WEB-BASED INFORMATION SYSTEMS IN THE STOCK MARKET FINANCIAL INFORMATION DOMAIN

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Abstract: The information domain is a recognised sphere for the influence, ownership, and control of information and it's specifications, format, exploitation and explanation (Thompson, 1967). The article presents a description of the financial information domain issues related to the organisation and operation of a stock market. We review the strategic, institutional and standards dimensions of the stock market information domain in relation to the current semantic web knowledge and how and whether this could be used in modern web based stock market information systems to provide the quality of information that their stakeholders want. The analysis is based on the FINE model (Blanas, 2003). The analysis leads to a number of research questions for future research.

Introduction

The development of advanced information systems (IS) serving the stakeholders of the various stock markets around the world is of great significance because they reflect the standards, the regulations, the objectives and the mechanisms for the exploitation and usage of money for the benefit of participating companies and investors. Money management is a capability required by all organisations regardless of the goods they produce or the services they offer. The stock market financial knowledge domain is probably the most commonly accessed and discussed by people of all educational backgrounds, cultures and incomes.

The critical economic role and the complexity of financial information described in the stock exchange financial information systems has led to the development of a number of standards. Unfortunately different groups of players have been using different standards or different interpretations of the same standard (Jayasena, Madnick & Bressan, 2004).

Organisations in the financial industry, like banks, stock exchanges, government agencies, or insurance companies operate their own financial information system or systems. Often they develop different contexts that may result in semantically heterogeneous representations of the same knowledge (Madnick, 1996). On the other hand, when making investment decisions, it is important that the information communicated between participantss is understood by both. Context mediation is one way to translate the meaning on a standard form. In COIN (Siegel & Madnick, 1991), sources and receivers describe their context to the mediator independently, which then uses metadata to detect conflicts in their data representation and to apply relevant conversions.

Interoperability of financial information systems is not the only problem in the international stock exchange system (Jayasena, Madnick & Bressan, 2004). Information quality is a very important aspect. Information quality includes dimensions like accuracy, reliability, bias, age, purpose, value, symmetry and is a very important aspect of information exchange. Systems reflect various changing regulations and laws that may differ from country to country or between regions. Coverage and accuracy of this reflection depends on many dimensions, like information systems building capability of software firms, age of the system software being used and support capability of tools employed for development. Access time and access restrictions to information result in asymmetries that can produce situations that will allow the development of illegal profits. The international networking of big brokers and other players gives them relative advantage to decision making comparing to listed firms or small investors, unless symmetrical information provision has been build into the relevant network of systems. Open standards in design and development of these systems is of critical importance for the increasingly globalised network of stock exchange institutions, but also open standards in the development and operation of the institutions themselves is of equal importance. The issue of time difference in the operation of the various stock exchanges around the globe adds a significant case for asymmetric information provided to the international stock market network stakeholders.

In the following paragraphs we try to evaluate the existing stock market information systems as nodes of an international financial network where stock exchange capabilities have become global for both institutions and investors.

FINE - Framework for Information Network nodEs

Blanas (2003) has developed a general framework on the evaluation of organisations as information systems. The framework is based on the networking paradigm and focuses on the operation, management and evolution of an organisational information network node. Figure 1 shows an expanded node linked to two other nodes presented as circled Ns.

The node is able to enclose a number of capabilities and quality characteristics in various extents and intensities. In figure 1 we can distinguish first and second level feedbacks.

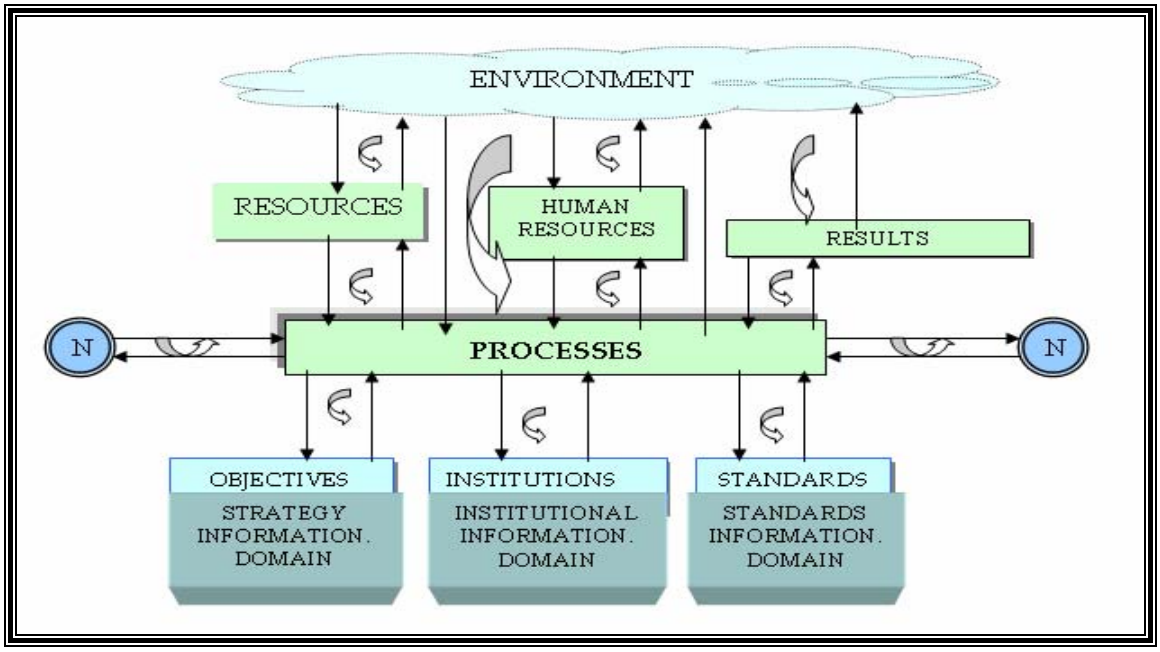

Figure 1 F.I.N.E. - Framework for Information Network nodEs (Blanas, 2003)

The first level feedbacks are the following:

[1.1] Processes → Human Resources → Processes

Human resource management on the development of leadership and motivation, evaluation, education, and training.

[1.2] Processes → Resources → Processes

Algorithm application, processing, storage requirements, access, evaluation, can be of strategic, managerial, administrative, operational type in respect to the value of information, level of automation, disaggregation and security, processing speed, storage capacity, and cost. Information has immediate relationship to the storage media and the access mechanisms.

[1.3] Processes → [Results →] Environment → Processes

Interface processes with shareholders, clients and citizens, operations, also on processes of service, evaluation, and development of new products and technologies. The level of understanding of the interface information depends on the level of asymmetry between institutional structures for the communication and processing of information.

[1.4] Processes → Objectives → Processes

The processes (conformance, participation, evaluation) refer to the level of recognition of environmental problems or chances, and the adaptation of the node to them, and they contribute to the acceptance, development and application of strategy. The configuration of objectives can become the main second level process for a strategic information domain.

[1.5] Processes → Institutions → Processes

Processes of institutional-managerial type (compliance, participation, evaluation) related to policy making, compliance nad participation to existing institutions and recording of any adaptation difficulties.

[1.6] Processes → Standards → Processes

Organization, operation, administration, assurance, logistics of projects and procedures, based on compliance, use and evaluation of standards. The standardization of information flows reflects the regulations and conventions of management. Many standards are immediate results of political-legislative instititionalization..

[1.7] Processes → Node → Processes

Outsourcing of subprojects and procedures, access to information residing in other nodes (networking) and on the interactions with other nodes' processes.

The second level feedbacks are the following:

[2.1] Results → Environment → Results

Environmental evaluation of node results to the environment.

[2.2] Resources → Environment → Resources

Environmental evaluation of procurement management and environmental issues management.

[2.3] Human Resources → Environment → Human Resources

Environmental evaluation of human resource management criteria and processes.

[2.4] Objectives → Strategic Information Domains → Objectives

Configuration of information domain strategies.

[2.5] Objectives → Institutional Information Domains → Objectives

Configuration of information domain institutions.

[2.6] Objectives → Standards' Information Domains → Objectives

Configuration of information domain standards.

In the proposed framework, we consider that problems are developed in cases of loss of equilibrium or asymmetry in communication across mechanisms. Equilibrium can be lost in cases of lesser capabilities or lost opportunities for learning or adaptation. Asymmetry can be developed from incomplete information or from control of the information flows. The capabilities of the various feedback mechanisms configure the capability maturity level of the node.

The first level feedbacks continuously improve the processes that comply with the current objectives, standards and institutions, using the evaluation processes and collect meta-information for the evaluation system.

The second level feedbacks use the meta-information from the first level and the existing environmental knowledge with probable use of benchmarking and propose the development of new objectives, institutions and standards.

If some feedback falls behind, that is an indication of a deficiency in resources, institutions, capabilities, environmental scanning, or will.

It is profound that the ability of a node to selectively diffuse or protect the information residing in its local memory depends on the corresponding abilities of the related nodes within the network

In the following section, we review the stock market information domain under the FINE network.

The Stock Market Information Domain under the FINE framework

The design of stock market information systems is not covered adequately in the literature. Very little is conveyed regarding the design issues, the system software and the tools applied in their development. One probable reason is to avoid attacks based on known flaws of these systems. Another reason is that there are no international institutions or regulations that demand that such information is published. There are many issues in stock market financial information systems development that require the attention of their stakeholders. We present some of these issues and we examine their possible impact using the description of the second feedback level in the FINE framework. Our analysis is focused on the strategic information domain with certain extensions to the institutional and standards' information domains.

Strategic information domain

The development of the stock market information domain is a very sensitive area for economic and security interests. The tendency for the development of stronger stock market nodes will accelerate with the provision of extra capabilities and support built in their information systems that other nodes will not be able to provide. These capabilities also depend on various political and strategic networks that relate to the companies decision making and their economic environment. The differentiation of the stock market nodes that are strategically positioned in the international stock market network today is already happening. There are a number of questions related to the operation and survival of smaller stock exchange nodes in relation to their information systems' capabilities.

The question of a semantic domain that will be able to describe the advanced stock market information has not been answered yet. Most of the currently represented information is in textual form, that is impossible to be processed in time by most users. Some IS are more advanced than others either in their designs or the richness of the provided information or the functional user interface. There are huge differences between the lower and the higher end of these systems. There is a need for a higher level of semantics at the design and interface level in order to be able to describe and operationalise complex financial information. These leads either in the development of "explanation" or "translation" mechanisms that will always suffer from deficiencies, or the development of ontologies for the semantic web, that is formalised designs of information that can be incorporated in suitable IS for easier searching, processing, and interpretation.

These ontologies must be able to face the needs of both the stock market exchanges and the customers. The outcome of such an effort cannot be anything else but an open design. Until now, none of the existing stock market IS is based on an open design. The only openness may be the use of some XML based tools and standards. There are a number of questions on the type of strategies that should follow by the stock markets around the world:

Should they develop semantic web representations for all their financial information domains?

If yes how is that going to be enforced? If not, who benefits from the existing asymmetry and inequality of information provision?

If enforced, what will be possible results for the various stakeholders? What will be the future of smaller stock exchanges? If not, what will be the dynamics for possible convergence?

Institutional information domain

To answer the questions in the strategic information domain may require institutional or other answers. Any institutional measure cannot succeed unless there is sufficient knowledge capability and power to support it.

Quality labor and sufficient capital are the main inputs for the development of a stock market information system. One could add knowledge, creativity, quality and standards that may not be direct derivatives of labor and capital. The question on where and how to complement the need for more and better input and output is crucial. We need to answer questions on the requirements for state support, institutional measures, and knowledge creation on an international basis.

The development of a common semantic domain for advanced stock market information manipulation requires the cooperation of a large number of stakeholders in both public and private spaces at an international level. There are a major number of institutions involved that will cooperate on such a strategy only if there is a win-win situation for everybody. In case of widely adopted semantic designs, the customers with the lower information processing capability will not be as disadvantaged as they are in the current operation. On the other hand, when

this happen, possibly the evidence for fewer stock markets will be profound and the international stock market network might end in fewer larger nodes. There are a number of questions on the type of institutional measures that should develop:

Will these advanced semantic domains be able to be operated by lower capability exchanges?

What institutions will be able to enforce the development and application of new standards?

We are currently going through the strengthening of organised hedge funds that have advanced sourcing and exploitation of information capabilities. When such a change happens will there be a more stable control of the financial markets by their stronger players? What institutions will be able to alleviate the development of oligopoly market structures?

As we can see in the next paragraph, the relevant standards are already in place. There is a need for institutional cooperation in deciding on accepting and using these tools, and on the acceptance of common open designs for the stock market financial domain. The development of IS that will have common designs on a desirable scale of selective features and using different IS development tools can still be left in the discretion and the capability of the independent stock market institutions.

Standards' information domain

The quality of information systems depends very much on the type of development tools being used. It is very important, on what tools should be used, and whether there are available quality designers and programmers to apply them and be able to cooperate effectively.

Programmers can achieve the same user interface and functionality using different tools and algorithms, the important part is the design and the information systems environment. There are fundamental differences in the operating systems, the interfaces, and the structure and the capabilities of the programming tools being used under the different environments.

The application of XML related tools is a unique opportunity for standardisation in financial market information exploitation. XML can be the vehicle for the development of the semantic financial domain. XML extensions and standards for the financial domain like FpML, XBRL, RIXML, ebXML, NewsML, IFX, OFX, MarketsML, ISO 15022, swiftML, MDDL, have been defined (Castells, Foncillas, Lara, Rico & Alonso (2004). Tools for XML usage have been in use like XBRL, RIXML, and NewsML in the last few years. What is missing? A common approach to the user interface domain regardless of the stock market IS that [s]he is logged in.

Conclusions

From the above analysis we gather that development of stock market information systems requires certain strategies to be followed in order to be able to maintain some level of competition on the control of information domains that may be monopolised in certain strategic areas of economy and security. But even if the stock market information systems design and application succeeds, there are great dangers for the control of information domains to remain oligopolised due to unequal distribution of critical masses of stakeholders, and other factors like distribution of wealth and usage of financial tools. It seems that for the moment there are more questions than answers.

Acknowledgements

This research has been carried out under the uaspices of the ARCHIMEDES project that is co-funded by the European Social Fund and National Resources- EPEAEK II

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RECENT RESULTS ON STABILITY ANALYSIS OF AN OPTIMAL ASSEMBLY LINE BALANCE

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Abstract: Two assembly line balancing problems are addressed. The first problem (called SALBP-1) is to minimize number of linearly ordered stations for processing n partially ordered operations V = {1, 2, ..., n} within the fixed cycle time c. The second problem (called SALBP-2) is to minimize cycle time for processing partially ordered operations V on the fixed set of m linearly ordered stations. The processing time t_i of each operation $i \in V$ is known before solving problems SALBP-1 and SALBP-2. However, during the life cycle of the assembly line the values t_i are definitely fixed only for the subset of automated operations $V \setminus \tilde{V}$. Another subset $\tilde{V} \subseteq V$ includes manual operations, for which it is impossible to fix exact processing times during the whole life cycle of the assembly line. If $j \in \tilde{V}$, then operation times t_j can differ for different cycles of the production process. For the optimal line balance b of the assembly line with operation times $t_1, t_2, \ldots, t_n$, we investigate stability of its optimality with respect to possible variations of the processing times t_j of the manual operations $j \in \tilde{V}$.

Keywords: Scheduling, robustness and sensitivity analysis, assembly line.

ACM Classification Keywords: F.2.2 Nonnumerical algorithms and problems: Sequencing and scheduling.

Introduction

A single-model paced assembly line, which manufactures homogeneous product in large quantities, is addressed (we use terminology given in monograph [Scholl, 1999]). The assembly line is a sequence of *m* linearly ordered stations, which are linked by a conveyor belt or other material handling equipment. Each station of the assembly line has to perform the same set of operations repeatedly during the life cycle of the assembly line. Set of operations *V,* which has to be processed on the assembly line within one cycle time *c,* is fixed. Each operation $i \in V$ is considered indivisible: An operation has to be completely processed on one station within one cycle time. All the *m* stations start simultaneously the sequences of their operations and buffers between stations are absent. *Simple Assembly Line Balancing Problem* is to find an optimal balance of the assembly line for the fixed