

Detection and analysis of problems in enterprise IT solutions

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Abstract: Enterprise IT solutions have turned into a must for every company that needs to grow and compete in contemporary demanding business environment. However the long, successful path of implementing complex IT solutions is not as easy as it seems at first glance – the percentage of failures is still high. In this paper we analyze the use of self-adaptive classification methods for detection and analysis of problems that may arise during software solution adoption.

Keywords: enterprise IT solutions, self-organizing maps, software failures, IT change management;

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1. Why are enterprise IT solutions so complex and fragile?

Enterprise IT solutions have turned into a must for every company that needs to grow and compete in contemporary demanding business environment. They have expanded from being a “symbol” of innovation and creativity into a must for every activity that needs to be done in time, with care and with a guaranteed quality. Yet a lot of IT projects end with a failure that can spread from the early stage of planning to the final steps of actually introducing the product and putting it to work. Being an important subject these failures have attracted interest of scholars and practitioner alike, as for example in [1], [2], [3] and [4]. Even this short list however, brings to our attention one important fact – that problems related to IT solutions can be studied from multiple points of view and are thus subject to countermeasures that may be hard to define correctly, understand in full and implement in practice. In part this is due to the fact that the generic term “IT enterprise solution” is used for quite different in both purpose and complexity products and in order to analyze their implementation in details it is necessary to understand the process of their development, the details of their adoption in the organization and the subtle specifics of the business processes they are representing and supporting. Typically all this knowledge is spread across the organization (and it is a very rare case to have a single person that is inside all of the details) which means that managing these solutions is costly, takes time and requires combined effort of different experts.

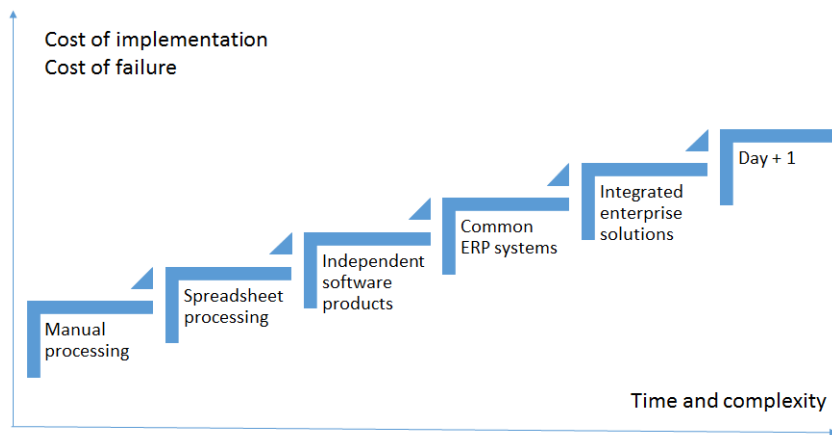


Figure 1 can also be used to provide insights on why enterprise IT solutions are so complex and subject to frequent change:

- since they are a product of a long evolution and there are often mixture of subsystems that exist on different “steps” of those shown on Figure 1. This limits their flexibility and their ability to adapt to changing business requirements;
- they are built to support business processes and as the environment changes, they have to track these changes closely in order to provide value for the organization. Thus enterprise IT solutions need to be built with functionality and architecture that can meet future (e.g. to a large extent unknown at the moment) demands;
- no matter how sophisticated the IT solutions are, they still depend on humans to use and configure them, which means that final results will depend on factors that are beyond the scope of the solutions themselves but that need to be accounted for by organization management.
- although common application frameworks are used for enterprise IT solutions ([5]) the abstraction that they provide is often limited (mostly with regard to technical details).

This list is far from being exhaustive, however it helps to outline some of the central issues that organization management encounters when dealing with enterprise IT solutions. A far more detailed list of issues with importance to practitioners can be found at [6], [7] and [8] for example. The goal of this paper is not to provide another classification but to figure out if there is a proactive way of detecting potential issues with enterprise IT solutions before it's too late or before the amount of sunk costs have piled up.

2. Being a proactive problem manager

Provided that most of the problems that plague enterprise IT solutions are known and have been a subject of different case studies (like for example [9]) one would expect that the implementation of new solutions, or update of existing ones would be a straightforward process. Yet according to Gartner approximately 75% of ERP projects fail ([10]), and this figure is also high for other product types. That indicates that despite all analyzed failure cases it is still hard to properly classify an upcoming project into one of them (and thus benefit from removing in advance all typical obstacles) or that there are

subtle differences that cause non-proportional increase of the probability to fail. Of course in a complex organization one can also encounter all of these possibilities.

Therefore it is important to address problems with enterprise IT solutions proactively and if possible in a way that would minimize the possibility of missing an important issue or mis-classifying a problem case. In addition to experts analyzing a specific problem we can also benefit if we use an automated system that is able to adapt and learn from experience and that could also provide additional insights on the problem, without being burdened by limited knowledge or other human factors that go along with experts' opinion. A classification and "early warning" system like that should comply with the following requirements:

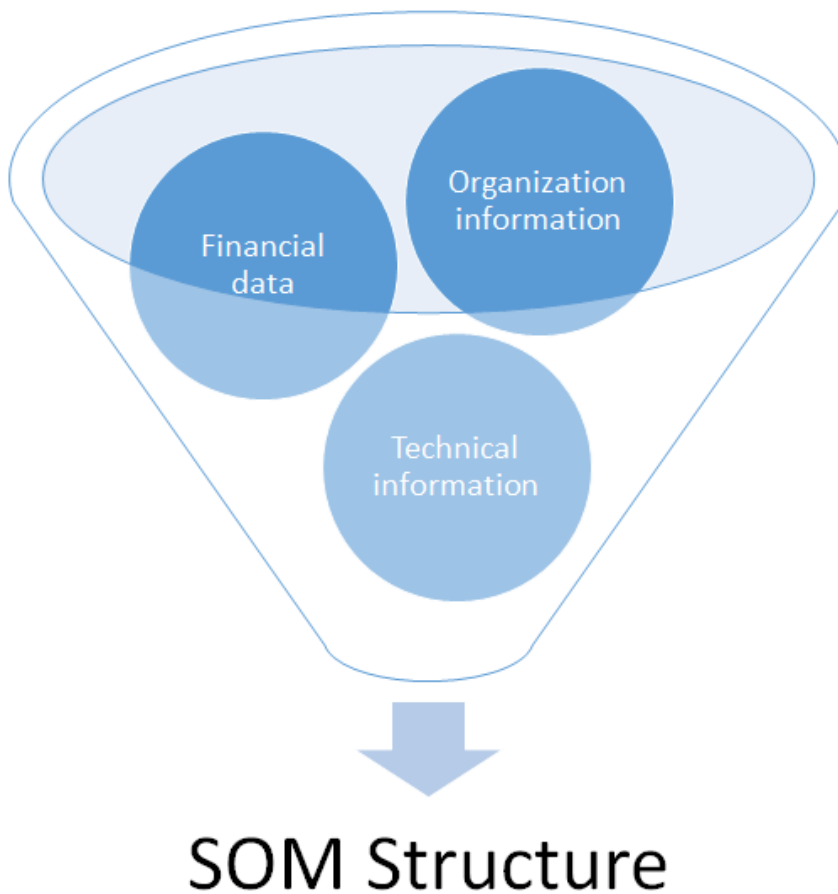
- to be adaptable and to be able to work with data of different types and formats. This is necessary as there are different factors (technical decisions, human behavior, organization structure) that influence the final results and they all need to be taken into account when analyzing the prospectives of a failure/success of enterprise IT solution;
- to be able to work in different conditions with minimal configuration (or as small as possible configuration and manual adaptation);
- to be able to learn and update its analysis rules – thus simulate the process of gaining knowledge and expertise.

Self-organizing feature maps (also commonly referred to as SOFM or SOM) are one widely used tool that can meet the aforementioned requirements and provide flexibility required to analyze all management, financial, technical data that goes along with the implementation of contemporary enterprise IT solutions.

3. Issue analysis and proactive problem classification with self-organizing feature maps

Interested readers can find more details on self-organizing maps in [11], [12] and [13]. They have already solid history of successful applications in finance (like for example [14], [15]) and economics (like for example [16]), but for our goals we can benefit from their unsupervised learning capabilities and map building that can be used to point to specific problems or patterns in enterprise IT solution applications.

As Figure 2 shows, the first step in the process is putting together different types of information that makes it possible to account for differences in financial condition, organizational structure and technical specification of the respective solution. The advantage of self-organizing maps compared to other approaches here is that information is sorted out in accordance with similarities between analyzed entries (during unsupervised learning) rather than based on pre-defined assumptions or models that are often incomplete or full of restrictions



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The output of this step depends on the primary goal of the model – whether it is aiming at more precise or at less detailed classification of a specific case. The number of inputs depends on the amount of available data, however it is important for proper classification to select inputs that are from different domain (too much inputs based purely on financial indicators may lead to misinterpretation and wrong classification). It should be noted that this output is not able to solve by itself the problems surrounding implementation of enterprise IT solutions. However it can be used as valuable input when planning the implementation and analyzing the possible problems that may arise during the implementation.

More traditional approaches toward issues during implementation of enterprise IT	Self-organizing maps approach toward issues during implementation of enterprise
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solutions.	IT solutions.
<p>Focused on analyzing consequences of failures and searching for reasons, after the problem has been discovered. In this case similarities may be useful why trying to explain the reasons but typically the harm has already been done.</p>	<p>Focused on classifying a case based on its different characteristics and is most valuable when used prior to actually implementing a solution. This way it can point the management attention to problems before they happen.</p>
<p>Focused on predefined models that use limiting assumptions or are only using information from a specific domain (financial, technical, management).</p>	<p>Can used to combine information from different domains and thus with proper encoding can sort out cases based on their true similarities.</p>
<p>Need to be updated regularly as organization structure changes and as technology advances.</p>	<p>Is capable of learning throughout the life-cycle of IT solution implementation and can be adjusted for different purposes However increased flexibility comes at the price of more complex modelling and required knowledge from people using the SOM model.</p>

4. Conclusions

In this article the major advantages of using self-organized maps to proactively analyze issues related to implementation or enterprise IT solutions have been analyzed. Contrary to more traditional approaches this AI-based technique can be used in very different environment and can not only provide information on cases that “fit into” a pre-defined environment but also prompt and give hints on problems that have not been formally studied yet.

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