Business Process Flexibility Analysis On Nuclear Power Plant New Build Project JEK 2

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ABSTRACT

The purpose of the business process flexibility analysis on Nuclear Power Plant new build project JEK 2 is to point out the problem of continuous changes on project business processes triggered by the dynamic growth/reductions of various project activities through the different stages of project lifetime and answer the question, what type of Information System (herein after as IS) could help manage that sufficiently and effectively enough.

Basic fact is that today we cannot manage the flood of electronic documents and information successfully in old fashion way i.e. just with documented procedures and processes. The information and document exchange can be simply too fast and “uncontrolled” in the world of electronic. Therefore, we need to control the processes through the IS but the question is can we manage that by the conventional IS or we need to integrate a kind of Business Process Management IS.

To answer that question, one typical project process is to be analysed (systematized) for identification of typical process changes. Then the different IS can be questioned for adapting or setting up ability i.e. how the process is flexible in the IS. This will be done on the case of nuclear power plant construction project, considered to be built as the second unit at Krško site (JEK 2). Process analysis will include modelling of existing and new optimised process as well as analysis of communication and documentation flow resulting in proposition for its optimisation. For process flexibility analysis the key identified or expected process and documentation changes will be stress out. On the base of these change the modification methods (process flexibility) will be analysed in conventional IS (regular programing) and in Business Process Managing IS (“graphical programing”), in short in conventional sys. and in process sys.

It is expected that in case of using process sys., the process management is more efficient and effective, but can we step forward and accept (maintain) strong process management culture on the such big project as building NPP or can we afford not to.
1 INTRODUCTION

Slovenia is one of the thirty countries in which nuclear power plants operate and has one nuclear power plant in commercial operation since 1983, the NEK (Nuklearna elektrarna Krško). GEN energija as the co-owner of NEK is planning to build a new, second unit at the operating NPP Krško site, the JKE 2 (Jedrska elektrarna Krško 2). Roughly speaking, JKE 2 is about ten-year project. It’s time and complexity depends on exiting nuclear infrastructure, legislation and the type of NPP. With the Utility, production unit NEK, Slovenian Nuclear Safety Administration (SNSA) and relative institutes, the nuclear technology knowledge and experiences have been accumulated from operation and participation in the construction project of the first unit, but the rather fresh Utility does not have enough recent experiences, manpower or even sufficient management and information systems established for leading such huge project. Nevertheless it is not a question, if the project is feasible or if the utility project team will be able to deliver NPP, because the key contractor or hired engineering can do it for him. The question is what kind of product quality can be achieved and how efficiently i.e. for what cost can it be delivered. It is the fact that more control the investor has more efficient and effective is the project and that means that investor will have to establish strong project, risk change and quality (process) management culture etc., which must be supported with most advanced and mature business information system (BIS). It takes at least a few years to establish management cultures and develop BIS, so it would be wise to start establishment even before the government construction decision is made, when on the other hand there is no doubt, that it must be established well before the project execution starts.

There are different ways how to build up strong management system (MS), but it’s the fact that today efficiency and effectiveness of MS are depending on IS support. However let’s not forget that MS should not be limited or driven by IS’s functionalities (quite frequent way), when the IS’s functionalities should be tailored to support MS’s business processes. Why business processes, because the industry good practice, respectively standards developed on these bases (ISO9001 [2], GS-R-3 [3]) are teaching us, that the process approach is effective and efficient way to deal with business needs. We have learned that in today’s dynamic economic market, the process flexibility is essential and that stands for short and long term process flexibility [1]. That means that the processes can be executed in a different way and also quickly redesigned, regarding the business strategy or marked changes. Furthermore, process flexibility is even more essential when we want to manage the project related business processes, especially in case of huge projects, as building a NPP.

So I believe that Managing the project (especially huge ones) it’s not just about project task execution, but also about how this tasks are executed and controlled, meaning that execution, management and supporting business processes are needed. There were 21 essential processes identified for project JKE 2 (Figure 1), focused mainly on project execution control not included investor’s general management and supporting processes (IT, HR, Accountancy, PR etc.))[4].

There are JKE 2 processes showing the execution way of some project phases and many processes dealing with massive every-day data, documentation and information flow between various participants. It’s not a problem that these processes are special, but the fact that some project processes (or type of project activities) are starting, ending or constantly changing through different project execution stages and so is the project organisation rising from few tenth up to few hundred team members and few thousand involved in the construction. As mentioned it depends on the type and power of the new NPP, which is anticipated to have, by the GEN’s feasibility study [5], from 1000 and up to 1600 MW installed and that means from 2000 and up to 3200 manpower at peak on the construction site.
The total number of manpower consist of [5] labour force from various fields and professions which is to be consisted from more than 30% of engineers, including quality control, inspecting and investors project staff. There is roughly 130 people in the core Project management and monitoring, additional 60 people in Quality control and more than 100 inspectors which will have to collaborate with the rest of the construction or equipment installation personnel, various suppliers and from the equipment installation stage also with the operating and maintenance personnel (Table 1).

Table 1: Estimated JEK 2 manpower in the peak of the NPP construction works [5]

<table>
<thead>
<tr>
<th>Work area</th>
<th>JEK 2 staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site workers – total</td>
<td>2200</td>
</tr>
<tr>
<td>Auxiliary workers</td>
<td>210</td>
</tr>
<tr>
<td>Supervisors</td>
<td>110</td>
</tr>
<tr>
<td>Quality control</td>
<td>60</td>
</tr>
<tr>
<td>Supplier’s and Subcontractors’ staff</td>
<td>180</td>
</tr>
<tr>
<td>Project management and monitoring engineers</td>
<td>130</td>
</tr>
<tr>
<td>Employer’s operating and maintenance personnel</td>
<td>200</td>
</tr>
<tr>
<td>Power plant start-up personnel</td>
<td>60</td>
</tr>
<tr>
<td>SNSA Inspectors</td>
<td>20</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>3170</strong></td>
</tr>
</tbody>
</table>

Different numbers are talking about intensive changes of the project’s business processes, consequently also investor’s business processes and some massive oscillation and internal fluctuation of manpower, all in less than a decade. On the other hand, from the nuclear safety point of view, also about maybe excessive mass of documentation and communication flow imprisoned in sometime uncontrolled electronic doc. and data world, meaning that electronic doc. and data flow simply can’t be controlled just by “old fashion” documented procedures and processes, but by the IS.

It is clear that today we can manage electronic data and doc. in so called Enterprise Content Management Systems (ECM) (definition by [6]) or in similar quite well, but the
question of this study is, if we can manage business processes including these data and documents and furthermore, if we can manage its changes i.e. the way of dealing with the data and documents, effectively and efficiently enough.

To answer that question I have analysed and designed a sample process i.e. “Managing purchasing projects” to find out the key typical process changes and question the way of implementing changes i.e. process flexibility in conventional sys. (ECM) and process sys. (BPMS – Business Process Management System; defined by [7]).

2 ANALYSIS AND SYSTEMATIZATION OF SAMPLE PROCESS

GEN energija is the investor and currently deals with feasibility studies for JEK 2 project. Therefore GEN has developed unwritten project based purchasing process for managing individual order, supported by vital project documentation templates and structure definitions, all managed in the MS File Sharing system and MS Office programs, manually with exemption of managing rough overall (master) JEK 2 project time schedule plan and also some individual project plans in MS Project application. However, maybe the project related purchasing management is more important than project management at this point, but still neither of them is not completely systemized when Quality Management System (QMS) for JEK 2 [4] is developed and not implemented sufficiently yet and there is no QMS in the company level. Respectively, vital investment control and project support processes at the utility level are not developed yet and more, there is no integrated supporting IS.

However the first step was made recently with feasibility study [8] for integration of MS Project Server (for planning and managing the project plans of activities and resources) and MS SharePoint (for doc. and communication management) for what reason I have designed an process diagram of existing methodology and stressed out document and data requirements for systematization and informatization.

In the next step I made the vision of project management systematization including project office (as defined in [9]) establishment to centralise the project execution methodology, project planning into the project portfolio management and project information tools into integrated IS, all to enable effective and efficient planning and execution of project on the bases of transparent key performance indicators (KPI). Including that also systematization of project change, risk and product quality management and further systematization of corporative process managing the Strategic Development Program is stressed out to be vital.

Since the systematization is highly depending on the informatization level, I found out on the bases of planed JEK 2 project and its business process flexibility problem, mentioned in the introduction, that project efficiency and effectiveness is not depending just on choosing the appropriate project management model or appropriate project planning tool, but also highly depending on choosing appropriate BIS, which can deal with the way that project activities are executed and controlled as well as with business process lifecycle control.

2.1 Process Sample Analysis

To test the process flexibility in different IS I have analysed process sample i.e. Managing Purchasing Projects and designed new process diagram (by BPMN 2.0 standard [10]) in two levels (see first level in Figure 2) including data and document requirements for systematization and informatization. The systematization is not detailed, but includes recognisable typical business process changes on which I could do the flexibility analysis, described in chapter 3.
However the process sample “Managing Purchasing Projects Process” systematization key elements are:

- Complete systematization of new Project Suggestion subprocess in the new Project Control Procedure and informatization in data content forms and registers with approval workflows.

- Formalization of improved Project Proposal subprocess in the new Project Control Procedure and informatization of doc. template into the data content form and register with review and approval workflow, including the project management team assignment approval. The decision making is to be now based on Strategic Development Program and the project portfolio KPI.

- Formalization of Project Planning subprocess in the new Project Control Procedure including: improvement of technical specification template with detailed doc. and quality requirements (quality plans etc.) and reviewing and sharpening the project time schedule plan template in more detailed planning of project activities and financial resources, and in introducing human and material resource planning.

- Complete systematization of Risk Management subprocess and informatization in data content forms and registers with risk evaluation, pondering calculations and action plans.

- Complete systematization of Quality Assurance and Control through integrated QMS and informatization of Control Check Lists, nonconformity and action plans in data content forms, nonconformity control workflows etc.

- Formalization and radical improvement of Inquiring process in Purchasing Control Procedure and complete informatization in new Purchasing inf. system with data, registers, forms (with doc. appendixes) and conformation workflows including: new Inquiring Request, new Proposal Registration, Proposal Commission Opening Record, Proposal Review Record and Contracting Request.

- Complete systematization of Supplier Qualification subprocess and informatization of Qualified Supplier Register in data content forms and register with approval workflow.

- Formalization of improved Contracting process in Purchasing Control Procedure with new contract and general contract template and compete informatization of doc. in DMS with preparation, review and approval workflows.

- Formalization of improved project execution control and product review subprocess in the new Project Control Procedure with:

  - Complete systematization and informatization of project portfolios in new central oriented project management system, including proactive follow up and up to date revising of Detailed Project Plans and portfolios data.

  - Complete systematization and informatization of: new evident activities for risk follow ups and workshops; improved (more evident) activities for product and process Nonconformity; new Action Plan follow ups etc.
o Complete systematization of new Change Control subprocess in the new Project Control Procedure and informatization of Project Change Register in data content forms and registers with approval workflows. The decision making is to be now based on Strategic development program and the project portfolio KPI’s.

o Complete systematization of new Task Control subprocess in the new Project Control Procedure and informatization of Personal Task Manager in data content forms and registers with execution workflow. Including synchronized tasks from project plans, business processes activities as well as individually opened task.

- Over all systematization of project and product documentation control in the new Project Control Procedure and informatization in Document Management System (DMS; defined by [11]) or similar, including doc. libraries and lists showing complete evidence and history of project and product doc., and including doc. metadata as well as data content in forms.

2.2 Project information system

Regarding general project managing requirements and process sample analysis I propose to build up the Project Inf. System (PIS) (Figure 3), consisting of different closely connected and robust specific applications with automated workflows and processes.
Basic important level of informatization is to manage all doc. contents in DMS and further higher level to manage also data contents in ECM system. It is important to reduce doc. use to minimum and manage communication and data work as much as possible as data content through forms and registers. By the defined systematization requirements the data applications for managing Risk, Nonconformity, Task, Reporting and Business Intelligence (BI) should be established as well as Project information and documentation collaboration portal including all project data synchronized from other information systems (ERP, CRM, Project planning sys….) and all doc. available also from different sys. (DMS…) as well as lists of retrievable hardcopy doc.. Beside mentioned data applications which can be in one or in different sys., it is important to use well designed, robust and in practice verified specific sys. e.g. Project portfolio planning and managing sys., DMS or ECM etc., but still it’s important that they are compatible and flexible regarding data synchronisation and modifications.

So we can take conventional way (Figure 3 - blue) and implement individual appointed systems connected generally only manually by users (managers, administrators, internal or outsourced users…) executing the business processes by the documented procedures or
process diagrams, meaning that process efficiency and effectiveness is depending on the workers process understanding and his diligence.

Or we can take advanced and already mature process oriented way (Figure 3 - red) and implement BPM System covering ECM within BPM and strong ability to connect with specific IS (ERP, CRM, DMS, Project planning etc.). BPMS can present central data content interface system, in our case PIS, combining all project related data and doc. on the bases of integrated business processes. BPMS can manage complete business process lifecycle from designing, testing or simulating, publishing, running, changing and terminating the business processes. It has revolutionary ability for designing process diagrams with included execution programme code packages within each process symbol and creating fully operational applications on those bases. That is so called “graphical programing” where process owner (not programmer) can create data forms, registers, connections, business rules and design the “program coded” process diagram connecting all together in the process based application.

3 PROCESS FLEXIBILITY ANALYSIS IN DIFFERENT TYPE OF IS

I made the process flexibility analysis on the bases of typical process changes and questioning workshops with potential suppliers of different IS.

Typical process changes were identified on the base of process sample analysis in chapter 2 and are defined with setting up or modifying of: document registers with metadata and templates, data forms and data registers, doc. or data workflows, processes applications, process application rights and integrate process system documentation.

Process Flexibility Questioning workshops were made for “conventional system” with potential bidder AGITO offering MS SharePoint integration with MS Project Server and for “process systems”: with potential bidder IB procadd–Abit offering AbitECM system including Intalio BPMS and Alfresco DMS; with potential bidder CREA offering complete BPM implementation service on the various BPMS e.g. Ultimus BMP Suite, IBM BPM (Lombardi), Oracle BPM Suite etc.; and with potential bidder NETS offering self-developed info. system DNA based on BPMS Oyrix. The aim of the workshop was to distinguish what kind of process changes i.e. application changes can be made by process owner (with no programing skills) using simple setup system functionalities and what kind of changes need to be made by the programmer writing programme code.

The workshops resulted in matrix comparing conventional and process system’s flexibility on identified process changes. In short; the key identified IS flexibility advantages which can be handled by the process owner (with no programing skill) are:

- Data content management i.e. designing data forms and registers is covered in both type of systems, but managing of data handling and data integration is far more advanced in process sys.
- Document management i.e. defining doc. type with metadata and template is covered in both type of systems, but managing of document handling and metadata integration is far more advanced in process sys.
- Document and data content workflows management is covered in both type of systems, but in conventional sys. the workflow is usually created on one specific doc. od data content when in process sys. the workflow is created as a self-standing subpart of the process, which can handle various doc. or data content.
- Business process management i.e. designing and managing business processes in the IS is not handled by the conventional sys. when on the other hand we can manage complete
business process lifecycle in the *process sys.*, including designing (“graphical programing”) of process defined self-standing applications.

- Process related system doc. management i.e. managing process diagrams, procedures and instructions are handled by *conventional sys.* in the document format (with some exceptions of integrated instructions in doc. workflows), when on the other hand the business process diagram is actually program model in *process sys.* showing the application setup and including all process related rules and instructions, further more BPMS covers evident process change management.

- Business and process measuring management i.e. managing KPI’s data of project and process performance is in *conventional sys.* limited to the doc. or data content workflow task performance, when in the *process sys.* KPI of business processes can be handled.

- Process responsibility role management i.e. applications Rights Management Services is in *conventional sys.* limited only on document and data rights, when *process sys.* handles rights also through the business process models.

4 CONCLUSION

Through process sample analysis and identified typical process changes I can confirm on the base of executed process flexibility workshops that with *conventional systems* (ECM sys.) the process owner (sys. customizer) simply can’t do much more than setup and modify document content, data content and simple workflows on specific doc. or data content. Without additional code programing by sys. designers it is not possible to develop complex doc. or data workflows neither it isn’t possible to integrate various workflows data and documents into the process based data application. So we can roughly manage only specific parts of business processes when process execution as well as process lifecycle management is strongly depended on employee, executing written procedures and processes.

On the other hand I can also confirm that with *process systems* (BPMS) the process owner can really manage business processes with integrated data content, covering also doc. handling and metadata, as well as total process lifecycle in the system (not on “paper”). Very important fact is that process as well as business data can be managed in one system, additionally also with very high ability to integrate (synchronise) data from other systems (ECM, CRM, Project panning…) all together resulting in huge measuring data base, offering almost limitless possibilities for setting up vital project or process KPI. Nevertheless, when dealing with very complex integration with other not so compatible systems we still need the program designer support.

In overall the results based on flexibility matrix analysis showed that in *process systems* (BPMS) process owners or maybe internal administrators or process analysts can setup and modify process supported applications i.e. informatized business processes mostly on their own, avoiding time-consuming and usually poorly communicated changes of IS. Meaning that process and IS setup is flexible, made by the business process expert (not by the programmer with usually poor knowledge about the business) and within the IS which is designed for its purpose.

Despite the general belief or practice, that we can or should manage business processes through DMS (ECM or similar), because we have to manage its documentation, the analysis results suggesting, that we must deal with business processes in BPMS and manage communication through the data content, for what we, in most cases, do not need documents.
Turning back to the root problem I’m convinced that because of business process flexibility and lifecycle management ability the BPMS is ultimately the right way to handle JEK 2 (or other infrastructure) project, but we must not forget that it is only a tool in which we must develop effective and efficient business processes, based on strong project and business process culture to be able to execute projects activities as effective and efficiently as we can.

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