# How to Successfully Start the Transformation of an Academic Institution

## Case study on the process mapping project at the Czech Technical University

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**Abstract.** This paper contains a case study on the successful initiation of an academic institution transformation project. The present environment in the Czech Republic is forcing all academic institutions to change their operations. Budgets are low, competition is high, and the number of students is decreasing. From 2009 – 2012 the Czech Ministry of Education implemented a project focused on the specifications of an efficient institution. Results of the project recommended a transformation towards lean and business process oriented organizations. Only the Faculty of Electrical Engineering at the Czech Technical University has been successfully and continuously implementing this transformation. In the following text all aspects and reasons for this success are analyzed. Firstly, the theoretical assumptions are described. Then the results of the transformation project are presented. The particular methodology used for the maturity level of the project's success evaluation is presented. In the end key success factors are proposed.

**Keywords:** process; BPM; BPMN; process modelling; process optimization; AS-IS; TO-BE; center of excellence; maturity model; organization culture; communication; process portal; transformation; key success factor.

## 1    Introduction

All organizations try to find optimal ways to effectively realize their own business. It does not matter whether we are talking about a profit based or a nonprofit based subject. The problems are mostly the same – low efficiency, high costs, low response time, unsatisfied customers, etc. It can be simply said that any organization must solve two conflicting demands: improving output quality on the one side and lowering operating costs or raising the organization's income on the other. Academic institutions can primarily minimize operating costs only according to the legislative rules.

To assist Czech academic and research institutions the Czech Ministry of Education implemented a project called "Efficient Institutions" during the years 2009 – 2012 [1].

Its goal was to help institutions analyze their present situation and propose which management methods be used in the key institution's areas to optimize their operations. The results obtained were published in the EFIN (Efficient Institution) methodology [2]. One of its parts focuses on the management of supporting processes. It is based on our investigations and in the following text we describe the method we have used for a successful initiation of the Czech Technical University's transformation.

## 2 Initial Situation Description

As it was presented in Hronza [3], in 2009 the Dean of the Faculty of Electrical Engineering at the Czech Technical University (CTU FEE) decided to optimize faculty operations (minimal costs, minimal redundancy of supporting activities, maximal automation of selected processes, full-cost model etc.) and started a transformation of the faculty becoming more of a business process oriented organization. This decision was made independently and at the same time as the ministry's decision. The main reason was to prepare the faculty for the coming of new long term changes (reduced budget, lower number of students, wider industry cooperation, more scientific projects).

For the purposes of the faculty transformation project the dean established a new internal Business Process Center of Excellence (BPCE). Its first task was to analyze the existing successful transformation projects. In the Czech Republic no successful university transformation projects have been found. During the EFIN project discussions and workshops it has been indicating that some institutions had attempted to start transformation activities but all of them failed sooner or later. The main reason was that no methodology on how to successfully put a transformation project into practice existed. This fact was confirmed by representatives of 8 from the total 26 Czech public higher education institutions participating in the EFIN project [4]. As for the private institutions, only 2 of the total 45 [5] were participating in the project but they also confirmed that attempts to transform the institution were unsuccessful.

Following this the BPCE then analyzed foreign institutions [6]. It has found that the standard managerial methods usually used in commercial organizations are commonly used in these institutions too. Also, their organizational structure is based on the process management principles. The key results of the provided analysis are as follows:

— The supporting processes are the areas with the highest potential [7];
— It is neither possible nor necessary to transform all activities;
— It is necessary to start with processes that are not subjects of power interests [8];
— It is not reasonable to provide all changes at the same time;
— Transformation of any institution is a long term project.

The results of BPCE's investigation confirmed the assumptions regarding what must be done but did not give instructions on how to do it. This was the reason it was decided to create a new methodology based on the common business process management principles and practical experiences of the BPCE founders.

## 2.1 Business Process Management

Every transformation project starts with a deep understanding of the organization and its behavior. Different types of models are used for this purpose in practice. Through organization and behavior models it is possible to easily and visually identify potential problems and point out previously-unaware improvements needed to optimize the situation. Today, such models are called business processes and their management is called Business Process Management (BPM). Some of the BPM's benefits are as follows [9]:

— Clear visibility and knowledge of an organization's activities;
— Definition of duties and roles within a company;
— Possibility to simulate and evaluate different business process scenarios;
— Identification of potential optimization areas;
— Ability to identify bottlenecks.

## 2.2 Business Process Definition

The current definition of BPM has been dated to the early 1990s [9]. Hammer and Champy [10] defined a business process as "a collection of activities that takes one or more kinds of input and creates an output that is of value to the customer. A business process has a goal and is affected by events occurring in the external world or in other processes." This definition views a business process as a systematic ordering of work activities across time and place. After a short disillusionment period, and since the coming of ERP systems to the market, BPM has often been interconnected with information technology. Davenport [11] defined business process as "a structured, measured set of activities designed to produce a specified output for a particular customer or market. It implies a strong emphasis on how work is done within an organization, in contrast to a product focus's emphasis on what. A process is thus a specific ordering of work activities across time and place, with a beginning, an end, and clearly identified inputs and outputs: a structure for action." Both definitions define the goals, temporal, location and the flow structure of a business process. They omit the role of those performing work activities and their collaboration. These aspects were mentioned in Ould [12], who viewed a business process as:

— A set of purposeful activities;
— Activities are collaboratively carried out by a group of actors (human or machine);
— Activities can cross functional boundaries and are invariably driven by the outside world.

In this definition it is important to note that a business process is not carried out by a single individual or department only, but it can involve many different people or systems from different organizations. All are working together to achieve a common business goals.

### 2.3 Business Process Analysis and Optimization

Business processes can be analyzed and optimized by either practical experiences or by scientific investigations. In order for the results obtained from the analysis to be reasonable it is necessary to have mechanisms more sophisticated than simple qualitative analysis of static diagrammatic models [13]. Aguilar-Saven [14] and Zakarian [15] recommend in their work the usage of formal techniques for an analysis of process models in order to make process modeling more attractive and meaningful. This formal approach to business processes modelling enables a measurement of the attainment of strategic goals and objectives by using performance indicators [16]. It is necessary always to think about both dynamic and functional aspects of the business process. According to van der Aalst [17] three different types of business process analyses exist:

— *Validation*; i.e., testing whether the business process behaves as expected in a given context;
— *Verification*; i.e., establishing the correctness of a business process;
— *Performance analysis*; i.e., evaluating the ability to meet requirements with respect to throughput times, service levels, and resource utilization or other quantitative factors.

Due to the complexity of today's business processes there exists a need for the development of suitable analysis techniques in the market [18]. Van der Aalst et al. [19] underline that business process analysis should investigate properties of processes that are neither obvious nor trivial first. Boekhoudt et al. [20] justify the necessity for analysis of business process models in order to clarify the business process characteristics, identify possible bottlenecks, and compare any potential process alternatives. Most of the business process analysis approaches are based on subjective methods [21]. Irani et al. [22] highlight that understanding and analyzing business process behavior help in recognizing possible sources of problems.

Process analysis itself has little value, unless it helps to improve or optimize a business process [23]. Process improvement is mostly provided by using associated formal techniques [23] that support both the modeling and the analysis of business processes [24]. Zhou and Chen [25] suggest that business process optimization should help to reduce time and costs, improve quality and enhance the satisfaction of customers. Also, Reijers [26] suggests that the goals of business process optimization are often the reduction of cost and flow time. Hofacker and Vetschera [27] underline that the concept of "optimality" of process designs is not trivial and the quality of processes is defined by many, often conflicting, criteria. Finally, Hammer [28] recommends removing all barriers and walls around the corporation and creation a new, with external subjects integrated, virtual company.

## 3 Tasks, Tools and Activities

A combination of practical experiences, provided investigations, and a general definition of BPM has brought the BPCE team to the following 5 transformation project areas

that represent key success factors in the successful transformation of an academic institution (in brackets we name each factor for later usage in maturity level measurement):

— *Understanding of an institution and its culture (ENVIRONMENT);* academic institutions represent a specific type of organization. In Czech Republic we can see a high level of decentralization and academic freedom. This means many different groups of university staff members focused on education, research, commercial or scientific projects, operations, management, etc. exist here. Because of historical reasons and the existence of a large number of different interest groups there are quite a few barriers present. In effect, it generates many internal problems in communication, management, control, delays, higher costs, the existence of many redundant organizational substructures, etc. In combination with external factors (reduced budget, lower number of students, etc.) it tends to lead to ineffective operations. If we do not understand how the institution works and what its organizational culture is we cannot be successful in the realization of any project. An overall understanding of an institution is a very complex and time consuming task. Project's experience confirmed that it is nearly impossible to accomplish by using external subjects only. In the case of an external subject the existing barriers are higher and the obtained results are very biased.

— *Creation of an experienced and acceptable team (TEAM);* the best solution for the institution's transformation is to establish an internal experienced unit that is responsible for all of the project's necessary activities, including project management. The team's composition must reflect practical experience, flexibility, ability to learn, knowledge of the institution, ability to communicate with institution staff, staff must accept unit members and costs must be low. The optimal solution is an internal center of excellence with an expertise in BPM; in the case of CTU FEE's project it is BPCE. The team is composed of institution employees and students. The employees are experienced in BPM, and they are also very familiar with the environment of the institution. They are graduates of the faculty who have returned after some time spent gaining professional experience. Their teaching and scientific activities guarantee that they know the institution's problems and the institution staff accept them as regular employees. Students bring flexibility, ability to learn, and sufficient capacity with low cost. Costs are generally much lower than using external resources. Lower costs help to keep long term projects alive. A very important fact is that the unit must be suitably independent within the institution hierarchy. This helps to prevent the risk of noncooperation. For the realization of the CTU FEE's project it was also very important that BPCE realized education and both scientific and commercial projects with the ability to gain external financing. Other departments did not feel that the BPCE was only a cost center that lowered their budgets. It also helped to overcome the feeling that the goal of the transformation was to minimize the size of their staff.

— *Building of communication channels and continuous communication (COMMUNICATION);* the most important part of the entire transformation process is communication. At the beginning of the transformation project it is very important to explain what the project team is doing, why the project is implementing, what the

project's goal is, and what the institution's staff should expect from the results of the project. It is also necessary to understand how people work, what they will accept, how to present information and indicate possible project risks. The team has to be prepared to explain why the project is taking a long time, why mistakes are made, and facilitate possible conflicts among the staff. Excellent and continuous communication is the basis of BPCE's acceptance and credibility. All obtained and created results must be continuously presented in an appropriate form and users have to be enabled to provide feedback. In the CTU FEE's project general processes information were described in the form of simple mind maps. A detailed process description has been created in the form of a paper description that is signed (accepted) by the process owner. Final results are presented on intranet process portal that is accessible by any person with a faculty user account. Users can comment on any process by using a web form or a discussion forum. Users can also send emails to the dedicated email address or come in person to BPCE and discuss their comments face to face. It is necessary to update models as soon as possible and explain why it is not possible to implement some required changes. It is also very important to regularly inform the management of the institution and representatives of the academic senate about the state of the institution transformation project.

— *Selection of the appropriate form of presentation of results (PRESENTATION);* all results must be open and presented to all faculty members, including students. It is not possible to train all these people to understand the specific and complex form of the process model description. It is necessary to use an existing form on the one side (for future automation purposes) and user comprehensible form on the other. Users must be able to easily understand what the information presented means at first sight. Models must not be complicated and the explanation of some details must be very simple. In the CTU FEE's project the BPCE has decided to use the BPMN notation that was designed with to be used by both business and technical people and it also enables future automation of the processes. This fact was confirmed by BPCE's analysis.

— *Definition of real, achievable and meaningful goals (GOALS);* it is not possible to realize a complete transformation quickly. Many different activities can lead to employee confusion. The project team has to implement small tasks that produce clear quick wins, especially at the beginning of the project. The team has to be prepared for the possible mistakes too and it is easier to explain smaller problems than larger ones. Quick wins also help to easily understand what the team are doing in the transformation project and why it is reasonable to put it into practice. It is very important to start with the tasks that are acceptable to most of the staff and that do not build new barriers. In the case of CTU FEE's project we started with the dean's office processes. These processes are used by most of the institution's staff and their selection demonstrates that the transformation is not only about the regular staff but about the whole faculty, including management. CTU FEE's project started with the process modeling, validation and verification.

These 5 areas are the main pillars of the new created methodology. It is very important to realize that it is not possible to solve any of the areas separately and in the above text

it is possible to see that some parts of the text can be presented in more than one area only. Many interconnections exist between the areas and anyone who wants to be successful should not underestimate any of them.

Before project's practical experience and results are presented, BPCE, which was implemented in the transformation project and the BPMN notation selection are described.

### 3.1 Centre for Knowledge Management

Centre for Knowledge Management (CKM) is an organizational unit of the Faculty of Electrical Engineering at the Czech Technical University (CTU FEE) in Prague. It was established in 2009 as a faculty BPCE and its mission is to support BPM lifecycle across the faculty [3]. CKM is controlled by the dean and it has mapped around 300 business processes up to now. Since 2011 CKM has been preparing the automation of selected business processes in cooperation with the Faculty of Informatics and Computing and Information Centre at CTU.

Two fulltime employees work in the center, along with two PhD students and approx. 15 students in the form of paid internships. Not all of students are working on the BPM project. The fulltime employees are graduates of the faculty with 15 years of practical experience in project and process management, implementation of information systems and ICT technologies. The PhD students have passed CKM courses and have been trained for the BPM skills. The student internships are between 2 and 3 years. New students are trained by the senior students. Most of the students are CTU students and they are very familiar with the environment of the institution. One very important fact is that all of them have passed the CKM courses. It simplifies the internship interview, accelerates the learning curve, and significantly lowers costs.

At present CKM also guarantees the education of 3 bachelors' and 2 masters' subjects focused on BPM, information systems, and performance management. Every year CKM employees support 30 bachelors' and masters' theses oriented on BPM and related areas. These extended activities help to overcome potential communication barriers because CKM employees are not considered to be in competition with other faculty staff. On the other hand, for the realization of the BPM project it was very important that CKM was established as a part of the faculty management because it gave CKM employees sufficient authority for the implementation of the project.

### 3.2 Business Process Modelling Notation

Many different notations for business process modelling in practice exist: BPMN, EPC [29], UML [30], IDEF0 [31], etc. The main difference between them is in their usage; for example, UML is mostly used by software developers, BPMN is used by business analysts, etc. BPCE's selection of the most appropriate notation was provided in two steps:

— *Comparison of the general properties* [6]*;* i.e., selection of the most commonly used notations in practice. We evaluated applicability for the BPM, flexibility, clarity,

usage for the different purposes (modeling, automation), SW tools support. We se-
lected BPMN, EPC and UML.

— *Comparison of usability properties* [32]*;* i.e., selection of the notation that can reflect
both known and unknown requirements. BPCE was looking for a notation that is not
closed and enables future addition of new (at the beginning unknown) requirements.
In cooperation with institution employees BPCE conducted Workflow Pattern anal-
ysis [33], Ontology-based analysis [34], Cognitive analysis [35], and metamodel
evaluation. As the most suitable notation it has selected BPMN notation.

Briefly, the Business Process Modeling Notation (BPMN) is standard for business pro-
cess flows and web services modelling [36]. The main goal of BPMN is to provide a
notation that is readily understandable by all business users. This includes the business
analysts that create the initial drafts of the processes as well as the technical developers
responsible for implementing the technology that will perform those processes. The
actual notation version is 2.0 [37] and it can be simply described as a workflow of
events and activities carried out by different resources. Process analysis and optimiza-
tion is then mostly focused on the evaluation of all possible passes through the process
and a resource allocation.

## 4      Results of the Faculty Transformation

Before the year 2009 there had been a few attempts to start a transformation process.
But all of them were unsuccessful. The last, and to this date, only successful attempt
was started in 2009. At the beginning it was the dean's idea to optimize faculty opera-
tions. He decided to establish a BPCE (CKM) responsible for the transformation pro-
ject.

In order for the project to be successful CKM was looking for a way to implement
it. It decided to start with a mapping of the dean's office processes and then present
described process models to the whole faculty academia. This goal specification has
been continuously refined during the first part of the project, similar to the agile soft-
ware development [38] .

CKM planned for models to describe AS-IS state, but process owners provided a
natural optimization too. This means owners did not strictly describe AS-IS state but
they provided simple modifications based on their and other employees experience
(ideas) and created "pseudo" TO-BE models.

After the first versions of created maps were accepted CKM decided to add an ex-
tended form of the description. The reason was that the BPMN description is easily
understood only by the owners and implementers of the process. Consumers of the pro-
cess sometimes do not completely understand what to do and how to do it. CKM de-
cided not to use another notation because BPMN met approximately half of the pro-
ject's planned goals, and it has also been planned that the notation will be used for the
automation of selected processes in the future. CKM has added a new form of process
description based on the BPMN and calls it "process as a service". The term "process
as a service" can be simply described as a scenario of user actions. It represents a group

of all related processes and information necessary for doing selected activity by employees, teachers or students. It combines both well known AS-IS and new, employees required, TO-BE activities. For example a simple scenario of education technical support is presented in Fig. 1. Any teacher is able to see which technical support can he/she use during his/her lecture/seminar and how to ask for it.
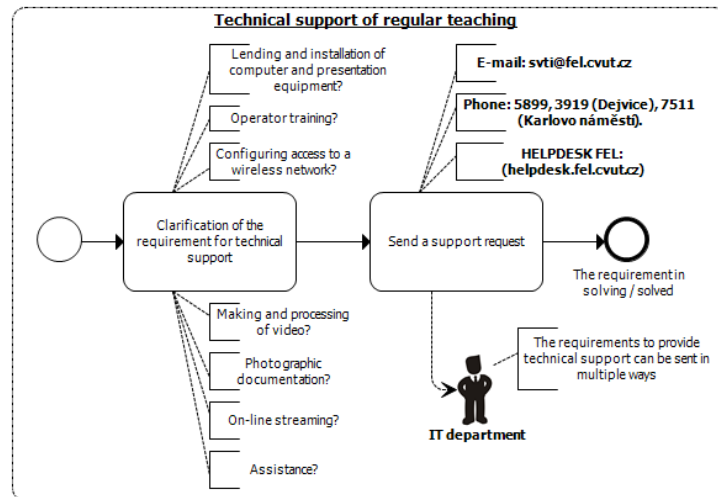


**Fig. 1.** Example of a process as a service.

Since 2009 CKM has mapped and created 300 process maps and approximately 150 processes as a service. For the presentation of all produced results we have developed our own process portal. Anyone who is granted access to this portal can find any required information from his/her point of view, and can also provide feedback. An example of the web page with the process description is presented in Fig. 2.

## 5 Evaluation of the Transformation Project

The evaluation of the state and success of CTU FEE's transformation is divided into two parts. In this chapter project development is presented and evaluated:

— *1st year (2009 - 2010) of the project:* 250 mapped processes, 1200 man-hours worked by CKM staff, 300 man-hours worked by the faculty staff; 950 man-hours worked for mapping, learning, knowledge transfer, faculty environment mapping and methodology preparation, 250 man-hours worked for documentation consolidation; CKM staff: 2 senior analysts (employees of CKM), 2 junior analysts (students), 1 portal developer (student);

— *2nd and 3rd year (2010 - 2012) of the project:* 50 new processes mapped, 500 man-hours worked by CKM staff (4 students), 100 man-hours worked by the faculty staff; mapping methodology creation, consolidation of created models (same details and form of results), revision of created process models, portal evaluation;

- *4th year (2012 - 2013) of the project:* mapped processes were in the process of owner acceptance, CKM is working on other projects;
- *5th year (2013 - 2014) of the project:* revision of acceptance comments, correction of models, 150 new processes as a service; 1 process as a service requires approx. 1 man-hour from CKM employee, 150 processes as a service require approx. 20 man-hours from faculty staff; work is mostly done by new students.

During these 5 years all of the supporting processes of the dean's office have been mapped and any granted user can view and comment on them in the process portal. Specified and at the beginning vague goals (map and open the dean's office) have been met. In the next chapter we describe the success of the transformation.
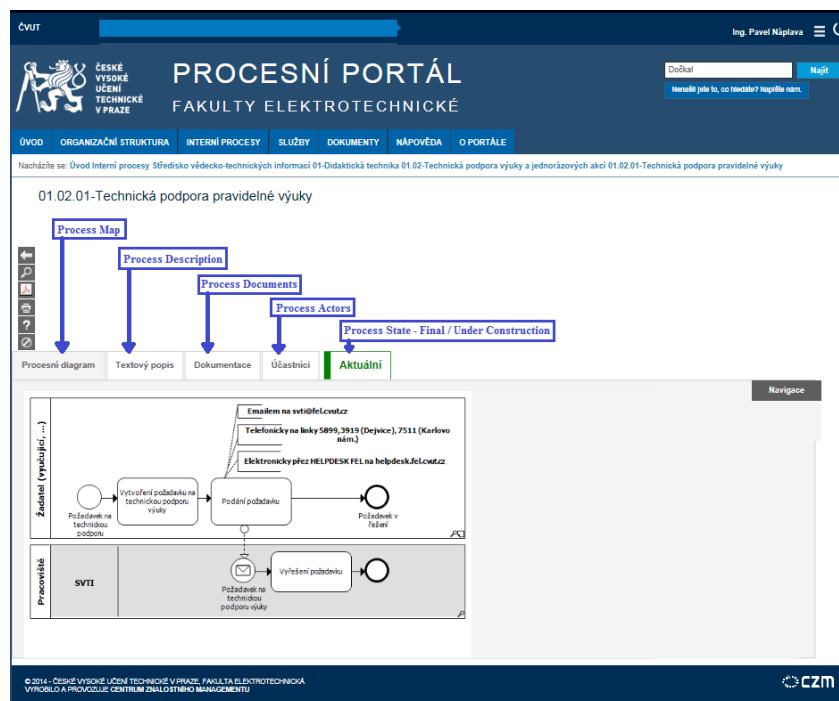


**Fig. 2.** Web page from the process portal.

## 6 Criterion of Transformation Success

In the beginning of this paper it was mentioned that most known transformation projects were unsuccessful. In this chapter CTU FEE project's success is analyzed. The 5 defined areas of the new created methodology are used. The maturity level development of each area throughout the duration of the project is evaluated and it is analyzed when it started to become truly successful. The following 6 maturity levels were defined (from the project's view it was reasonable to describe 4 of them):

— *0 = nothing;* the area is new for us, we need time to learn, we are not able to define anything;
— *2 = basic;* we have a basic idea, we are able to make some decisions, we have some experience;
— *4 = complex;* we are sure we know nearly everything about the area, we are prepared for the solution of any problem, we are experienced;
— *5 = excellent;* we have excellent knowledge.

The time development of area maturity levels is presented in Fig. 3 (values are evaluated at the beginning of each year).
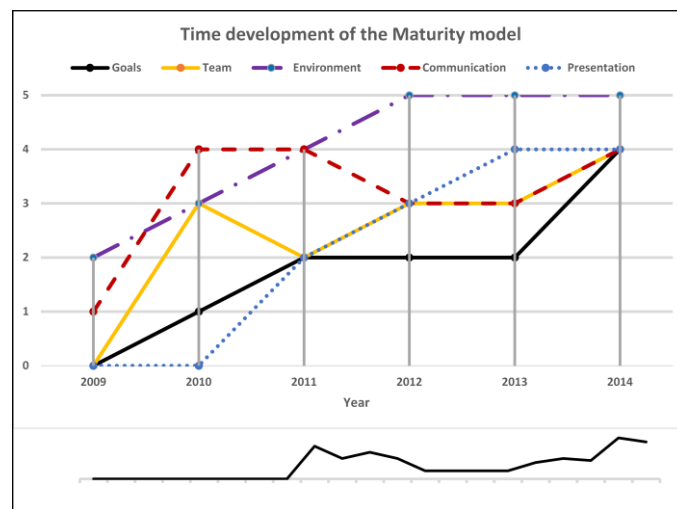


**Fig. 3.** Maturity levels of methodology areas.

The values presented were obtained from continuous feedback based on questionnaires. In the bottom of the figure the trend of process portal visitors is visualized. It helps to understand the following analysis:

— *2009:* CKM had good knowledge of the faculty and it was able to communicate with some faculty staff; goals were unclear; CKM started to prepare team, methodology, and process portal;
— *2010:* communication channels have been established, CKM team is accepted by the faculty staff, communication is opened; first goals were defined (mapping of dean's office supporting processes); first version of process portal was in testing environment; departments that had not been analyzed still existed and CKM did not know their culture;
— *2011:* CKM finished the mapping of defined processes; new junior students are coming; mapping methodology was changed; process portal was opened to faculty staff; all dean's office departments were analyzed;

- *2012:* processes have been finalized and given to users for final acceptance; process portal was rebuilt to reflect user feedback; no new goals; CKM had a deep understanding of faculty culture and were aware of the existing interconnection with CTU;
- *2013:* CKM is not working on the project, owners of the dean's office processes started to accept final process descriptions; communication with faculty staff was minimal; process portal was technically optimized;
- *2014:* new goals (process as a service) are defined; CKM has started to work on external BPM projects; created and accepted models are opened to the entire academic faculty academia; CKM has started to add new functions to the process portal enabling online process editing.

From the analysis of Fig. 3 it is possible to derive why CTU FEE's project has been successful. 3 important key factors (KSF) defining the success of project exist:

- *2011 – realization team had enough time:* CKM needed two years to present the first reasonable and acceptable results; after two years CKM was fully accepted by the faculty staff and people have started to trust the project's reasonability;
- *2012 – 2013 – realization team was able to overcome critical project points:* it was a big mistake to minimize communication and leave faculty staff without any control during final outputs acceptance; the acceptance took a very long time; if CKM was not a part of the faculty the project would be undoubtedly terminated;
- *2013 – realization team was opened to new ideas and was not working only on the one project;* cooperation on other projects (both internal and external) brought new experience and improved the quality of realization team; open and trusted communication with the faculty staff inspired CKM to extended goals and set of results.

As for the minimal value of maturity level that is necessary for the success of the project CKM has analyzed that it must be equal to value 2 for all areas (in CTU FEE's project CKM achieved this after two years). A comparison of the minimal required value and the development of values of each area during the duration of the project is demonstrated in Fig. 4. Derived KSFs, especially the fact that the team had enough time, confirm commonly known but in practice overlooked KSFs.

It is necessary to say that CKM is not working only on the transformation project. For example, in the beginning of 2013 CKM was asked by West Bohemia University in Pilsen to cooperate on its BPM project.

## 7    Conclusion

In this paper a case study on the successful CTU FEE transformation project was presented. The new methodology that enables to measure 5 of the key project areas and evaluate what the institution must do in order for the transformation project to be successful was created. Compared with other existing methodologies we can find many similarities with the recommendations presented in Hammer [39].
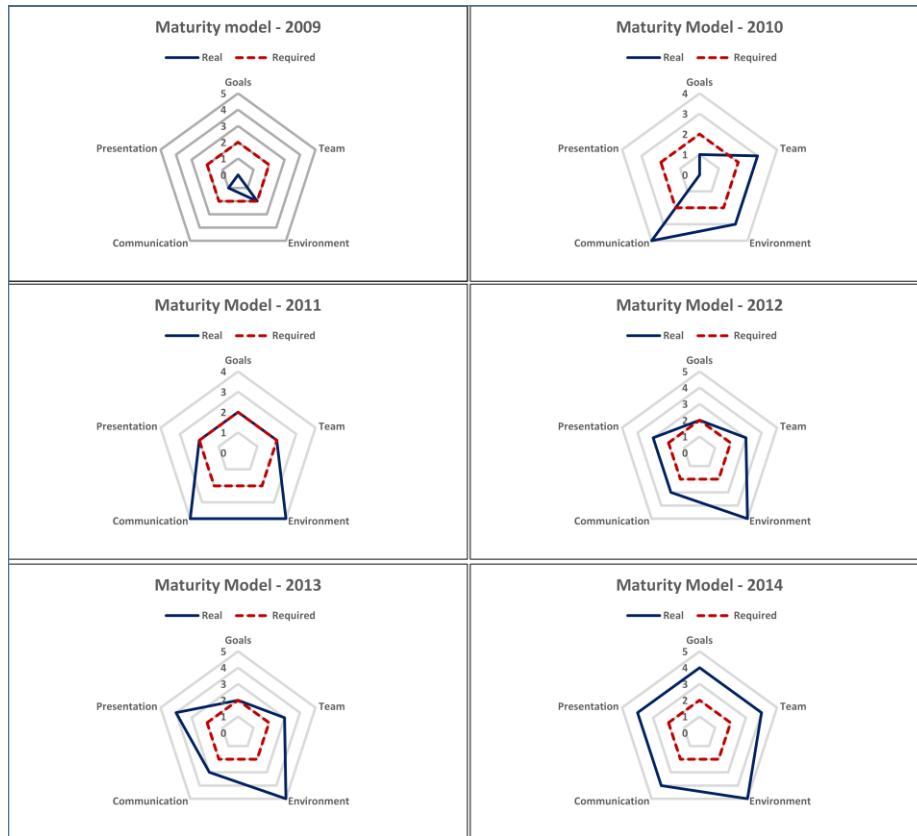
**Fig. 4.** Maturity model development.

In comparison with similar established projects it is possible to state that the key condition of transformation success is the existence of a strong and independent internal BPCE, responsible for all aspects of the transformation. The center must combine practical experience with student flexibility. The appropriate CKM structure has been helping CTU FEE to overcome most of the existing problems (institution culture, communication barriers, low costs, appropriate form of presentation, etc.). Any institution that implements the project has to be patient and tolerate mistakes and omissions. In the case of CKM and CTU FEE 2 years were required to establish a center and produce the first reasonable results. Also very important is the fact that the goals were not tightly specified at the beginning of the project. Flexibility with an appropriate communication strategy brings feedback and supports creativity in any phase of the project.

Established CKM is now able to fully support the CTU FEE transformation project and help other CTU faculties to initiate their transformations. CKM's trainee program enables to guarantee the quality and time of similar external commercial projects too. New students are mostly trained in one month and after 1 or 2 months of senior analysts shadowing they are prepared for independent internal mapping. After 6 months they are able to work on external projects too.

At this moment all dean's office supporting processes are mapped and presented in the process portal. Since the beginning of 2013 CKM has been mapping supporting processes of selected faculty departments. It has also started discussions about the project's follow-up goals. They lead to the selection of the processes suitable for the process automation and ways of measuring faculty performance. These activities are the subjects of CKM's further investigations.

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