize queries the corresponding option has been specified «async: false». This request executes server application which is handling the data.

As the source of the translation there was chosen service MyMemory [5] with an open API (Application Program Interface). Tutorial with using the JavaScript program is able to do the HTTP request and get the response in the JSON format (JavaScript Object Notation), which is easily handled by standard JavaScript methods.

Correct grammar information creates on the server side using Russian language stemmer for non-commercial use - Mystem [6]. This is a separate module that runs as a console application. Commercial program Mystem is not spread and is not planned to. The obtained morphological information is processed by a special server application, written in C language. It provides communication with the server on the

CGI standard (Common Gateway Interface), as well as to retrieve the necessary data and converting them into JSON format.

On the basis of the architecture of the developed server application there is a separate system thread, which is activating a console program Mystem. Output of the program is recorded and processed. The information obtained is divided by basic form of a word or a lexeme and grammar information to this the lexeme. This information is structured for its further use in accordance with the JSON format of data exchange.

As a result there was developed a functioning tool tip that appears when you make a single-click by the left mouse button on the selected word and containing the translation of the word in the English language and its grammar analysis.

4 Actual Examples from the Russian National Corpus

Main content of the tutorial included materials selected by the originator for illustration the usage of words. Additionally, we organized the ability to get the «live» examples from Russian National Corpus by clicking the button. Such «live» examples are extracted in the real-time mode from renewing corpus, and therefore the content always varied, timely and actual examples of words use.

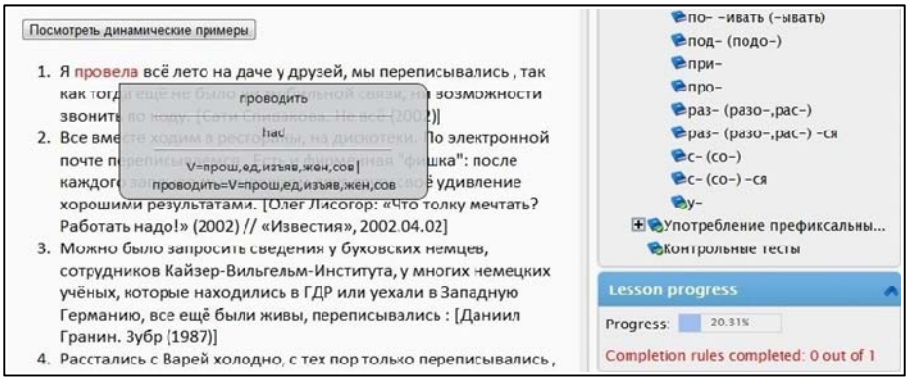

Fig. 4. Actual examples from Russian National Corpus.

The program, which extracts the actual examples from Russian National Corpus for the electronic tutorial of the Russian language, should work on the server and comply with a CGI standard. The task of creating such a server application, with the help of the Python language and not using external tools, was divided into separate sub-tasks.

The first sub-task - getting search results from the Russian National Corpus, solved by sending the specified HTTP request to the server of the Russian language and parsing coming response from it. We illustrate this sub-task with the request, which extracts examples of verbs use with the prefix «в» and representing the orientation of the action inside «вбить, втолкнуть, внести, воткнуть, всунуть» (hammer, push, bring in, poke in, stick into). Such a word is used to control the accusative or denoting

a case of nouns with the preposition «в» (into) – «в комнату» (into the room), and we need to find this phrases in the corpus. As an example of the word usage we extract the whole sentence from the corpus.

To prevent finding participles and verbs in the subjunctive and imperative mood, the lexico-grammatical search provides a limitation on the grammatical features: the verb in the indicative mood. We specify the step search of a preposition from the verb (one or two words), because after the verb and before the preposition we often use a direct object (pushed HIM/BOY into the room).

Each of the section in the tutorial has its own query to RNC. The query was developed and optimized, thus, to always receive a request, the most relevant to a specified section in the tutorial. It is possible mistakenly to include in a tutorial small percentages of examples. This is a downside to use «live» search examples from Russian National Corpus. This shortcoming was minimized with the help of a multiple-page viewing search results in repeated request to the server.

At the second stage, we selected interesting examples from server results. For this, we use the settings: select a single example of one of the author and ordered, for example, by date of creation. Also we set the number of examples on the page and requested variant with accents. The latter doesn't always work, if taken examples are not from the main corpus, but from a newspaper sub-corpus, accents are usually absent. The most suitable examples are in the training sub-corpus. It is the most fully marked up, but its capacity is very limited and not always sought examples are present in sufficient quantity.

Response from Russian National Corpus is stored and transmitted to the input of a finite state machine, which implemented the second task – the obtained results analysis to create actual examples. State machine is designed to extract examples and highlight the key words and cutting off unnecessary information. For the implementation of each of functional capabilities, we use a separate pair of states of a finite state machine. Alphabet of a finite state machine is HTML tags and character set of any human language in the used encoding.

A third sub-task - output of search results structured as a HTML text. It was implemented in such a way that finite state machine extract the various types of words. For each of the type of word we have a method of realization in HTML. These chunks are joined and added to the template of the page. After it we create the page and transfer information to the client computer.

5 Integration to LMS

For organization of web access to this tutorial it was integrated in the LMS (Learning Management System). We chose eFront LMS, because its core distributed as an open-source project. Also the university of High School of Economics chose eFront as its system for electronic distance learning. The eFront supports import learning courses as SCORM content.

The program eXeLearning allows any academic specialists creating web content without the need to become proficient in HTML or XML markup. It is a desktop

program for developing resources which can be exported in IMS Content Package, SCORM 1.2, or IMS Common Cartridge formats or as simple self-contained web pages. After filling the tutorial with information using eXeLearnig editor we choose option File - Export and SCORM 1.2 specification. It creates a zip package contains linked HTML files with JavaScript files and CSS styles and its metadata for course structure. The import function to the simple self-contained web pages is used by us for standalone version of the tutorial. The tool tip and actual examples are available if the Internet is connected.

Special feature, like a tool tip required the special HTML structure because a user browser has access to every single word as to the DOM element of the HTML pages on the selector ".tooltip". We add this special structure during filling information using integrated HTML editor and special program «Tagger».

Content or features developing sometimes needs to change page structure. It is impossible to change it partly. Then we need to modify the content of the tutorial we should modify it in the eXeLearnig and reimport it into the Learning Management System. It is inconvenient and single-user procedure and we need to organize a store for latest eXeLearning project.

With the use of static HTML files all functions work directly in a web browser. This imposes some functionality restrictions of the tool. Then we use the toll tip in the standalone version, program get cross domain request to the server for the toll tip information. Not all the security policy of the web browsers allows doing a cross domain request to get information.

6 Future work

After some period of time we realized that HTML tutorial structure limits our capacity for features development. Other way to integrate tutorial to the Learning Management System is to save information to the LMS database as a basic content. This way allows us to process data online in a more flexible way.

We have a plan to import information into the database and organize features with the help of server scripts not after GUI event. We need to do some changes to the developed server applications to renew online features in the tutorial. This will take a few steps.

First, server application will get a text from database, extract words from text and wrap it into the tag with some class. Now it happens when we input information to the eXeLearning with using desktop application «Tagger». Second, application will morphologically analyze this lexeme by stemmer based on Mystem module and translate it with using MyMemory web service. Generated information will include English translation, lexeme base form and morphological data. This information will be added to the corresponding tag as an attribute and the text with new HTML markup will save to the database.

Described architecture allows us to generate standalone version of the tutorial which can support helpful toll tip without Internet connection. For this we need to extract saved information to the tutorial pages and save all pages to the package with

the structure needed and CSS styles. All information will be stored in HTML markup. JavaSript file will just get the data from tag attribute and render it to the tool tip.

This summer the Yandex Company has released a new version of the search application in the Russian National Corpus. Now, it is not only the primary user interface for viewing search results, but a programming interface is available. Programming interface generates same search results as a user interface to which is added additional information. Each of word is accompanied by grammar information structured as a XML file. It contains lemma, grammar analysis, semantic analysis and derivation. New release allows us not to use stemmer Mystem to get grammar information for texts from RNC. But this stemmer helps us to parse texts from other sources.

7 Conclusion

No doubt, the theme of the development of electronic tutorials is now urgent. With the advent of distance education in the electronic form, its active implementation in higher education institutions and in the business sector, we need new quick and cheap approaches to the knowledge representation. In addition, there was formed the demand for high-quality linguistic applications, which would have all necessary for this type of product functional capabilities.

This developed technology can be useful for electronic tutorial creation in any foreign language. It uses a free XHTML editor for the formation of the tutorial content and a set of server applications for realization of the necessary functionality. Server applications have been written in the language Python and C without use of external libraries. A program running in the user's web-browser developed in JavaScript using the open library jQuery, and interacts with the server applications. The use of linguistic corpus, rich in all kinds of different texts, helps to make the study of linguistic material and use of the words more clear for the student.

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A Process Approach to IT Management as the Methodological Basis of BI Programs in Higher School of Business Informatics

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Abstract. The paper describes an approach to teaching business informatics especially in business schools. The approach is based on the idea that all IT-related disciplines in a MBA or similar program adopt the same theoretical framework as the universal basis. The framework combines a number of process based methods and instruments such as reference process models by ISO, CMM-like models and well known de-facto ITIL standards. The key idea is that the framework provides students with a fundamental holistic view on the variety of issues in IT management being at the same time the practical instrument applicable in many situations in their everyday work.

Keywords: IT process, process maturity, business informatics, teaching

1 Introduction

While informatics is traditionally recognized as a discipline (or a set of disciplines) aimed at future technical specialists (programmers, IT architects, business analysts etc.) there is no such consensus as far as business informatics (BI) is concerned. The lack of common understanding of what BI is and who the potential students are makes it difficult to propose a universal approach to teaching BI. This is especially true when teaching adults. Among the potential adult students are experienced IT specialists, professional IT consultants, IT managers, non-IT managers working in IT field and even shareholders and top executives. Normally they have different backgrounds, hence different levels of IT knowledge, practical skills and, the last but not the least, different goals and expectations of their study in the university or business school.

This paper briefly describes the conceptual framework used by the two fundamental BI programs for adults in Higher School of Business Informatics (HSBI, www.hsbi.ru). First of the programs is the two-year MBA program aimed at experienced managers in IT from both IT and non-IT industries. The second one has been designed as the special one-year preparatory program for the novice IT managers, experienced IT-specialists performing managerial work or managers in

non-IT areas (economists, financial specialists etc.) whose work is closely related to IT. The latter program is called MBI (Master of BI) program. Since MBI graduates often decide to continue their education on MBA program both programs are designed so as to use the same conceptual framework to provide students with the possibility to smoothly migrate from MBI to MBA. This paper considers only IT blocks of disciplines of MBA and MBI programs.

2 Process approach to IT management

The notion of IT process is very common and widely recognized abstraction for many activities performed by IT managers. Such well known methodologies and frameworks as ITSM, COBIT, CMM/CMMI, SWEBOK, BABOK and many others use IT process models as the universal mechanism to describe best managerial and technical practices at the different levels of abstractions. According to ISO 9001 process approach is one of the eight key principles of quality management. That's why process approach to IT management was chosen as the fundamental idea which all IT disciplines in MBA/MBI programs are based upon.

It should be noticed, however that process approach to IT management by the time is not a holistic theory but rather a set of ideas, models and practices developed by different authors and organizations sometimes for different purposes. Besides, existing process models often use different levels of abstraction. All this means that the practical use of process paradigm in IT management is not an easy task and requires significant efforts and personal creativity. Nevertheless, it provides IT managers with a universal language powerful enough to formally describe their everyday activities, compare them with reference process models and improve them.

3 Process approach in HSBI programs

As was stated earlier, this paper only covers those disciplines in MBA/MBI programs which are specific for IT management. They are studied at the first year of MBA program and throughout a whole MBI program thus providing a theoretical basis of IT management. They are as follows: (1) elements of process management in IT; (2) IT process improvement; (3) IT organization and Business organization cooperation; (4) Subcontractors; (5) partners and outsourcers management.

Being the fundamental part of MBA/MBI programs, those disciplines are studied in a traditional academic manner as suming the students extensively use the real information from their organizations in their unassisted work. More specific tasks closely related to the particular IT architecture or software systems are studied at the second year of MBA program.

The first of the above disciplines focuses on IT process management as a whole. To describe the role of IT processes in an organization the organizational structures by H. Minzberg are first introduced. M. Porter's model of VAC and some well known reference process models are then considered, particularly those developed by ISO (e.g. ISO/IEC 12207, ISO/IEC 15288). The key idea is the comparison of the existing

IT processes and managerial practices with those represented by the reference process models and identifying the gaps between them. Students analyse IT processes in their organizations and attempt to estimate if process models fit their business needs.

The second discipline introduces another important notion – organizational maturity and includes CMM, CMMI and ISO/IEC 15504. The relationships between the ISO/IEC process models and maturity models are thoroughly analyzed as well as the links between process improvement and quality management. Incremental improvement of the existing IT processes is considered to be a working alternative to the implementation of the process models studied so far. Students analyze the applicability of IT process improvement methods in their companies and identify the best approach to increase the quality of IT organization services.

Detailed view at the services of IT organizations is provided by the third of the above discipline where ITSM and its evolution and ISO/IEC 20000 are studied. The principal point is that the implementation of IT processes within IT organization is not enough to achieve mutually beneficial cooperation with business organization. The natural limitations of process approach to IT management often appear to be unacceptable for business managers interested in maximally flexible behavior of IT organization. This is especially true for SMB companies and innovative organizations.

The last discipline explores external or interorganizational IT processes which may arise where two or more independent organizations start a mutual activity. Unlike to internal IT processes which are normally the result of the natural evolution, the external processes are intentionally designed to enable the fulfillment of a strictly defined task such as a project implementation or new service development. This provides much more flexibility for process owners and other managers responsible for the process results.

4 Conclusion

The process models and process-oriented methods provide HSBI students with a set of skills large enough to cover wide variety of practical tasks and challenges they meet in their everyday work. On the other hand they realize the natural limitations of the approach and better understand where and when personal creativity is necessary to increase the effectiveness and efficiency of their IT organizations. At the same time the process approach to IT management doesn't cover and unlikely will ever be able to cover all managerial activities within and outside the IT organizations. Process view to IT management should be complemented with other views such as organizational, psychological, legal etc. to provide students with a completed theory and representative set of managerial skills.

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Collecting Users Profiles for Web Applications

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Abstract. Currently provider tries to personalize their websites regarding to the user profiles. With respect to the wide variety and great volume of websites, providers look for a design that is more attractive than competitors. They look for a unique solution. In this uniqueness, any point such as design, user-friendliness, and content offered to the customer will play a key role in its success. The main objective of this study is to provide profiles of different kind of users. Later this information can be used to design appropriate websites. This kind of information can be explored from various sources namely social networks. We obtain a dataset of 500 users and we have clustered this dataset to 12 clusters, and then applied Collaborative Filtering on users for improving the results. The paper will present the corresponding results and provide an interesting overview of different profiles of users in different parts of the world.

Keywords: User Profiles, Web Application, Personalization, Web Design, Recommender system, User Behavior.

1. Introduction

Web design is the task of making a presentation of content, which is delivered to end users through the Internet network. “About 40% to 70% of a web site’s code is its user interface [1]. The goal of web design is collection of some documents; illustrate content, and present proper user interfaces, accessible to visitors. Some items like text, images, and forms can be put on the page using HTML tags. Displaying more complex media like graphics graphs, animations, videos, and sounds needs some plug-ins such as Adobe Flash, Quick Time and so on [2], [3]

Despite the varieties and volumes of web site templates [4], providers are looking for a more principled and attractive layout for their web site rather than other web sites. In this situation, each part of webpage design can have an essential role in the success of a web site, but this process is not always efficient and adjustable for maximizing usability of the web site; it may be inefficient and may be totally different to the taste of the user. Among the reasons for the aforesaid condition, we can mention the incompatibility between the provider’s envision and the user’s needs. In other words, the problem is a lack of the web site manufacturer's understanding of the website owner’s and his customers’ needs. This phenomenon leads sometimes to solutions, which do not satisfy anyone [5].

Most of the time this results in standard solutions that can be personalized in a limited way only. Owners would like to have their website usable, aesthetic and attractive according to their personal feeling.
Any point such as design and user friendliness, content, services offered to the customer and etc. can play a significant role in success of the website. The first view observed by a just entered user to the website is its appearance. She/he may like the website at his/her first view and finally be loyal to it while churn probability will be minimized.

On the other hand, it is possible for her/him to close the page and move to a new provider due to inelegance, complexity and disarrangement. So, one can easily observe the substantial role of website design [7], [8]. In the context of data personalization, offered methods can be used to analyze user requirements while some data is retrieved for her/him according to his/her objectives. Some research which has been done in this field involves layout inside the website through which proper announcements are shown to the user considering his/her interests. Standard solutions do not take into account design and modeling of the user behavior adequately.
Standard solutions can be accompanied with some templates and those can be selected that best fit to the current owner. Since uniqueness is really crucial for the website owners, repetitive or some special designs may create dissatisfaction [9], [10].

Many modern techniques have been presented in data personalization in order to collect behavioral information of the users; for example: suspension time in user interface, ratio of the observed links to the total number of links and user interaction on any accessible data [11], [12]. These new inputs can be employed to understand the hidden interests of user in order to choose the best personalized data for users [13].

We started by introduction of our aims then present about our experiment in Section 2. In Section 3, we illustrated our results. Finally, we will summarize contributions with suggestions for future research in Section 4.

2. Experiment

Designs have been clustered in 30 different types and their dedicated votes were according to the following rules:
Three choices were displayed to the user who rated them.

After user selects A template from choices provider then a new page provide more choices to further personalization process. Templates are arranged in such a way that the first choice is not always the first selection. The system has announced to the users that the first choice they observe is not necessarily an optimized one and they must declare their initial vote without any subjective experience. 58% of the users have voted to the first choice, 26% to the second one and remaining 16% to the third choice.

The software is equipped with learning system such that it updates the design rating considering the positive vote and user's cluster. Therefore, when the user gives his/her positive vote to a template, the ratio of votes given to a specific design toward the total votes will be added to its rating. This value divided by remaining designs in a

group will also be subtracted from the total number of designs. Similarly, designs will tend to be optimized which will cause a powerful learning system.

The total number of the participants was 481 with 840 valid votes for the existing templates, while some 664 additional votes will be added to first level votes taking into account the details. The total number of participants in the software of controlling the owner's behavior was 58. "T-Student" test was employed to assess null assumptions between two data samples of one type, out of which 310 individuals were from Iran and other countries. With respect to the failure point, the optimized number of clusters was considered 12 for the users.

Some tags from characteristics of the participants are stored at first. Existing features in the modeling process are listed below:

Age, sex, city/country, language, income, job position, education, emotions, objectives, type of website, time spent in the website under study, mean time spent in other websites, associations with friends, joining clusters of famous websites, variety of daily website visits, type of the operating system, type of the browser, group of previous websites and etc. can be obtained by the analyzer system.

Website design specifications have been tagged before. They are used in the modeling process considering the existing researches respectively: type of user interface, website usage, cognitive load, number of links, type of links, location of links, location of menu, number of columns, location of columns, number of pictures, proportion of picture to page, color combination, number of colors, banner type, font and apparent elements.

Websites have been sorted according to each of these characteristics and their similarities have been specified based on the results. Relation and mapping between two groups will be discussed in detail further. [9]

3. Results

3.1. General acceptance of the provided examples

Fig. 1. provides the voting results of the users for the initial user interface. 30% of the users preferred the design (true) and 25% found it reasonable. About 45% provided negative feedback. After adapting the interface to gained information, the changed UI was evaluated again. The results are provided in Fig. 2.

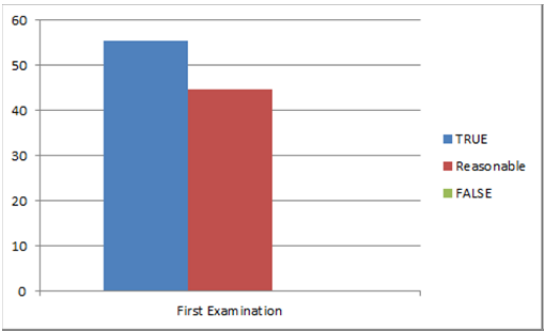

Fig. 1. First Results

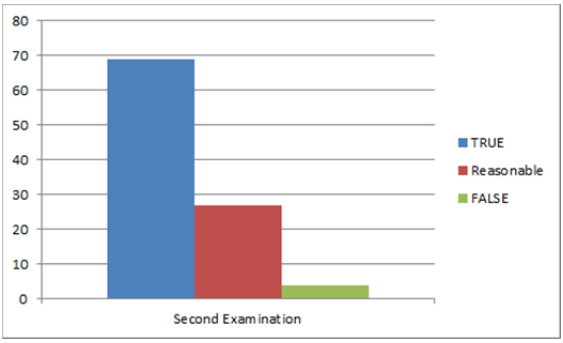

Fig. 2. Second Results

3.2. Color Preferences

Colors with darker tones such as blue and brown were more attractive to men, while designs having a color spectra such as pink, purple, red and yellow, in comparison with other colors, was a prevalent trend among women's choices. Designs with the desired tone for men were 48% of total designs, 67% of which were voted as the first choice and the remaining 33% were voted as second choices. Designs with the desired tone for women were 30% of total designs, 82% of which were selected as the first choice while the other 18% were voted as secondary choices.

Sampling population was composed of 268 male and 192 female participants. Designs were also tagged such that they were sorted in four groups from the darkest to the lightest tone. It was observed that women show more interest in lighter colors, whereas men show more interest in darker colors. In Fig.3., the horizontal axis of the diagram shows the average dark to light approximate tone scaled from 1 to 4 and the vertical axis of the diagram indicates the redundancy of each group.

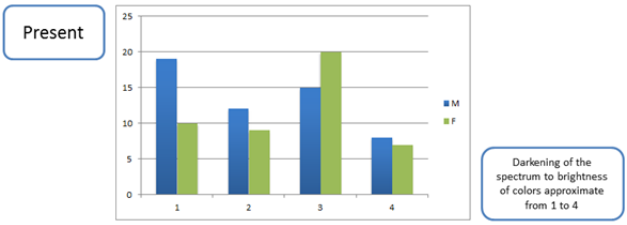

Fig. 3. Sex towards color

Since most of the participants who have taken part are from Iran and some European countries, results in the Middle East and 1st level European countries (more prosperous)

have provided the most accurate results. Fig. 4. compares chosen countries and favorite kind of colors for the participants.

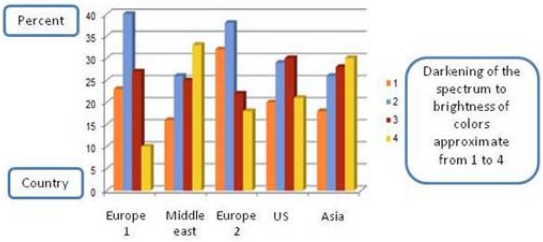

Fig. 4. Color toward User's Location

As shown in Fig. 4, lighter color designs have attained higher ratings in Asia and the Middle East compare to other tones; meanwhile European countries have experienced a rather reversed regime. Asian countries, especially those in Middle East, have chosen light colors.

In Fig. 4., the horizontal axis of the diagram shows the average dark to light approximate tone scaled from 1 to 4 while the vertical axis of the diagram indicates the percent of designs chosen by individuals in each group.

3.5. Time spent in website with relation to user's education

According to Fig. 5. those who have a higher education spend more time on a website. Many participants with a higher education have spent 40-45 sec time in the website.

In this diagram, the horizontal axis shows the education level while each color is indicative of the average time spent in the website.

The vertical axis shows the percent of designs chosen by individuals in each group. The average time spent on web pages as reported by the literature has given values greater than this research.

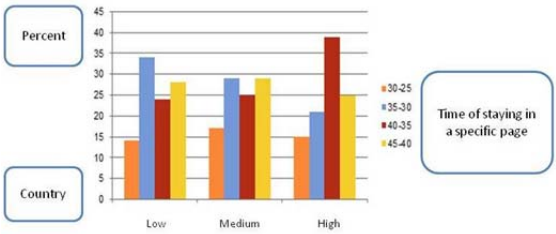

Fig. 5. Spent time in website towards user's education

Fig. 6. has summarized the relation between age and number of links in the website. As can be observed, different age groups have different numbers of favorite links. Y2 group has liked a great number of links while Z group has preferred to experience a mid-level amount of links.

In this diagram, the horizontal axis shows the age group with each color being indicative of the number of links in a website, namely less than 8, between 8 and 12, and more than 12 links. The vertical axis shows the redundancy of designs chosen by individuals in each group.

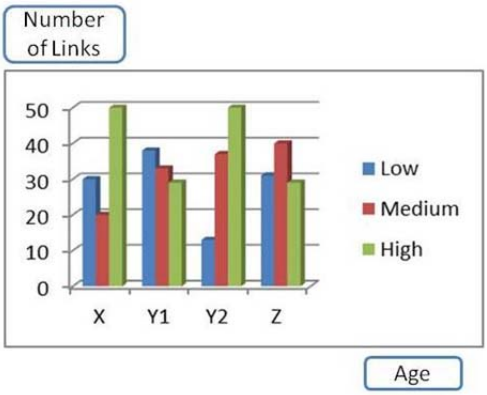

Fig. 6. Age toward Number of Links

It is evident that the second degree of complexity which is located next to the highest complexity has shown a different behavior in this diagram. Those who are interested in this degree of complexity have spent the longest time in the website. In Fig. 7. is approximate value of complexity from 1 to 4 in which each design has been tagged by its relevant complexity. Regarding the choices of individuals with the average time spent in websites, their redundancy normalized to unit has been shown here.

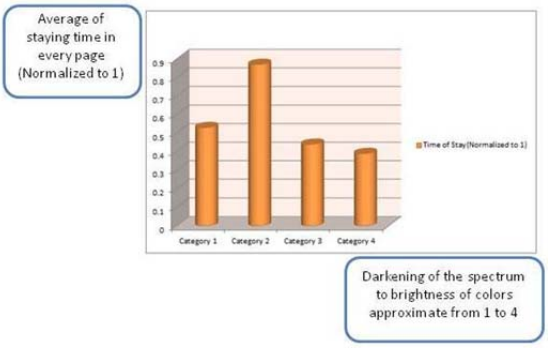

Fig. 7. Spent time towards banner's simplicity and complexity spectrum

3.4. The role of location

Location of the participants has been divided into 5 regions and the characteristics have been shown such that they could be comparable.

These diagrams are used to compare different locations towards some specifications which have revealed successful results. This diagram is indicative of

the average time spent by individuals in websites. Thereby, time has been displayed and location of each region has been specified regarding the average time from the diagram.

People who live in the Middle East have had the least time spent on websites meanwhile those who live in North America have also shown the least spent time in web pages.

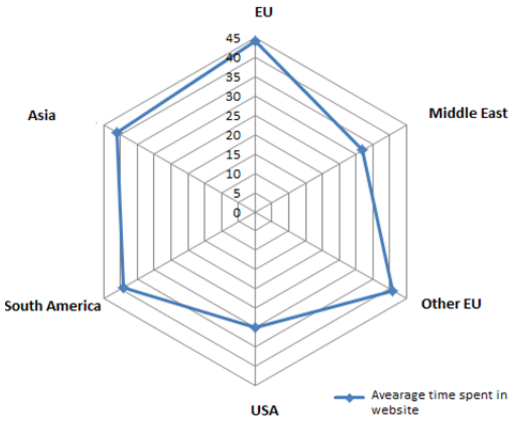

Fig. 8. Location towards average time spent in websites

Fig. 9. illustrates the number of links in web pages since the average number of links towards each region has been specified on the diagram. The number of links affects user's concentration and accuracy of his/her choice. Whenever the number of links is greater, it would be more difficult for the user to choose his/her favorite link. At the same time, more requirements would be felt to suggest links and help automatically.

People, who live in 2st level European countries, are more interested in greater number of links.

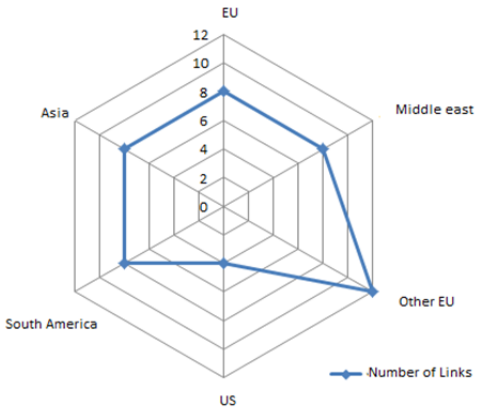

Fig. 9. Location towards number of links

Considering the interest of people from various regions in the world to lighter or darker tone colors, Fig. 10. reveals the relation of color variety towards location of participants. In this diagram, the amount of color variety has been determined for each region. People from North America show less interest to high variety of colors.
Fig. 10. Location towards color variety

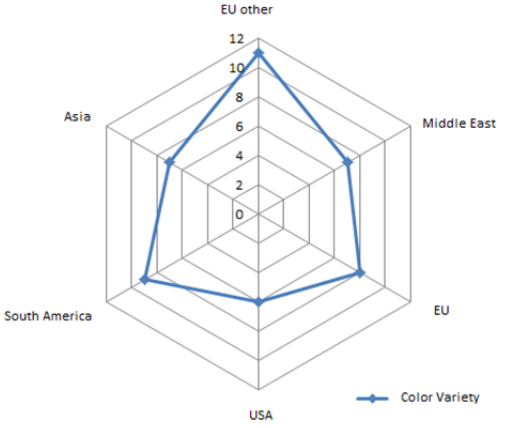

Fig. 10. Location towards color variety

Location towards page complexity
Fig. 11 focuses on the interest in complex pages in various regions. In this diagram, the average tagged amount of complexity has been specified for each region. Advanced European countries in addition to Asian countries show great interest to more complex pages.

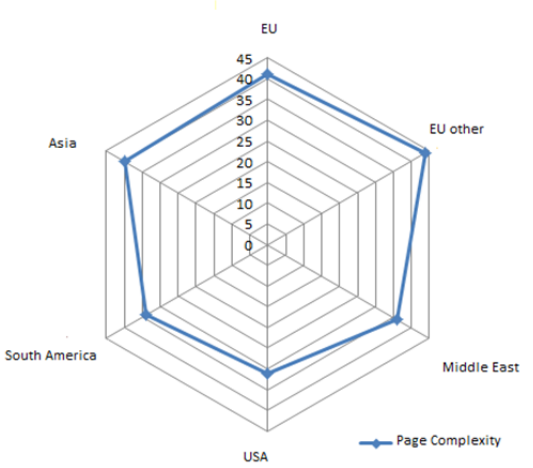

Fig. 11. Location towards page complexity

3.4. Further aspects

As was mentioned before, the percentage of visiting top websites is effective on choosing design by the user. This information is obtained from the extension which has been installed on the browser. The results have been normalized to 10 using *Matlab* software. Those who have visited the maximum number of top websites have shown their interest to designs with minimum number of pictures.

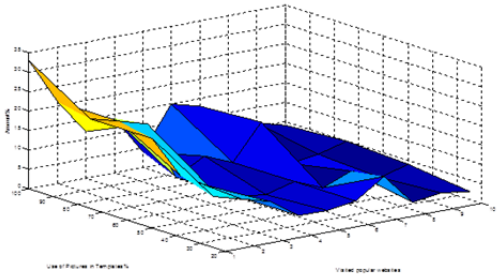

Fig. 12. Visiting top websites towards using pictures in the website

3.10. Age towards number of links

In this diagram, the horizontal axis has 4 values: 1 for age group of X, 2 and 3 for age group of Y (between 18 and 31 years old which has been divided into two sets), and 4 for age group of Z. Loads of the diagram are the number of links and vertical axis is redundancy. As can be observed, lower ages have chosen the greatest number of links.

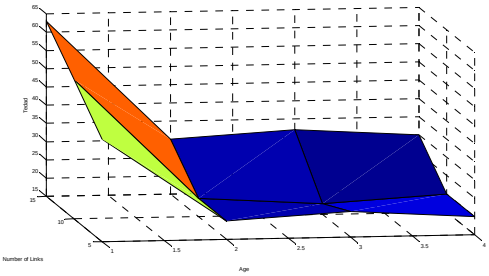

Fig. 13. Age towards number of links

Trend in this diagram is similar to the previous one and it is possible to interpret relations between age and education. One of the horizontal axes is education in which value "1" denotes lower education levels and value "4" denotes higher education; the other is the number of links and vertical axis shows redundancy. It can be seen that lower education has been accompanied by the greatest number of links.

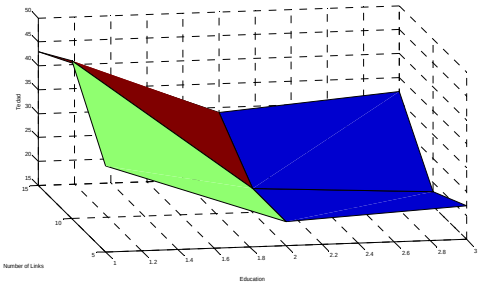

Fig. 14. Education towards number of links

This type of diagram is used to compare different purposes of various websites towards some characteristics which have shown acceptable results. The following diagram specifies the average amount of time spent on each page such that the average spent time on each page has been defined towards different goals of the user on the diagram. The amount of time spent for individuals who have chosen "goal-oriented" and "advertisement-oriented" websites, have been reported to be more than the others.

Fig. 15. Website purpose towards some characteristics of the website

This diagram indicates the average number of visits to the website in which this value has been depicted versus different goals of the user on the diagram. The average number of visits to the website for individuals who have chosen “goal-oriented” and “advertisement-oriented” websites, have been reported to be more than the others.

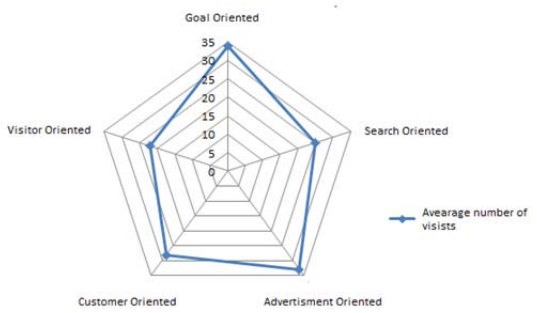

Fig. 16. Average number of visits to the website

The following diagram illustrates load of the web page such that this parameter has been sketched on the diagram against different goals of the user. The average load of the web page for individuals who have chosen “goal-oriented” and “advertisement-oriented” websites, have been reported to be more that the others.

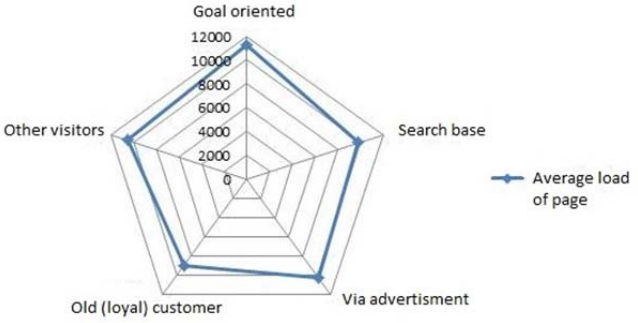

Fig. 17. Average of the web page load

5. Conclusions

Sampling population with the age of 18 to 31 years had the greatest number of participants with successful results. Age range is significantly variable in other age groups and their results do not have acceptable accuracy.

Users with education level of diploma and lower with users of lower income are interested to be place the column at right. It can therefore be concluded that they have been more related to the Persian websites whose exploring experience was limited to simple issues in Iran governmental websites for example websites of gas card, post, Housings and etc. which usually have their column at right. One conclusion made from these observations was that exploring experience of a user has direct impacts of his/her favorite styles. People who have education level less than bachelor, prefer less than 8 links.

Age and sex have imposed the most prevalent influences on the choices such that distinction in chosen designs of each group is completely obvious.

The group with education levels lower than diploma has the least attention to page components. They are also interested in a greater number of links.

Users who have low income levels like to visit a website with light colored and busy header pictures. On the other hand, users with high income levels are keen to visit websites with warm colored and nature header pictures. Individuals whose average time spent on various web pages is more than normal, are interested in third type of the websites which do not have columns or busy design.

Users who explore among famous websites are rather interested in picture free designs.

Users older than 31 years choose the header picture from busy ones. They also use the darkest colors to design the website and prefer plenty of pictures in it. With respect to the limitations such as participation of users in all ranges under study, some of the specifications have adequate resources while others lack such resources. For example, a majority of the sampling population are Iranian students who will affect education level and financial situation as well as other specifications. Another limitation that has considered publish/subscribe goal and business for his/her website. One other drawback experienced was related to the difficulty to bring people of other countries to agreement. The least number of participants were from Africa and Australia while the number of participants from America was not enough as well. It seems that the income criteria have not been answered properly. The major limitation against the research was in social networks in which users hardly trust newly released applications due to incidence of virus worms, so it will be rather difficult to make them satisfied. In some areas, a clear lack of resources can be felt in mapping between website characteristics and topics such as personal specifications.

Achievements of this research can be further developed in the following areas:

To design of dynamic websites which requires much time and cost; to conform page patterns regarding the tags from page classification interested by users with the proposed templates for them; and to develop results obtained from observing users' behavior toward other practical areas.

Taking into account the research topic being modern in addition to its close correlations with other areas including psychology and sociology, many other attractive features were also explored during this study, unfortunately it is not possible to discuss them all here. Some of the issues which can be studied and examined in future research are summarized below:

Considering greater number of characteristics with more details in addition to more users from more variety can certainly impose a positive effect on the model and tagging the designs, meanwhile it will make results more accurate. Furthermore, if a

user's exploring behavior is recorded in longer period of time, the results will be of higher accuracy. A number of parameters have been considered here for the voting system and page ranking. For example, receiving feedback from the user affects its class cluster designs in such a way that adds a coefficient for the positive votes and subtracts it for the negative ones. Modification of these coefficients can lead to higher performance. Coefficient mentioned for distinction of specifications for each part of the website can also be altered. Changing the normalizing parameters can have positive or negative effects on the results.

Some characteristics which have been collected from questionnaires may lack enough accuracy and they are better to work automatically. Besides, some people may not allow their demographic information to be published through social networks due to security issues. Applying techniques to make them agree to do so, (for example through trust let techniques) can have significant effect on the accuracy of data.

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Efficiency as an Aspect of Quality: In the Way of Developing a Method for Evaluating Efficiency of Enterprise Modeling Methods

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Abstract. All organizations aim at making progress in their carrier. Therefore, they should have a clear image about the current (AS-IS) and the desired state (TO-BE); and based on that figure out the actions they should follow for moving from AS-IS to TO-BE state. Enterprise Modeling (EM) is a support for this purpose and requires applying the proper tool, i.e. an Enterprise Modeling Method (EMM). However, this application process requires to be efficient. This means the intended results (models) should be achieved, whilst the resources are used in a worthwhile way. This paper concentrates on how to conduct an efficient EMM application process. The foundational idea behind this research is that if behavior of an EMM (and its different parts) is foreseeable, the results will be closer to the stakeholders' preferences and the resources will be used in a more worthwhile way.

Keywords: Enterprise Modeling, Efficiency, Quality.

1 Introduction

Any organization aims at making profit and progress to be able to compete in its business area. To fulfill this, we have to have a clear understanding about the current (AS-IS) state of the organization is, what we intend to achieve (TO-BE) and how to move from the current to the desired state. Enterprise Modeling (EM) and Business Process Management (BPM) are two areas that for a long time have been part of a tradition where the mission is to improve business practice and management [21]. Respecting [17], an enterprise model that is result of receiving support from EM, helps people who are involved in the development process and probably have different professional backgrounds, to communicate in a more convenient way. In order to pursue any discipline, we should use a proper tool. Accordingly, receiving support from EM imposes the need for application of a proper tool for it, which is an Enterprise Modeling Method (EMM). An EMM is developed in order to help visualizing an enterprise from one or several specific viewpoints. EMMs provide intuitive and understandable graphical languages to represent relevant concepts and their relationships, so modelers are able to explicitly and clearly capture and present

domain knowledge using limited training in the corresponding methods and tools [49].

The same as any other process, we want a process of applying an EMM result in models from an acceptable degree of quality. For this purpose, we have to ensure a consistent and cost-effective attainment of the desired product quality during production. Conformance quality relates to the need for managing production processes to yield products adhering to expected specifications [1]. When it comes to EM, it is the EMM application process that should conform to quality issues. An aspect of process quality is whether it is worth to be conducted. A process might be expensive, if the results do not match to our needs or the required resources will not be used in a worthwhile way. In other words, in the way of developing enterprise models we require not only concentrate on obtaining the models, rather taking care of resource usage. Assessing the gained output in comparison to the used input is discussed under the name of efficiency.

In this paper, the author reports about a PhD research that focuses on efficiency evaluation of EMMs. The aim of this research is developing a method that can be applied by people who are involved in an EMM process to verify efficiency of the intended. process.

The Research Questions (RQs) that should be addressed by completing this research are:

- RQ 1. What is the meaning of efficiency in the context of EMM?
- RQ2. How can we evaluate efficiency of an EMM?
    - RQ 2.1 What are the suitable criteria to describe efficiency in an EMM?
    - RQ 2.2 How to evaluate each method part in an EMM?
    - RQ 2.3 How to evaluate efficiency of relation between different method parts?

2 Related Works

2.1 Notion of Method

Several people have worked to shed light on the notion of method., such as [8], [10], [18], [35] and [41]. In some references ([8], [35], [41] and [42]) a method is considered as a process that should be followed to reach a specific aim, such as development of an artifact. On the other hand, there have been people that have taken a closer look at this notion; Goldkuhl et al [18] as well as Cronholm and Ågerfalk [10] have worked on the method notion from this viewpoint.

Goldkuhl et al [18] present a simple and at the same time comprehensive picture about method. Thus, the notion of method that is followed in the current work, has been adapted from [18], but modified. Below we present the notion of method that we reached after making modification to (Goldkuhl et al's [18]. The explanations about various method parts are also adapted from [18] and [44]:

All methods are built on some implicit or explicit *Perspective*, which is the conceptual and value basis of the method. Parts of *Perspective* can be inherited in the method in a rather tacit way. A method entails procedural guidelines (*Procedure*) to help in finding out what to ask about the under study domain as well as how to ask and answer these questions. The representational guidelines (*Notation*) support documenting answers to these questions. There are also *Concepts* that are the cement part between *Procedure* and *Notation*. When there is a close link between *Procedure*, *Notation* and *Concepts*, we call this a *Method Component*. A *Method Component* itself might be a other *Method Components*. This has been shown in the figure by cascade of several *Method Components*. A method is often a compound of several *Method Components*, that is often called a methodology [3]. Different *Method Components* together form a structure called *Framework*, which includes the phase structure of the method. The phase structure clarifies what has to be done, what has to be achieved and in what order the work steps should be completed. Elucidation about roles that should be involved in the process of working with a *Method Component* and how they should interact is the subject of *Cooperation Forms.* See Figure 1:

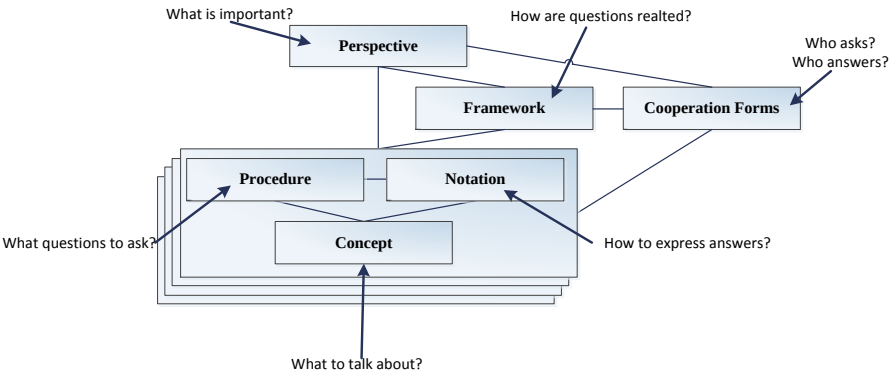

Figure 1. Finalized Notion of Method

2.2 Notions of Quality and Efficiency

Quality is a matter that is always important. We want products and processes be from high enough quality. All people agree upon this and there is no need to discuss this issue more. But quality itself is a broad term that has different meanings to different people in different institutions, public or private, depending on their specific perspective [51]. Therefore, it requires explanation in each particular case to clarify its meaning. To do this, different people have presented lists of sub-criteria for this term to shed light on its meaning. In this way, there have been researchers that have stated efficiency as a criterion to quality. Examples of such works are [22] and [45]. But what efficiency means?

To reach any aim such as gaining products we have to perform related processes, for which we have to use resources. But resources are not unlimited [25] and using them is costly. Therefore, we want not only obtaining the results, but utilizing the resources as well. This issue is discussed under the name of efficiency. Several people have worked on this and presented definitions for that. As Emrouznejad [2] says:

efficiency has been commonly defined as the ratio between output and input.

This is in fact the perception that most of people have about this notion. Examples of this can be found in [9], [12], [34], [47] and [50]. Each of these references have presented their own definition about efficiency, but in all of them they were focusing on making comparison between the obtained output in comparison to the used input.

There is also one more way of looking at this issue, which considers efficiency as "foreseeability of a working process". This viewpoint has been followed by less number of people. An example of this is presented by Kurosawa [28]:

efficiency is used for passive or operational activity, which is usually defined technically so that the system and its behavior are foreseeable in advance.

Although it seems that these two attitudes are not related to each other, they are in fact two sides of the same coin and support each other. And in case that we concentrate on following any of them, the other one is also fulfilled.

2.3 Quality Evaluation in EM

By going through the published researches in the context of modeling we can see that several researchers have worked on the quality issue. In this way, quality of modeling products (models), modeling processes and modeling languages have been of interest. Examples of this can be seen in [4], [5], [7], [13], [14], [17], [24], [27], [29], [30], [31], [32], [36], [37], [38], [39], [43], [46] and [48].

Some of these research works have presented a list of quality criteria, whereas some others are dedicated to development of evaluation frameworks. Respecting the given examples we can say that in the context of modeling most of the works are about quality issue. However, quality itself is defined by specifying its criteria. In the IS field there have been researches that their purposes were defining the quality criteria. These works present the results in the form of quality models that show what the relation between quality and its criteria. These quality models are however applicable in modeling context too. The quality models that have been developed by now are Boehm [6], ISO 9126 [23], McCall [33], FRUPS [19], Dormey [11], BBN [20], Star [26] and SPQM [40]. In all these quality models, efficiency is marked as a criterion to quality, but still the concentration is on quality. Indeed, no attention has been shown to the problem of efficiency in the context of modeling. According to this importance of efficiency (see section 2.2), the decision became to conduct a research about efficiency in modeling. As EM is a support for various types of business, the focus of the research work is narrowed down to EM. To receive support from EM it is required to apply the proper tool, which is an EMM. Such a method is required to meet some specifications to support an efficient modeling process. Consequently, the focus of the research was narrowed down to identifying specifications of an EMM

that supports an efficient modeling work. Such an EMM is called efficient. This is complemented by underlying questions to aid evaluation of efficiency of an EMM.

3 Research Approach & Results

3.1 Research Approach

To perform this research, a combination of Deductive, Inductive and Codification approaches was used. The aim of this thesis was forming a new artifact. Figure 2 shows a general and also detailed overview from the pursued research approach. As it can be seen in this overview, the research started with a set of “Initial RQs”, which were suggested by the PhD supervisors. These “Initial RQs” however, were not specifying the research gap, rather were used as a hint or starting point. By keeping an eye on these two, the author conducted the next two steps: “Literature Review” and “Case Observation i”. Step “Literature Review” entailed going through the existing literature, such as conference papers, journal papers and dissertations. This step that was rather time consuming, aimed at finding out the “State of the Art in the Research Field”. On the other side, step “Case Observation i” was done, which resulted in obtaining a set of empirical data, so called “Empirical Data i”. Based on the results of the last two steps, the research problems were identified and the RQs were defined, i.e. step "Problem Definition & Formulation of RQs" was carried out and the "Knowledge Gap (Problem & RQs)" were identified. The next step was "Results Extraction". To do this, various inputs were used. ”State of the Art”, "Empirical Data i" and "Knowledge Gap (Problem & RQs)" were a part of what was used here to develop the "Results". Also, by looking at the figure we see that there is a step called "Case Observation ii", which its results ("Empirical Data ii") were used for making refinements to the results.

The gained results however required to be refined. This refinement (which we have assumed it to be a part of “Results Extraction” step) was about applying the results to two EMMs and identifying the change needs based on this application work. The cases that were observed in "Case Observation i" were mainly modeling sessions from InfoFLOW2 project and Enterprise Modeling Course (at Jönköping University - Spring 2011). Similarly, "Case Observation ii" entailed observing sessions from Enterprise Modeling Course (at Jönköping University- Spring 2012) and InfoFLOW2 project. It should be noted that different sessions of InfoFLOW2 were observed in each case observation.

Although, the explanation above induces the perception that the research steps were carried out in a simple and straight forward sequence, in practice there were several iterations over them. During this work there were two major iterations. From one side steps of the “Results Development” phase were required to be iterated. From the other side, it was even required to go back and forth between steps of the “Results Development” phase and “Background Formulation”. Both of these iterations intended at supporting “Results” attainment. When the results reached a satisfactory state, it was time for “Making Conclusions and Answering RQs”.

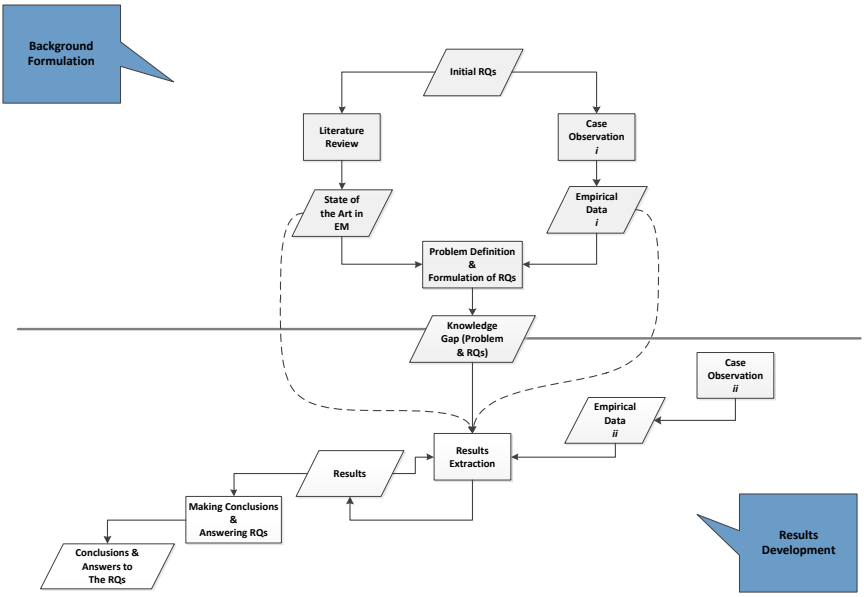

Figure 2. A General Overview of the Followed Research Approach

3.2 Work to Date & Planned Work

From the phases and steps that are mentioned in Figure 2 and section 3.1, steps forming the "Background Formulation" are almost covered, i.e. "State of the Art" is identified and "Empirical Data i" are extracted.

From "Results Development" phase, "Results Extraction" cannot be done in one go and requires iterations for the purpose refinement. Hence, referring to "Empirical Data ii" and modifying "Results" has being done iteratively. And because of this, reviewing "Empirical Data ii" is also ongoing. It has been even sometimes necessary to go few steps and do some extra work regarding "Literature Review" and review of "Empirical Data i". This might look contradictory to what is written about completion of "Background Formulation". Nevertheless, as major part of that phase is done, we say that it is completed.

At this time, refinement of "Results" using required inputs for this step is under process. When the "Results" reached a satisfactory state, the last step i.e. "Extracting Conclusions & Answering the RQs" will start.

4 Results

According to section 2, following an efficient process (i.e. a process that supports both obtaining the intended results whilst utilizing the resources) is a constant need. This is true for an EM process too, which is about applying an EMM to develop enterprise models. As we stated in section 2.2 there exist two types of viewpoints towards notion of efficiency, which are "the ratio between input and output" and "foreseeability of a working process", that support each other. Accordingly, if in an EMM application process the working process is foreseeable, the resources will be used in a worthwhile way. Moreover, it helps with gaining results that match to our desires. This means, following a foreseeable process aids in fulfilling conditions for efficiency.

Starting from this idea if we can foresee how an EMM application will be during its application, efficiency of the process is supported. To do this, we need to know how an EMM and in fact each of its comprising parts (*Perspective*, *Framework*, *Method Component* and *Cooperation & Collection Forms*) should be.

According to all above, contribution of this research is a method that includes a set of criteria that each method part has to fulfil to be foreseeable in the application process. A subset of these criteria should be always in the same way and are not dependent on the application case, whereas the other subset contains criteria that their fulfilment is dependent on the application case. We call these subsets "criteria for general case of application" and "criteria for specific case of application", respectively. Besides having awareness on the criteria, we need to be able to evaluate their fulfilment. Therefore, a set of evaluation questions assigned to each criterion are defined. In this section we aim at presenting the gained results, but it is not possible to demonstrate all of it. Therefore, the author decided to select just two of the method parts and bring a summary of explanation on their criteria, plus the suggested evaluation questions. According to this, efficiency criteria and related evaluation questions of *Perspective* and *Cooperation Forms* in specific and general case of application are presented in Table 1 and Table 2, respectively:

Table 1. Efficiency Evaluation of EMM *Perspective* in General & Specific Case of Application

Efficiency Criteria for General Case of Application:
Perspective is supposed to specify what has been covered by the EMM. This is done by specifying what important in this method is and can be expected from it. To select and work with an EMM, first we need to review it and assess whether it is a suitable choice, or not. Hence, it is vital that method *Perspective* be clear and understandable. Consequently, any change in the *Perspective* means the coverage (and consequently the expectations that we can have from the EMM) is going to be changed, too
Question for Evaluating Efficiency in General Case of Application:
Does the *Perspective* clarify what can be supported by the EMM? Does the *Perspective* show what cannot be supported by the method? Has any explanation been given about the meanings that could be mixed up (with similar words)?
Efficiency Criteria for Specific Case of Application:
When a modeling team is going to apply an EMM, they want to use the modeling results in a further application. Therefore, a modeling team has to pick a method that its *Perspective* shows there exists alignment between this EMM (and its output models) and the planned moves.
Questions for Evaluating Efficiency in Specific Case of Application:
Does the method *Perspective* match to the modeling team's intentions?

Table 2. Efficiency Evaluation of EMM *Cooperation Forms* in General & Specific Case of Application

Efficiency Criteria for General Case of Application: To apply an EMM by a modeling group, we need to know what competencies our team members should have. In general sense, competency is about "the ability do something (Merriam Webster's website)". When it comes to EMMs, this can be translated to the roles that we need for the modeling purpose and their knowledge. For each modeling case we need to involve people who are competent. An aid to the method users to figure out what competencies are required is presenting this information in the method handbook. This information is mainly about what roles are needed, what level of knowledge and experience should they have. Not only the needed roles, rather we should know what working ways should be followed by the modeling team. This means we need to know what *Cooperation Forms (Principles)* is appropriate. It is even preferred that the method handbook contain explanation on pros and cons of the prescribed *Cooperation Forms*. This is helpful specially in case that the modeling team needs to make comparison between a number of Cooperation& Collection Forms to pick one.
Question for Evaluating Efficiency in General Case of Application: Is it explained what competencies should the modeling team have for using this method? Is it explained what *Cooperation Forms* are applicable for the EMM (and what are the pros and cons of each)?
Efficiency Criteria for Specific Case of Application: If a modeling team has planned to do an EM process, which requires applying a proper EMM, they need to cooperate with each other. In a specific EMM, following a specific (set of) *Cooperation Forms* is possible. Therefore, the involved modeling team should be able to work with the underlines *Cooperation Forms*. This ability is mainly about having theoretical as well as practical knowledge for working the EMM.
Efficiency Criteria for General Case of Application: Do the modeling team hold the minimum level of ability that is underlined by the EMM developers?

The suggested evaluation method is applicable both for a completed EM process and an ongoing one to evaluate whether the process is or was efficient.

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ПЕРСПЕКТИВНЫЕ НАПРАВЛЕНИЯ ИССЛЕДОВАНИЙ В ОБЛАСТИ БИЗНЕС-ИНФОРМАТИКИ

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