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Standardization Problem in the Implementation of ICT at University

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Abstract

Universities are divided into faculties that can operate at their own. Being consistent with university-wide law faculties can develop their own systems that will help them to complete teaching process. Every system implementation is different; because of that development of model can make improvements on how university works because of shorten time needed to prepare, run and finalize final implementation. Main goal of this article is to determine if problem of standardization of implementation of IT systems at university exists. Analysis showed that changing one system and by the same time maintaining consistency with business strategy leads to improved results, what can be translated into lowering costs and growing efficiency of business.

Keywords

University, Standardization, Business Organization, Planning, IT Implementation

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1. Introduction

Information systems (IS) due to technology improvement are changing rapidly. This has been noticed by many authors and can be seen described [12], [10]. This can be also observed in health sector like hospitals [9]. Organizational culture (and hence IS) is also changing [11]. Also, e-services like e-government and the accompanying studies of user satisfaction show that "(…) both types of customers (internal/external) are indecisive and/or doubtful with the performance of the Customs Information Systems" [1]. This applies not only to CIS but all systems implemented in public sector.

Considering above, user habits are changing, types of actions, time of reaction, and thus their requirements. Standardization is the way to unite "behaviour" of (almost) every system in certain institution (or sector) what can lead to huge improvements. According to Oxford Dictionary to standardize is to "cause (something) to conform to a standard" or "determine the properties of (something) by comparison with a standard"[1] – what is a very vague term. Also, Merriam-Webster dictionary defines standardization as "1. to compare with a standard; 2. to bring into conformity with a standard"[2]. A "standard" is defined as "a level of quality, achievement (…) that is considered acceptable or desirable"[3]. Term "standard" is also defined by Stango (2004) [22] as "(…) specifications that determine the compatibility of different products".

On one hand "Standardization is the process of developing and implementing specifications based on the consensus of the views of firms, users, interest groups and governments" [26]. On the other hand[19]author of article, by quoting Robinson, state that "there exist different formal Standards

1https://en.oxforddictionaries.com/definition/standardize (access: 2016-11-11)
2http://www.merriam-webster.com/dictionary/standardize (access: 2016-11-10)
3http://www.merriam-webster.com/dictionary/standard (access: 2016-11-10)

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Developing Organizations (SDOs) in the world (…) and each has its own mechanism for endorsing a particular IT standard". As shown on Figure 1 [19] standardization is both linear and non-linear. As author writes the initial stage of idea of standardization is non-linear whereas it tends to be more linear as idea moves towards implementation. This is because process is regulated by protocols and/or restrictions specified by particular SDO. This applies to every company as many countries / companies have different regulations within the same matter.

According to S. Spivak and F. Brenner standardization can be defined as "(…) process of formulating and applying rules for an orderly approach to a specific activity for benefit and with the cooperation of all concerned (…)" [21]. Also, it "determines not only the basis for the present, but also for future development and it should keep pace with progress" [21].

According to above, standardization should involve and be defined by and can be achieved by fulfilling the following requirements:

(a) formulating rules,

(b) applying them,

(c) to achieve benefits,

(d) should involve all required groups of interest,

(e) should be developed constantly.

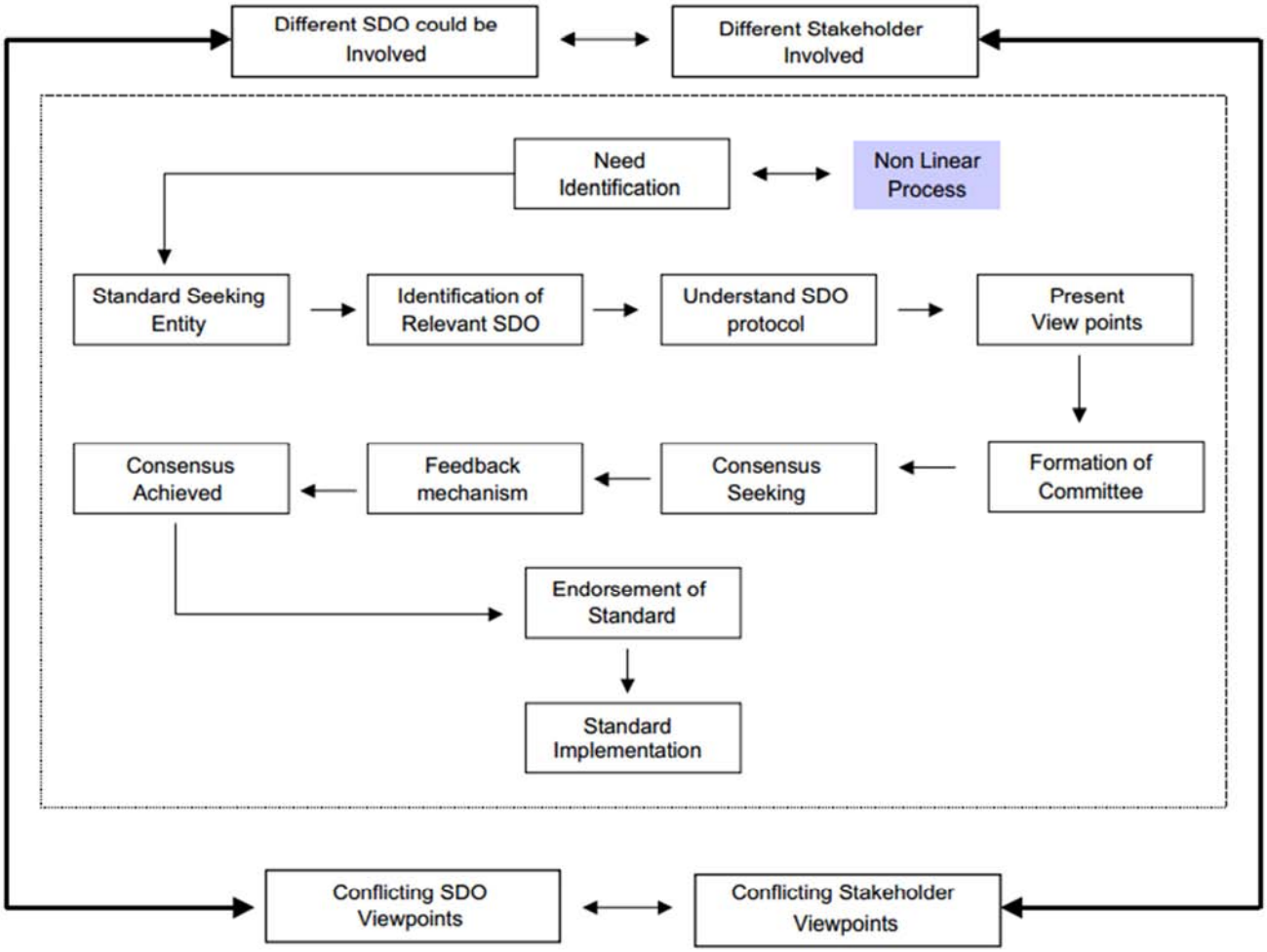

Figure 1. The standardization process (source [4]).

4 Saltzman Jon, Chatterjee Samir, Raman Murali, A framework for ICT standards creation: The case of ITU-T standard H.350, p.291, Fig. 3, in: Information Systems 33 (2008), 285-299.

Above definitions show that term "standardization" or "to standardize" is different depending on situation or organization. Once it is adjusting something to fit into formula, sometimes it is changing properties or defining new specifications based on the current state (point of view of different companies). This is crucial for this paper because we cannot standardize if we don't know what it means. Authors of article "*A framework for ICT standards creation (...)*"[5] state that their study suggests that there is no standard process of creating ICT standards (ICT – Information and Communications Technology). As we read further "more work can be done to examine what we term here as the 'standards gap'. We found evidence that academic institutions are not completely aware of the connection between creating/researching standards and the implementation of those standards in real-world products.". This means that there is need of standardization and developing methods of how to standardize.

For purpose of this article "standardization" (at the universities) is understood as process of unifying processes and taking necessary actions to optimize performance and efficiency of organization.

Standardization, as a way of optimizing performance, is widely described in medical area or ecology ([7], [18], [23]). This is also well described in electricity industry. In IT area there are nor many publications regarding standardization of implementation therefore one of this paper's goal is to prove that this problem is growing and some solution should be created.

Also, this paper's goal is to show that in companies of big complexity factor standardization is key of proper functioning, what leads into increased productivity and efficiency, that there is no unambiguous answer how IT systems implementation should be done. There should be developed model that clearly shows how to prepare for this and how to avoid problems. Before that there should be identified areas of standardization of faculties as major entities of university.

Public sector institutions often are divided into single faculties, departments or subdivisions. That means that every single part of organization can be perceived as standalone company, with its own regulations or procedures. This often applies to universities and their faculties. They should be considered as a public entity due to financing from public sources but at the same time maintenance its independence due to internal regulations, the statute and maintaining the government bodies.

Implementation of new systems in universities, not only public, is complex tasks. For example by 2006 every public university had to implement either a Research Information System or at least added a CRIS module to their Campus Management System [5]. Authors say that "scale and complexity of an organization matters" – processes and procedures for decision making take longer than expected; also "Participatory user involvement is important" – what shows that no matter what system you try to implement, there is always user to be the most important and their cooperation makes implementation easier or not. Also in UK – implementation of the Balanced Scorecard (strategic planning and management system[6]) at a university institute [20] which taken place in 2010 and 2011, which can trace and measure performance of the Institute systemically "contributes to the sustainability of the Institute through identification of tangible outcomes and evidence to support the Institute's business case.". Another example is Moodle implementation at the Latvia University of Agriculture [16]. As author says "one of key elements when implementing e-learning system is integration in already existing system" and then "(…) it is necessary to determine project team and set responsibilities, collect all information about current situation and possible changes". Second part of second quote is very important – that is getting knowledge of what you have and what can be done. All of the above examples (and many other) show how important it is to create strategy when implementing new system. That can lead to create new standard when performing such action.

From IT system point of view, there are also two types of "customers" – like in CRIS – students (external, like customers) and employees (internal, staff). Both types need to use the same system in very different way. Students follow new technologies and their expectations are constantly growing whereas employees work with what they have provided by employer. Also, time needed to swap between systems is long enough that new implementations are considered to not be profitable economically-wise. This is because not only regarding nominal cost of new system but also trainings, cost of new machines and of course data migration. There has been research in Korea [6] that can be used as a trigger for academic teachers to standardize their curricula. As authors write "Third would be studies on effective ways of training teachers to prepare them for teaching standardization." [6]. This is essential because if we want to standardize something we have to know how to do it – as mentioned at the beginning.

Developing model (or step-by-step instruction) can make

5Ibid.

6 http://balancedscorecard.org/Resources/About-the-Balanced-Scorecard

huge improvements on how university works. This is because of shorten time needed to prepare, run and finalize final implementation. This translates into lower costs, and as public institution university has to carefully manage their expenses. What is more, model prevents from data disintegration. Also, model can help to unify complexity of faculties, their principles of operation and data interpretation. That's why main goal of this article is to determine if problem of standardization of implementation of IT systems at university exists.

To achieve this objective will be seeking answers to the following research questions:

Q1: does university need standard of implementation of IT systems?

Q2: is it possible to unify processes of different faculties within one university?

Q3: if so, can this be transferred to other universities?

Q4: is there standard of making standards?

This paper is divided into following sections: research significance where we describe problem of standardization in IT point of view and its importance, then we present results of our investigation. Next we present procedure of how to standardize (related and based on our case-study) and at the end we show that there is certain way of how-to-standardize but it is very dependent and different in every type of organization, however it is possible.

2. Research Significance

New system implementation should be supported by changing (evolving) business organization habits, what leads to business transformation. This changes can succeed only by development of the culture of the organization itself [17]. Philip and McKeown pointed out what Brown and Starkey wrote in 1994 – "the culture of an organization is an important factor affecting attitudes to, and systems and processes pertaining to, the management of information and communication" – after 22 years this still is true. As we read further – "The implementation of divisionalisation and the introduction of business units, the developments of professional functions across all disciplines, the introduction of multi-disciplined design/build teams in all new programmers, the deployment of multi-disciplined cellular manufacturing introduced in all operational areas, (…) resulted in rapid improvement in performance including quality, schedule adherence, productivity and cost reduction." – all this is good and can be true under one circumstance – by maintaining uniformity and consistency of business.

Processes, functions and companies' rules should be implemented in their IT system so that system is "reflection" of reality – how company works. This can be noticed very well in courier companies when we instantly monitor where is our package. The main obstacle here is data consistency when company has many systems performing different operations –one system for bookkeeping, one system to monitor work time, other for communication etc. Number of things that can go wrong is so high that there is trend of standardization to keep everything in one place in one format. Also, standardization is good moment to change habits and other procedures when needed. That gives us complexity of changes that follow our needs. Changes are always tough but doing it at one time can save lot of time later in terms of adjusting system again. Every case depends on company complexity. In this paper it will focus on universities. It should be pointed out that university is specific type of institution, which includes obvious goal to educate, but at the same time it is business company that is regulated by law and must comply with the specific law. This business must be cost-effective, otherwise it will be closed.

The relationship between universities and standardization has been noticed by Michel Ianoz in 2003[9]. Author writes that universities should play (or can play) important role in this area. To be able to be involved in development or writing standards, firstly the institution itself should be well organized and processes should be standardized, so that people working at the university have good example how this should work.

Data migration, as mentioned before, is one of key points in standardization. This is because of variety of used systems. Every system has (or can have) different output format so that transferring data from one to another can be difficult. Universities are good example of this problem – for example monthly reports to headquarters from faculties. Our assumption here is that every entity has their own IT systems or procedures who they collect data. Every faculty can collect different data, often not needed by HQ. If they have all required data, then the problem is small and relatively easy to fix (or there is no problem at all). Troubles begin to grow when HQ require you to supply them with data which you simply don't have.

Another example is contact with students. Every student has own personal email account in university's domain and can receive all notifications from system or teachers. Works theoretically but reality shows that not every student is using (or even knows how to use) this account. Then, because of lack of communication, student does not know about cancelled classes or that has to show up in deanery to sign some documents. One of the simplest solutions for this problem is to hang printed notifications in the cabinet and hope student will notice it. One faculty uses emails whereas

some are calling student or sending text messages. When students are transferring from one faculty to another and are not informed how things work, then can have difficulties to organize.

Student can also take lessons in two different faculties which work differently – although general concept of examination is the same, some rules can be different, like filling up "examination card" – some faculties require students to collect traditional signatures from teachers, others don't. There is also growing trend of online studying [3] what also is area of interest because need of more online students must be accompanied by proper system, that can handle requests, traffic etc. – to make these online studies available. Authors pointed out that there is no visible difference in learning outcomes. After finishing studies student receives diploma – which is generated (often automatically or half-automatically) by headquarters. They have to collect essential data and convert into their format so that at the end student is getting proper certificate.

All of above leads to question: how can we avoid these problems? Answer is simple – by unifying all structures and using one system for whole university. This of course takes time and requires to work different but at the end results are better and achieved quicker. Using one system at the university can help in various ways, what is presented below (Table 1).

Table 1. Problems, benefits and downsides of using one central-IT-system.

Problem	Explanation	Benefits	Downsides
General issues			
Support	local help desk (not 3-rd party company)	saved time	sometimes local tech support can be overloaded
Backups	central database; faculty does not have to care about backups	saved time and money by not duplicating storage	restoring whole database, not only part for one faculty; partly-restore can be difficult
Storage	central storage, faculty works remotely	no need owning server-room or special servers	difficult access to machines for local IT support at the faculty if needed
Individual needs of faculty			
Processes	every faculty has the same processes, eg. examination or managing classes but every entity works different	unifying principles of work rules makes central administration easier	Every faculty is different so needs are
Data (and their collection)	only data/information needed	no data overload	
System functions	As whole university, every faculty should have the same	easier to manage faculty and thus university	

Source: own elaboration

As we see above main downside of standardization is that every entity in complex organization (like universities) and has different needs. This is perfectly normal because they work different – like Faculty of Physics has different workflow and requirements than Faculty of Management.

Using one integrated system is associated with merging and unifying privileges for different persons. Although personal structure of every faculty should be the same, there are some situations when another person for particular task is needed. Then there should be launched a special procedure to, for example, grant access to resources. Fact of such event should be stored (in paper, email or different form) so that in case of unauthorized access potential cause can be found. This procedure can take long time but in this way we can define who and what is doing. That is another benefit of possessing one IT system – it already has implemented safe triggers and tools to find errors.

On the other hand some faculties must have their own structures in database so they can work normally. Such IT system should give possibility of customization but there should be limits what can they do and what is not allowed. The stop-point cannot be accurately presented and should be discussed between both sides (HQ and faculty).

To understand organization you have to know its inside relations. This can be described by systems theory (systems science); according to Encyclopedia of Child Behaviour and Development [25] systems theory is "(…)a way of conceptualizing the structure and properties of an organization in terms of the relationships and interdependence among its components (…) "; as author says, "component parts of a system can best be understood in the context of the relationships with each other and with other systems, rather than in isolation(…)"; furthermore existence of many of the environmental influences makes traditional organizational theory fail [25]. To understand relations in organization in point of view of new functionality (or way of functioning) is to answer two basic questions:

(a) what we have now?

(b) what we want to have?

which can be divided into:

(a) how can we go from input to output?

(b) how much it costs

(c) and is it affordable?

(d) how much time do we need?

To answer above questions we have to know what should be standardized before new system implementation. Not everything can be standardized like some procedures mentioned before, what follows directly from the custom specifications and needs. There could be situation that for some part of business structure is no need to unifying (or even it is not possible because of complexity of matter).

Next, there should be certain way, instruction or detailed actions to be taken to standardize IT implementations at universities, what leads to make the process better, more accurate, quicker and therefore less expensive. If there is no such procedure, implementation is more and more expensive, takes more time to complete. What should be noticed is that reality and requirements are still changing over time, so when procedure takes too much time, the results may be incomplete. That can cause more errors in implementation itself, so whole idea and point of standardization is lost. Data can be outdated.

All of the above makes goal of this article more important – standardization of IT systems implementation at the university is needed as it unifies processes and forces to do ground-check of procedures at the faculty. Coming up with new method of "how-to" is not only good project but, what more important, it is essential in order to structurize whole entity (university or faculty). Is can also bring tangible benefits to science and practice. These include rising efficiency factor or speeding up processes or do new implementations easier and quicker; changes made to old systems will also be easier to make. All this translates into lower costs and making running business (and university, as mentioned before, is on one hand business) more efficient.

3. Characteristics of the Research Problem

In this chapter author's research was presented.

3.1. General Characteristics of Problem

Implementation of new system (as a group of applications or single application) requires elements of process approach, that is: identify processes and define their dependence and their order. Then you have to examine what you have and what has to be done in order to achieve proper results.

Recent author's studies show that planning classes at university is much more complex than it seems to be. It was made for one of the faculties at the Warsaw University of Technology to improve process of planning classes. Whole project took over a year to complete. It took so long because of need of elimination one of the systems and at the same time developing existing one with functionalities of the first – main goal was to merge two existing systems and improve it – implement new functionalities, accordingly to users requests. What should be mentioned is that whole system needed to be constructed to fit in reporting formula required by the headquarters. Also, there were plans to get centralized software so that this system will not be functioning in perspective of about 4-5 years. All of that lead to make financial analysis to answer question what is better: completely new system for 5 years or modifying existing one to respect new standards and user requirements. After analysis, among others using COCOMO II Cost Model, it turned out that modifying existing solution is more efficient financially-wise than buying new software until centralized software is implemented.

The above problem can be described broadly as lack (or not enough) efficiency of implementation of IT systems. That can be driven by no standardization of automated processes. To confirm this, research was made based on above implementation so that results could unambiguously confirm of decline existence of problem. The faculty was in need of new system without support for existing one and at the same time there were plans to reorganize faculty structure and modify process of servicing the course of studies. As whole university has 20 independent faculties more of them were not centralized what caused not enough expert knowledge to plan the implementation in the way that could cause as less mistakes as possible.

Nevertheless, some faculties were already in the possession of new software. That meant that they could share their experiences in order to help other subunits, and therefore help whole university. Furthermore helpdesk and trainers knew how other faculties work and could share their ideas when new faculty was decide to switch systems.

3.2. Encountered Obstacles

Task of rewriting system was complicated due to 3 very different user groups using this system and their divergent expectations (described below). An attempt to meet their requirements was great opportunity to prove that any system can be developed in way that directly translates into increased efficiency.

One of the requests was to make it available for students to check professors' classes; second was to get all needed data to fill in required forms that every teacher has to present at the end of the semester – simple, but yet effective automation. Moreover, we tried to force user to provide all necessary data in one place so that their next steps will be easier, presentation will be clearer, what leads to better user experience and overall better results.

Many functions were presented in many places at the same

time what caused lot of unnecessary traffic; menu options and available functionalities were placed in different structures, so that many users were confused where they should look for needed functions.

There was also inconsistency of privileges – users were given access to functions that should not be presented and they shouldn't have access to.

All of the above required our team to get familiar with:

existing procedures:

(1) how data is transferred between systems,

(2) how classes are planned,

(3) what are the user habits;

(a) both systems and their functionalities;

(b) user new requirements.

The most complicated and time-consuming was to get knowledge how are classes planned. Due it's complexity you have to take into account many factors that are deciding who, when and where can teach, that not every classroom is appropriate or that some classes are taking place every two weeks or even have to be planned irregularly.

Most of the teachers work in different places as well (besides university) so they have limited time, what should be also taken into consideration when planning classes. In order to develop method of planning classes (or any other university-like activities that involve dealing with rooms and avoiding conflicts – like setting up meetings or conferences) you have to gain the most detailed knowledge of rules and principles of your subject. This requires time but is essential. All of these above determine boundaries in which we can take action. Of course there is no absolute solution because you can't make everyone happy but the goal is to get rid of conflicts (same groups/teachers/classrooms) and minimize the dissatisfaction factor.

3.3. Implementation and Completion of the Project

As mentioned before, above system was planned to be used for specific time. That raised question at the very beginning: how much have to be done in order to fulfil all the needs and at the same time not implementing functionalities that will be in next software and how long can we wait for them. That required deeper analysis to meet both the requirements and expectations as well as capabilities of programming team.

Now system is not functioning any more due to mentioned centralization. The most important question was: should we switch to new system partly or all at once. Decision was even harder because of new staff members at the faculty, that were responsible for planning classes. On one hand they should learn new software but at the same time they should knowold system in order to get archival data to compare how faculty was functioning.

The result was to switch completely at once because not doing this was only delaying in time. Users are slowly but effectively using new system; they are offered (at no cost) support in all aspects of using system. Some features are not used in overall but as new needs are showing up these functionalities are presented and new trainings are organized.

After nearly 5 years from planning and almost 4 years of using modified system the whole project has deserve to be success. There were only minor adjustments and one feature implemented after main implementation and that was because of good analysis, trainings and adjusting system for company's needs.

3.4. New Centralized System – Half Year After Implementation

New software, provided by the headquarters, includes numerous "co-systems" and applications that are connected to one logical dataset, what assures data completeness and integrity. As main system is used by over 50 universities in the country, Warsaw University of Technology is using it as well. That only proves that this system is flexible and can be adopted (and, if needed, modified by local programmers) to university specifics.

Faculty of Management is using software to take care of all students' assessments, make didactic room reservations, check students projects in terms of plagiarism with other students' theses or internet sources. System is also used to keep bookkeeping records, make financial commitments. Also, all students can access special web platform and check their grades, professors classes, write to teachers or other students from the same class group, grant access to Wi-Fi network.

After half year almost every piece of software is used. When one faculty needs some functionalities, automatically other faculties can also use new functions after successful implementation.

This could be achieved only by uniting faculties and encourage them to use this system (it is not obligatory). What should be pointed out is that if the processes themselves are developed the right way, there is no problem (or the problems are minor) to use other tools, because it is not the matter that is changing but only way of data presentation and access. Of course, there is always natural barrier of user habits that cannot be omitted. For that reason the process of new system implementation is crucial because if user is not convinced that this new tool is better, there is no point to make them use it. On the other hand we can force user to use

it (and unfortunately this situation often happens), nevertheless it is much easier if user is willing to accept help or, as this half a year showed, admit to made a mistake. We are all humans and this is normal to make mistakes. Based on this errors we can learn and not commit that mistake twice.

The process of standardization of IT implementation is changing while more faculties are joining centralized system because new unit means new requirements, therefore new algorithms need to be implemented. For this faculty the process of implementation has ended but their experiences will be used by the headquarters by next joining faculty. Now faculty is being educated and trained to use new functionalities, there is also help provided if any problems are occurred. The success of this particular implementation comes from good background investigation, well organized study process and all connected processes.

3.5. Discussion of Project Results

Standardization as a process of automation other processes should be perceived very widely. No matter how big or small subject is you have to decompose problem and deal with every piece. This may apply to every process of changing IT infrastructure or deploying new technology solution. Implementation of new system or changing existing solution is always dangerous and carries the risk ("potential of losing something of value, weighed against the potential to gain something of value" or "intentional interaction with uncertainty" [14]). Here risk is understood as taking actions that will result that new system will be worse than old one. To minimize this risk there are certain actions that should be taken in order to avoid unnecessary conflicts:

(a) determine law boundaries (of whole university)as corporation and at the same time as teaching organization and its specifics,

(b) examine system and rules that are working now,

(c) analyze processes (which have to be standardized),

(d) analyze systemic requirements and users requirements;

(e) define functional requirements and non-functional requirements,

(f) project of changes in current system,

(g) implement all these.

Every step from list above is important but analysis of systemic and/or users requirements is the one that can cause most problems.

Users are used to system that they use. Implementation of new system always meets with question "do we really need this?". To minimize side effects new system (or whole solution) should be consulted with users so that when they have to use it they know the logic behind the presentation layer.

As we mentioned before definition of standardization depends on the subject; however, regardless areas of standardization, often implementation of new system is limited to manual of installation guide or quick guided tour how to use the system. That is ok for end user in home environment but not in business. Taking into account complexity of universities there is no one way of how new systems should be installed, explaining why or when. Therefore especially important is to provide schema of workflow in order to run new implementation safely and as quick as possible.

As mentioned in the introduction, authors of the article [19] point out that "(…) many other topics are closely related to the process of creating ICT standards and deserve further research (…)"; also filling the "standards gap (p. 298 of article) is needed as well as make academic institutions more aware of the relation between creating standards and implementing them in real world projects.

In one faculty was need of transferring data from old system to new one. Task of faculty was to provide data in correct format in order to supply database of new system with correct and complete data. As it turned out it was quite a big problem because different data was needed and with completely different structure, therefore whole process of migration was extended. In this case both sides were working on this – some of columns were right, other needed to be converted with regular expressions. The rest needed to be filled in manually after data migration.

University, as one company, has unified agreements with students – that is what we expect. Unfortunately many faculties want this document to be formatted differently and want some extra data of the student. It is of course doable but destroys integrity with other faculties and as a result entity is, in some field, independent.

Recent modernization of system of planning classes at one of the faculties shown many areas to be considered. For example provide data consistency with old but yet still working system that cannot be turned off. During implementation it turned out that formula of documents was changed therefore all projects and templates needed to be recreated.

Many users complied about low resolution, small letters, text presented not clearly – that's because system was given "as is" without further assistance. Technologies are changing so systems should as well. Some of the problems and solutions were described in appendix.

User requests were, in most cases, simple and easy to

implement. This shows how little was needed for the system to be perfect solution for the company (faculty), at least at the time of system creation. What should be mentioned is that system was written especially for the faculty to illustrate and digitalize planning and settlement processes. That combined with perfect knowledge of processes was matter of time to develop system, that helps users and unifies processes.

Reality showed that system wasn't quite ready for rapidly changing technologies and processes – the way of functioning of faculty changed for the time being and decision was made to update system, both updating to be consistent with new technology and adjusting to new reality.

Due to described differences there is justified need of prepared procedure that could support the standardization process during the implementation of new integrated system. That procedure could help not to omit important steps and would suggest what areas should be examined. This way we can be sure that all the work before actual implementation is done properly, what as a consequence will result in faster, smoother and in overall better implementation. Good analysis of the processes can prevent from downtimes.

4. Integrated Procedure of Implementation and Standardization

Main goal is to come up with method of IT systems implementation in the way that can unite and reconcile individual needs of faculty and rules of the whole university. Figure 1 shows simplified workflow.

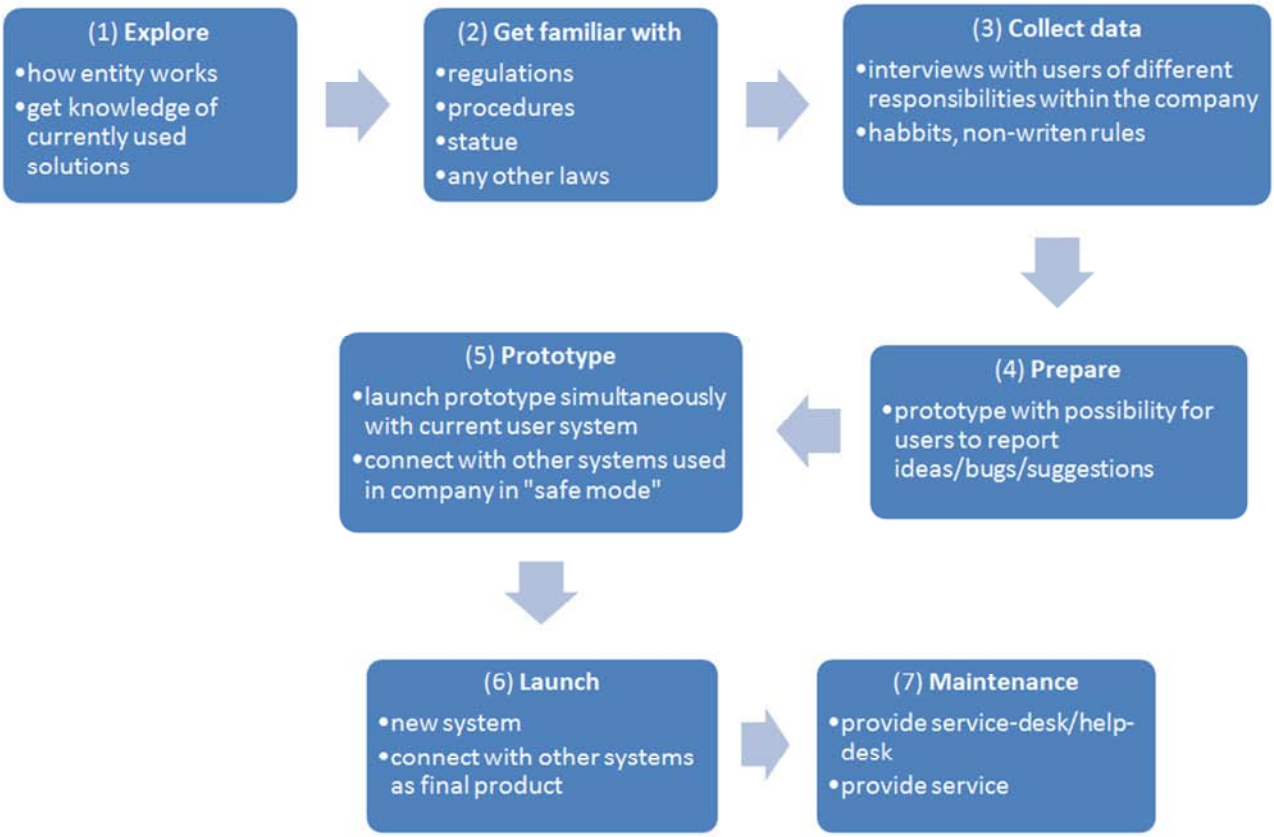

Figure 1. Integrated procedure of implementation and standardization of IT system (*source: own elaboration*).

Whole procedure can be divided into following steps, showed on Figure 1.

Step 1: Explore

Result of this part should be clear image of how entity works, what are currently used systems, how they are related and how they can be accessed.

Step 2: Get familiar

This step should be treated as continuation of step 1 – get into details. You have to know all the necessary law-related data of how entity is functioning, what can be done, are there any agreements needed.

Step 3: Collect data

Widely understood as get feedback from users about current state, solutions. This is especially important (as mentioned earlier) because the better analysis the better results.

Step 4: Prepare

Having in mind all collected data from previous steps make working copy of new solution with test data, available for users of different responsibilities to test new system. This step is to launch prototype for small group of users.

Step 5: Prototype

This step should be treated like step 5 but for larger scale. Data should be imported from previous systems but still without committing changes in real-life data. Connection and sharing data with other systems is essential but at the same time we shouldn't allow users to change data in other systems.

Step 6: Launch

Quintessence of all preparations: launching new solution connected with old systems allowing changes in all data – exploitation of new system.

Step 7: Maintenance

Guarantee necessary help-services and assistance in further exploitation.

First is to talk – with every person (or almost) that is responsible for current solution, including head of the organization. You have to know the boundaries which were described above. Then make interview with IT section to determine the technology they are using in order to integrate new services with old ones. This is the most important part and should be examined most – standardization is to collect everything we have and make it possible to share data in every possible way (of course if there is need). This can be done much easier when used technologies are supported by all manufactures of single solutions.

Next step is to know user habits and requirements – this allows new solution to be as much user-friendly as it could be. Then, when the prototype of new system is ready, is time of testing and adjusting to certain needs.

When new system is ready to deploy there should be always time when both (old and new) systems are working simultaneously. The length of this period cannot be imposed because employees need time to switch to new system but cannot be very long as well. This is because supporting and maintaining both systems generates big costs to the company.

At the end there always is support and help-desk services which help users to get better results and use new system as much effective as they can.

5. Verification of Usability of Procedure

During implementation of new planning system analysis revealed many requirements what confirmed that new system is very needed. Time was and probably will be the biggest opponent.

Firstly we had to understand how entity works and gain access to all needed data – procedures and relations between every sub-entity.

Before actual designing and prototyping there was very big problem to gain access to database – from legal point of view, what is presented in step 2. Before idea of new system faculty was buying new software or was given from headquarters, so there was no need to export data to third party company/user. When planning modernization of existing solution the first step to be taken is to ensure that you can access data freely and there are no extra costs.

Collecting data – as part of step 3 – was key of understanding what is actually needed. This is because users-teachers had different point of view then administration. This resulted in preparing (step 4) prototype for users of different privileges; after many consultations system was deployed for more users to check if there are performance issues or other errors that didn't existed in previous version (step 5). Also, real data was imported into this prototype to allow users operate on copy of data that was actually used. Accordingly to step 6 we launched system with fresh copy of data from old systems. This resulted in maintenance break and was planned to be done when nobody was using system. Also, we developed new backup schedule and maintenance services in order to successfully end this project.

After implementation we provided help services and local adjustments to meet small organization changes.

Many users' requirements exclude each other or were unable to implement. Of course the main and the biggest demand was to create button that will create suggestion (or first revision) of plan. That was unenforceable due to other limitations.

Often users wanted functionality that was simply not able to implement because of rules and law at the university or faculty itself. Other group of requirements was gaining access to resources that users should not have. Then there were technology limitations like used programming language – what was result of changing current solution and not building new one. We must not forget about costs and budget that couldn't be exceeded.

On the other side there were lots of requirements that revealed weakness of old solution like low usability, the lack of consistency of information or no backup procedures (which taking into account scale and importance of such system shouldn't happen).

One of the requirements was to provide access for students – by this time system was only for employees. The problem was: do we need to create every user their own account (and

if so – what about security policy) or should this system be opened (part of it). The solution was to create one special account that every user knows and can log in with this credentials and check all the needed information. Of course this has its limitations like no access to secured areas or no possibility to change data.

Another request was to create sort of "admin panel" for Dean of the faculty where will be presented data of teaching load.

The success of this implementation was consulting how new system should work before actual prototyping. What more, we had to deeply understand how this process worked now and how it needs to work. Knowing how classes are planned and what are the expectations of how this will be working allowed us to present better results and come up with suitable idea faster and easier.

Every functionality was consulted with at least two users from two different groups: employee and their direct superior. That gave us clear image what final product have to react on certain behaviors.

Another thing is to provide testing platform where users can play with new system and report needed changes. That gives benefits of extra testers but more important they can feel new solution therefore it can be adjusted to meet their needs.

However, the most important factor is to take into account business model of the organization and either change it before implementation or reflect it in logic of system, that data flow is the same, the data consistency is provided and that the new system's result (in this case new classes schedule) is close to described final result of business strategy (for example goal is to educate more engineers more effectively, that means optimize time and effort to educate them well).

6. Discussion of Results

Implementation of new system done with respect to development method of standardization procedure, was successful. The only thing that didn't work out is the time needed to complete necessary preparations. This is because of lack of knowledge how to share data with third-party partner – law-related issues presented in step 2 of procedure.

Also, further assistance was complicated as users still had new requirements that, in their opinion, should be implemented. Some of them were easy to fix but developing new functionalities was out of the reach. This can be omitted in step 4 and 5, when users can report bugs – this is the last moment. Of course, new ideas should be listed in step 2.

Implementation of new system in view of standardization revealed many imperfections that were corrected. For the first time data had to be given to third party user so every legal aspect was covered, described and now, in event of any further similar occurrences, there is provided instruction that should be followed. Also, new system was widely described and explained with guaranteed support after implementation.

Analysis showed that changing one system and by the same time maintaining consistency with business strategy leads to improved results, what can be translated into lowering costs and growing efficiency of business.

New software distribution made by the headquarters showed that faculty was prepared to introduce new system to the users. There were some problems but they have been overtaken so that everything worked out. Processes were studied and therefore future implementations and changes have gone smoother what can be observed now. The only problem that occurred is, in some cases, different data presentation, what lead to that "low-level" users to have some difficulties to fill in forms. Nevertheless, there have been organized trainings for everyone where not only the technical issues were discussed but, what more important, how and why this must (for the time being) be implemented as it is now. At other faculties there is trend to designate leaders that know system and can teach others coworkers, so that faculty can receive help faster. Undoubtedly one of the key-success was to eliminate completely old system(s) and teach new employees using new software without knowing old tools and yet doing the job done well. Considering above the main goal was realized.

Results of new implementations should be measurable. This can be done by measurements that need to be defined. Factor should be evaluated objectively with the quantified meter, should include components like time needed to complete single operation (before and after implementation), the number of errors or costs of maintenance of the system. It shouldn't include components like level of users satisfaction or work efficiency as this is rather non-measurable. This is a starting point for further research.

7. Conclusions

This paper's goal was to show that standardization is key of proper functioning of any organization, what leads into increased productivity and efficiency.

As a result of implementation of new planning system main goal of providing system that will help planning classes was achieved. Standardization, that is implementing system that was compatible with other technologies and systems used at the faculty, providing centralized backups, ensured that within time processes were joined and as a result faculty was operating better and faster.

As a downside we failed to completely eliminate other

system, which's functionality was designed and implemented in new solution but the main obstacle was "user factor" to switch to new software.

This case isn't only one. Many users, due to their habits, still will use old systems because they know how to use it and they are afraid of changes. In such cases there should be leader's (or head of the institution) decision to obey and use tools that are provided. Also, time needed to swap between systems can be longer.

Nevertheless providing access to different tools operating on the same data is essential. The main goal was to provide tool that is compatible with other systems and can be used by many users at the same time to plan new classes resulting in saving and time and money.

This process revealed areas of business that need to be taken care of. The first thing is to audit teams in deaneries and balance their "processing power" reasonably by combining persons of different knowledge to make it possible to learn from each other. Then you have to create rules and set clear responsibilities in each team so that everybody know what is responsible for. At the same time there is need to audit procedures regarding students with appropriate law statements; if needed adjust system to meet requirements; create detailed documentation explaining different scenarios, try to describe as many as possible; provide periodic newsletters for employees about changing law or rules.

Then, when staff is educated, you can implement new IT system which will allow them to use their knowledge in most effective way. To optimize company efficiency you have to first improve your local procedures.

Appendix

Identified Problems of Planning Classes System (Web Platform)

System was created especially for faculty therefore all implemented functionalities were up to date at the moment of system creation. For long time system wasn't expanded/developed whereas procedures and needs of faculty were changing. As a consequence system wasn't up-to-date with the real state of faculty what caused few problems. As showed below many of the problems were basic and easy to solve.

During research of users' needs many problems were identified. These have been collected and presented in tables below. These are only the most recurrent issues, not all of them were included; presented in no particular order.

Table A1. Identified problem: visual experience.

Problem	poor visual experience
Cause	used old and/or outdated technologies; poor page resolution
Solution	Detailed inspection of subpages revealed using outdated method of implementing "masterpage"in used technology, so that not every page was looking the same. First step was to create new template, with new graphic layout but maintaining menu in the same position. Then, converting all subpages to use this one template which allowed to change whole system layout by changing only one file. New buttons were added to scale text size dynamically.

Source: own elaboration

Table A2. Identified problem: sudden logout.

Problem	sudden user "self-logout"
Cause	user was automatically logged off after 60 minutes of inactivity
Solution	New timer on master page was introduced which was counting down remaining time to auto log-off. Also, time was extended to 2 hours.

Source: own elaboration

Table A3. Identified problem: error messages.

Problem	incomprehensible error messages
Cause	no custom error handling
Solution	new mechanism of error handling was introduced, as well as all functionalities were carefully checked to prevent user from supplying data in wrong format – in example giving number with wrong separator (for instance comma instead of dot)

Source: own elaboration

Table A4. Identified problem: complexity.

Problem	menu too complex
Cause	functionalities were duplicated in many sections
Solution	new system structure was developed and at the same time all functionalities have been rearranged

Source: own elaboration

Table A5. Identified problem: permissions.

Problem	user can change their all profile data, including username, employment relationship, number of hours to-be-worked, organization unit etc.
Cause	all fields could be edited
Solution	user cannot longer change their profile data excluding email, password

Source: own elaboration

Table A6. Identified problem: forms fill-in.

Problem	some forms are complicated to fill in
Cause	no help or hints how to fill in forms
Solution	created new functionality to help users in filling forms and actively checking data integrity "on-the-go"

Source: own elaboration

Table A7. Identified problem: no data after logging in.

Problem	no data for new users
Cause	default user account was created with no enough data
Solution	user when logging for the first time, was redirected for special page to fill in all the forms in order to be able to use system

Source: own elaboration

Added functionalities

Table A8. New functionality: data download.

Problem	difficult data download
Cause	no export methods were implemented
Solution	for settlement reasons new reports were needed because of faculty development itself. Therefore new functionality was implemented in order to give user ability to download all the needed data, in many different formats

Source: own elaboration

Table A9. New functionality: students access.

Problem	student can't check professors' classes
Cause	no access for student
Solution	there was no entry for student in order to check if professor has classes what lead to difficulties in contacting with teacher

Source: own elaboration

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