SUPPORT OF ERP SYSTEM REPLACEMENT WITH PROCESS MANAGEMENT TOOLS[1]

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ABSTRACT

There are many sources in the literature that deal with the implementation of a new ERP system, but there is a little distinction between the implementation and replacement of an existing one, although they require different kinds of preparation. The paper proposes a novel method for ERP system comparison and change, in order to realize a successful and efficient ERP system replacement project.

Keywords: Enterprise Resource Planning, ERP system change, Process management

1. INTRODUCTION

Enterprises and business processes face continuous changes; therefore, they have to keep pace with all the changes in their surroundings and inner environment by making fast and appropriate business decisions in order to maintain their positions and mission. Human, material, financial and information management, organisation, design and control are inevitable. Information from the staff and contributors should be interpreted and analysed, be used as the basis for decision making to a rational extent; the method of information process requires long-term planning that is above the operative level. Enterprise Resource Planning (ERP) system means that each stage of data entry and data processing hands over information to the next one while the tool is unchanged [1]. It means that data do not need to be saved on a data storage and then be put into another system from there. The activities (in theory) are never repeated and duplicated (e.g. the modification of the bill of materials is possible only in the production module), and each data is stored in a common data basis, to which users with different license profiles can have access to and gain data with different details. Enterprise Resource Planning systems' primary user function supports data entry, while Decision Support Systems (DSS) and Business Intelligence solutions are suitable for strategic decisions as they support the analysis and illustrate data in depth.

The basis of ERP systems are master data, which are stored in the system modules and support their functioning. Master data is, for example, the product identifier that is needed for the demand planning, supply management, accounting and purchasing. [2] The bill of material, consumption data and purchase price are related to the master data as well. Transactional data are separated from master data as they change very frequently, even daily and are periodically archived. The biggest challenge when implementing an ERP system is to define what changes are caused in other data if there is a change in one of them.

2. METHODOLOGY

In order to prepare this article a thorough desk-research was conducted in the following fields: ERP system development, critical points of introducing ERP, ERP system switch and factors leading to ERP system switch.

Besides internet sources, this article builds on experiences gained during a real-life switch. Scientific data base such as ScienceDirect, Taylor&Francis or Google Scholar were extensively used as internet sources.

The results of desktop research are followed by the introduction of new methodology and its actual application, during which resource planning methods were applied. The suggested methodology was actually applied in one concrete ERP system switch, when the enterprise switched from its former into a new one, and both EPR systems have leading market shares in the world market. The process to be introduced was applied in the interim period of the transition, when the transition project had already been started; however, the heavy part of the duties was to be done.

3. LITERATURE OVERVIEW

3.1. The relation between value added process and enterprise resource planning systems

Categorising ERP systems can be according to the task: [3]:
Supporting value-added processes (operative processes)

[1] This research is supported by EFOP-3.6.1-16-2016-00006 "The development and enhancement of the research potential at John von Neumann University" project. The Project is supported by the Hungarian Government and co-financed by the European Social Fund.

Logistics, controlling or asset management belong to this category. These elements constantly analyse and plan the material and financial resources that are needed for the short-term operation of the organisation. It is a general component as it can be found with every organisation and industry specific elements are built on it.

Supporting non-value added processed (management and support processes)

This analysis covers all areas of enterprise achievement. They are processes that support operation, they are inevitable from certain aspects but do not generate direct value for the customers, e.g. accountancy, tax declaration.

Supporting cross-enterprise processes (e-business)

An ERP system creates a cross-enterprise integration by analysing external and internal suppliance, purchase and customer service processes via collecting and storing information both about customers and suppliers.

According to Porter's Model enterprises should carry out actions that add values to the products and services, and make a profit as the produced value exceeds the costs of the action. This cost influence can be achieved by automatizing value adding processes, providing and coordinating suitable information flow. [4] To carry out each task certain input is needed, which means further tasks, e.g. storing and transporting. As every task has cost implications, finance-accountancy follow-up, insurance of machines, devices and staff should be also focused on.

Figure 1 is about action levels:

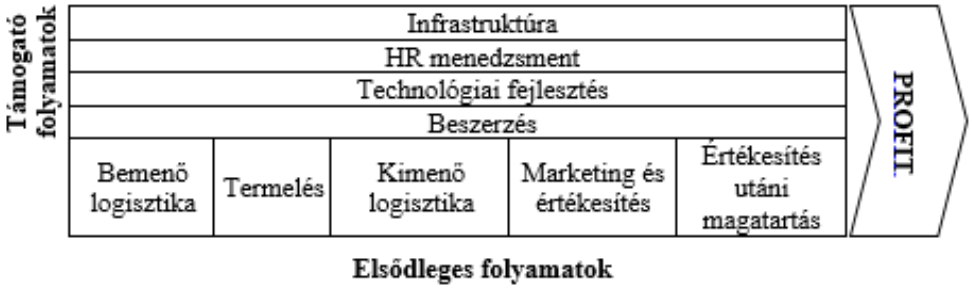

Figure 1: Porter's process model

Value adding processes directly produce values for the customers. Input logistics include acceptance of supplies on delivery, storing them and transferring them to their destination on time. Production (operations) is the process during which the organisation transforms inputs into outputs. Output logistics means storing and distributing final products. Marketing and sales realise the demands at the selected markets, make promotion and conduct business. Operation after the sales includes putting the product into operation, services following sales e.g. complaint handling and a claim under a guarantee.

These processes do not add values from the enterprise point of view, but they are inevitable as they support the success of primary functions and analyse their efficiency. Enterprise infrastructure, HR management from recruitment to incentive management belong here. Technology development is very relevant in decreasing the costs, and supply means having the necessary inputs at the highest quality in the lowest price.

It is obvious that enterprise development processes cannot be separated from each other as there and strong relations and correlations between them. There is a need for information on finances and resources, the development of past and present demands and market changes; moreover, making predictions based on all this information is also necessary for long-term planning.

3.2. Possible reasons for introducing ERP system and a shift for it

Markus and Tanis in their study in 2000 [5] make a clear distinction between system shifts on technical and business problem level, and also make a difference between small and large enterprises. Typical reasons for introducing or shifting in an incomplete list

Technical reasons with small enterprises and/or enterprises using simple processes:

Development of IT infrastructure, or in other words reducing IT staff burden e.g. by eliminating parallel systems

Eliminating data redundancy for the sake of easier data analysis

Reducing operating costs of computers

Real business demands of small enterprises and/or enterprises using simple processes:

Enterprise enlargement

Improving non-efficient processes, cost reduction

Handling multicultural environment within the enterprise, currency harmonisation

Reducing the number of faulty and late customer compliance

Technical reasons with large enterprises with complex tasks:

Everything that occurs in small enterprises

Interface development
Real business demands with large enterprises with complex processes
Everything that occurs in small enterprises
Process standardisation between enterprise divisions
Developing a single corporate image towards the customers.
Supporting enterprise level decision making

The necessity of introducing or dismissing the system can be caused by several factors at the same time, however, the objectives should be prioritized according to their importance and expenditure (price, hardships and duration of implementation, staff objection, etc.) when choosing the appropriate system.

The new system can be implemented in three very different ways:

big-bang (in other words: waterfall model), when all the modules are implemented simultaneously at the whole enterprise and the sharp shift also takes place at one time.

The advantages of implementing bing-bang is the single-beat introduction time, well-defined deadlines, starting and ending periods (the next stage can be achieved only when the previous one is completed), well-documented steps; however, the drawbacks are that is time-consuming, requires very precise planning, all the mistakes come to the light at the same time, and their correction is very expensive. A shift usually means in real life that new software should be finished by the deadline, and it should be introduced on the first day of year X. The old system license expires on the last day of year X-1, and the old system is switched off, and people use the new system from the next day on.

The phases of the waterfall model are the following: [6]

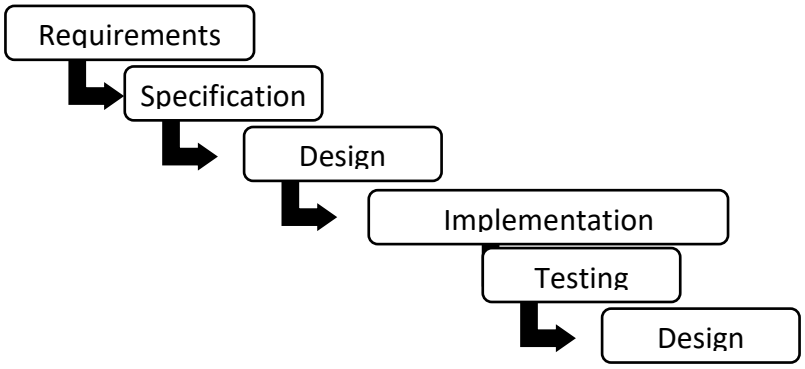

Figure 2. Phases of the waterfall model

Gradual, where the modules are implemented or shifted one after the other in a prescribed order, so the changes affect only minor units.

The advantage of the gradual implementation is that it is less risky, and if the parent company has branches, this type of implementation is recommended. However, the implementation time is long, and needs a lot of money because the license for all the simultaneously used systems should be paid for, and temporary interfaces are also required. [7]

With an agile method – in certain cases it is the most widespread and effective –, the implementation is realised in small steps, with regular project phases and partly simultaneously.

Participants in an agile project think of several, short time cycles, and start the implementation according to an architecture they agreed on at the beginning. The architecture fixed first is to be simple (MVP: Minimum Viable Product, it is the basis of further work) so that the modifications (adding new things and eliminating old ones) could be fast and easily fixed in it. During the several, short work phases the software/module handover is achieved via continuous feedbacks. [8] This step-by-step process guarantees the project success, as the enterprise cannot define all the tiny elements that it expects from the system, however, as the implementation deadline approaches it can give more precise information. This method requires a high level of flexibility and a good partner relationship both from the customer and the supplier.

All the three strategies have their pros and cons; the enterprise should decide what risks it could take: choosing the riskier implementation method and the fatal error comes up in the last moment, or it devoting more time, money and resources to the more careful implementation; these aspects are important, require expertise and case decisions.

3.3. Changes of enterprise processes

A general expectation from ERP systems is that after their implementation enterprise business processes should work more rationally, efficiently, however, it is due to the new system to a small extent. Standard softwares never completely covers the entire activity of an enterprise; the rest could be covered by clearly defining all the enterprise processes and altering them with CPI or BPR methods for the sake of successful implementation. [9] CPI (Continuous Process

Improvement) means constant modification, improvement of enterprise processes in order to eliminate all its weaknesses. Its methods include Lean or Six Sigma. BPR means „basic rethinking and radical redesigning of enterprise processes in order to achieve dramatic improvement." [10] Processes that do not match the standard software, and the enterprise is unwilling to modify them require software modification; ERP systems try to provide this capability.

As ERP systems partly function for an enterprise as a means to (re)structure its own processes, the users have no other choice than to learn the methodology so that they could fulfil their own tasks. What counts as an advantage is a disadvantage as well; post-modification after the implementation is restricted as it requires system development, which is expensive and time-consuming. That is why deeds before the implementation are worth being considered.

With non-value adding activities it is worth adapting the enterprise to the systems being implemented than vice versa; if the system were adapted to the enterprise, the update for a newer version would be difficult or even impossible. While in the opposite case, with value adding activities it is the system that should be adapted to the enterprise activities.

A system developed completely bottom-up is less widely used; in such a case enterprise IT experts or a software developing company prepare a system completely adapted to the enterprise needs. It takes much more time than purchasing and implementing a ready-made software; and it is more expensive, too. As this solution requires IT background knowledge, this implementation method is impossible nowadays except for some specialised cases with small and micro companies, when the system is specialised on very unique tasks.

3.4. Assessment of success factors of ERP system implementation

Implementing a new ERP system is a long-term process and has an effect on the whole organisation. The enterprise should take several factors into consideration so that the back testing of the results would be successful. The literature recommends several models to point out those factors which have an outstanding influence on the operation and acceptance of the system. These factors are success factors, since their effect on the project are positive and the project ends with success.

3.4.1. Gable model

According to Gable's model [11] the successful operation of an ERP system is influenced by:

the quality of the incoming information, which analyses data reliability and accessibility,

the system quality includes hardware equipment and software transparency, GUI surface quality, support and interfaces with all the other systems,

system and individual influence, or in other words the organisation members' attitude to the new system and modifications.

3.4.2. Infinedo model

Infinedo added to further factors to Gable's model [12]:

experts' preparedness: expertise and industry experience,

the workgroup's expertise in the work they are involved in: when planning the process it is important that the participants understand what effect each step has on the other employees.

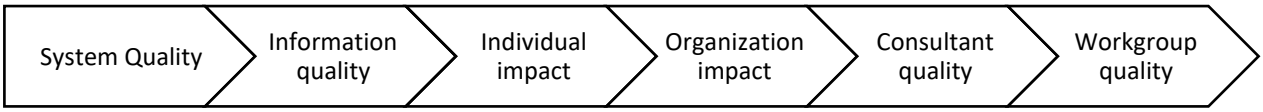

Figure 3 : Infinedo model

In Figure 3 factors that are directly human dependent are in light fields. It is four factors out of the six ones; the quality of these factors is unstable as humans are unable to perform their tasks with the same quality day after day; and their environments also have an influence on their performance and mood. That is why having the determination and financial background for a successful EPR implementation are not enough. [13]

3.4.3. BSC approach [14]

BSC based assessment means analysing quantitative and qualitative criteria to make decision making easier and assess implementation success and the EPR development rate The 4 dimensions that are considered:

Financial approach: appropriate financial planning in order to shorten the payback time, cost minimisation to avoid overspending.

Internal business process perspective: it is a factor to be assessed to make enterprise processes more effective.

Customer perspective: the goal of introducing a new system is to enhance customer satisfaction in most of the cases.

The opportunity for innovation, extension and development: the goal is to make the users learn how to use the new system in an easy way [15]

By analysing the aforementioned factors the enterprise can get a comprehensive picture about the potentials of implementing the new system and the changes be prepared for. [16]

3.4.4. Task-technology fitment

Smyth 2001 model has three characters in focus: the task, the technology and the user. [17]

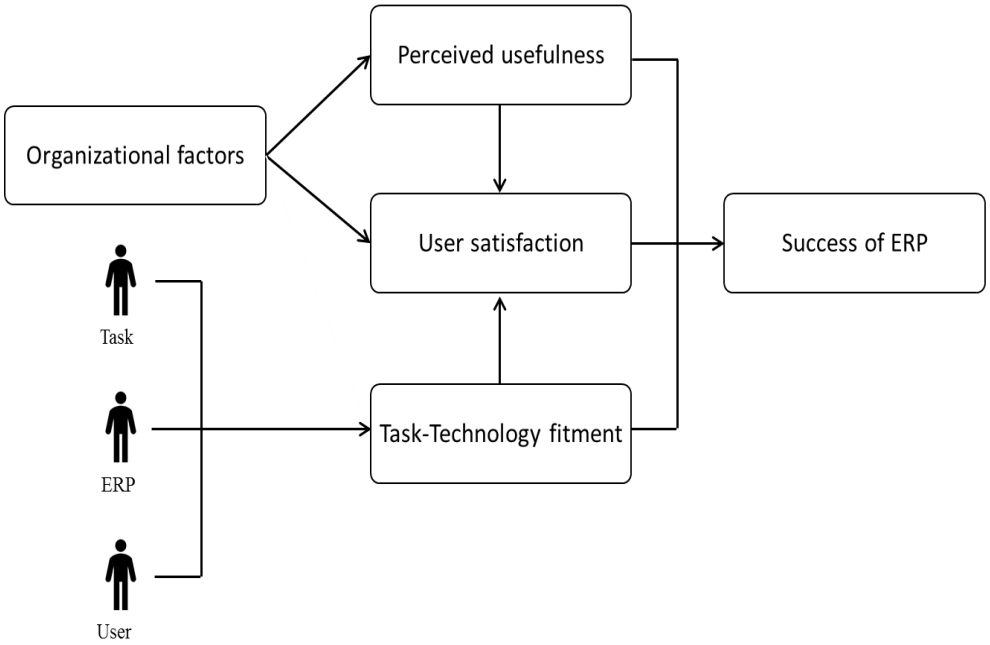

Figure 4. Smyth TTF model

According to Figure 4 task technology fitment depends on the system and the user. This is the way the enterprise can realise what system it needs to fulfil its tasks, what characteristics and services it needs. When defining the system requirements, employees' skills, preferences and willingness to learn should be taken into consideration.

Organizational factors mean the usefulness and user satisfaction; these are the three success factors.

Being aware of the three aforementioned models, enterprises may prepare for the difficulties before, during and after implementation, and should allocate extra resources on the –usually- critical areas signalled by literature.

4. INTRODUCTION OF THE CURRENT SITUATION AT THE ANALYSED ENTERPRISE

The enterprise has extended its activities in the recent years, which meant that the previously used system could not meet the new quality requirements and give reliable data in time. As several systems existed, there was no expectation to implement an independent system and interface; being a large company, the enterprise was in search of a system that could meet the demands of the entire company and successfully complete all the strategic improvements

The enterprise goal with the new system has been

to completely support all the activities of the enterprise,

to meet customer demands at a higher level,

to make all the branches use the same system and process the same data

to plan enterprise resources more precisely and increase their availability.

There has been no similar system introduction at this enterprise before, as several smaller system had been used simultaneously; moreover, each branch has been expected to represent themselves, so the need have been manifold. The following method has made the switch to the new system easier and more understandable for the employees and all the other participants; precise information is to be given what to expect and when. This solution makes information flow and following steps easier at such a large company. The method that is to be introduced in the article makes the process easier to be overviewed and offers a stable background for the efficient communication and cooperation between all the participants.

5. SUPPORTING ERP SYSTEM CHANGE WITH PROCESS MANAGEMENT TOOLS – THE SUGGESTED NEW SOLUTION

A new methodology has been developed for a more precise and successful ERP system change and process reorganisation. The applied methodology uses an extended SIPOC table that makes introduction and getting to know the effect on the process easier. According to literature SIPOC table is a process representing technique [18] that is used to document and visualise enterprise processes, discover areas that need improvement and uses only few but important data. Still this table is a flexible descriptive system, and the enterprise can decide on its own to what extent the system is used to analyse processes. In this case the executive and user organisations, the description of the system, and the in, - outputs mean the core of the table. The five columns of the table are the following:

Supplier: supplies all the necessary resources for the process step

Input: input resources determining the process, which can be resources, information or documents to be used

Process: the definition of the process

Output: the end result of the process step that is forwarded to the customer/user (in some cases the output of a step can be the input of the following one)

Customer: everybody who has access to the output

The suggested methodology introduces those general enterprise process steps, just like applying SIPOC method in a classical way, that are supported by ERP system(s). Here the primary goal is to document the business process that is/was supported by the outgoing ERP system as a secondary goal and is to be supported by the new system that is to be introduced. The basic element of the suggested method is to add further information on the business process in the SIPOC table both on the previous and the new system as this is how supplementary information is available, for example

What process steps and to what extent are supported by certain functions of the old and new system?

At what process steps, e.g. in a transaction are enterprise function merged and when is a process divided into parts, e.g. in 2 or more transactions?

How many use certain transactions of the old process, and how many use the new functions of the same process steps?

When do the information providing and using employee roles change?

Where and to what extent does the information necessary to complete a process change?

Etc.

The original SIPOC table is a robust structure that can be developed user specifically to support ERP system change; this is suggested in literature, too. An important element of the extension is that the extra information (process step attributes) is provided both for the original and the new systems. Therefore the characteristic features of the usage of the old and new systems are included in the table. The systems and their functions/transactions are under one another in the table so that their correlations are defined by business processes. The most detailed process fragmentation must be defined that correlates with each transaction both in the old and new systems. It needs thorough planning, but business process changes are considered with the ERP system change as well.

After the appropriate process fragmentation the further elements of the SIPOC table (SI and OP) are developed for both systems, and several further attributes appear regarding both the time and quality of the work. Further attributes in the table – with explanation – are as follows (they have been estimated both in the new and the old systems):

The number of those who take the steps: how many people take part in a given process step

The number of working hours: how many working hours are needed for the task in a work phase (including data collection).

Defining categories regarding the availability of the input data:

1: data available with hard work and slowly

2: data available fast and with hard work

3: data available with little work and slowly

4: data immediately available

Defining categories regarding the quality of the used data:

4: data immediately available in the required quality,

3: data immediately available with little manual modification,

2: data with time-consuming correction,

1: data clearing as a "project" is needed

Lead time (working days): The number of working days from the beginning of the process till processing and forwarding, the complete length of a process step.

Informational complexity of a step: Choosing the category that reveals how complex the information to be handled is and what knowledge is needed.

4: easy-to-solve task with transparent data,
3: hard-to-solve task with transparent data,
2: easy-to-solve task with complex data
1: hard-to-solve task with complex data

Categorising the presence of communication: how extensive communication is needed with other employees and organisations:

no one,
one particular person,
some people (2-5 persons),
more than 5 people
Labelling the concerned ERP module
Quality category of the output data produced in the process step:
4: precise data,
3: +-5% error rate,
2: +-20% error rate,
1: +-50% or higher error rate

5.1. The practical example and experiences on the new solution

The new methodology is to be introduced by focusing on and explaining the process steps, taking the particular enterprise as an anonymous example of changing from one ERP system to another one. Rows in blue field are about the processes before the change, while the yellow fields are about the processes in the new system. The introduced methodology originally puts the characteristics of the old system left to the process step (P), and the ones of the new system on the right; however, the process steps are placed under one another in the table because of the format of the article; blue field refers to the old, the yellow field refers to the new system.

Executive body	*Input*	*Process*	*Output*	*User organization*	*Software*	*Number of workers*	*Nr. of working hours*	*Accessibility of inputs*	*Quality of the used data*	*Lead time (week-day)*	*Complexity of the step*	*Presence of communication*	*Involved modules*	*Stadard deviation of generated data*
Technological Directorate	Material utilisation data	Statistics of the previous year's material utilisation data	Material utilisation data from the last year's auxiliary tablesheet	Planner production sites	Old ERP system	1	8	4	3	1	4	With one named person	Maufactur-ing	4
Technological Directorate	Material utilisation data	Statistics of the previous year's material utilisation data	Material utilisation data from the last year's auxiliary tablesheet	Cost centers	New ERP system, MS Excel	1	8	4	4	1	4	With one named person	Production Planning	4
Controlling	Purchase plan for materials and services	Controlling approval of net demands	Controlling approved demands	Acquisition department	Own developed ERP, Old ERP	10	18	4	2	8	2	With some people	Document Manage-ment	3
Controlling	Demands approved by regional leaders	Controlling approval	Controlling approved demands	Technological Directorate	New ERP system	10	15	4	3	5	3	With some people	Document Manage-ment	4
1st area	Previous year's material utilisation + new demands	1st area's demand fixing	Fixed demands for the 1st area	2nd area, Technological Directorate	Old ERP system, MS Excel	44	30	4	4	22	2	With some people	Maufactur-ing	2
2nd area	Bill of material + purchase plan	2n area's demand fixing	Fixed demands for the 2nd area	Technological Directorate	Old ERP system	13	14	4	2	22	2	With some people	Maufactur-ing	3
Technological Directorate	Production plan	Fixing the investment demands	Fixed investment demands	System	New ERP system	3	14	4	3	5	4	With some people	Plant Maintenan-ce	4
Manufacturer areas	Production plan	Manufacturable demands fixing referring for the primary demands	Fixed primary production requirements	Technological Directorate	New ERP system	5	4	4	4	5	3	With some people	Production Planning	3
System	Manufacturable demands of the fixed demands	Decomposing the manufacturable demands from PM	Decomposed manufacture demands	Technological Directorate	New ERP system	System	8	4	4	1	4	With nobody	Production Planning	4
Technological Directorate	Previously fixed demands	Simulative MRP Running for the demands fixed in PM and PP	Gross demands decomposing into secondary demands	Technological Directorate	New ERP system	1	2	4	4	1	4	With nobody	Production Planning	4

Figure 5: The suggested and extended SIPOC table (a random anonym example)

The first step in Figure 5 is the „preparation" of planning period, when the business areas get their material usage quantity left from the previous year. It is a process in which it is actually the end user who changes but quality of the used data improves. However, it is important to mention that the quality of the used data may be even more precise because of the data cleared during data migration. Data migration carries the risk of data corruption and inconsistencies in master data and transactional data. In the absence of effective control procedures the reliability of the data from which the amounts in the statements are calculated is highly questionable (Szívós & Orosz, 2014).

The second outstandingly important step is to confirm the controlling. This confirmation could be done outside of the system; in the previous system the demands were organised into excel spread sheets, and the data were structured according to their own expectations. They will have further opportunities to filter data (in the new ERP) and coordinate them.

One of the most outstanding changes can be seen after recording demands in the 1st and 2nd areas: the ways of using demands in the future and their retrieving procedure have a greater importance in the new ERP. The origin of the demands and the reasonability of their demands could and should be more precisely defined. This has to be solved because production and keeping the new regulations have been put into focus and each production item has to be followed, and planning the demands is done in four steps instead of two as the already mentioned activity has gained greater importance. In the new process/ ERP system data recording takes place not only in two big areas, but in every budget centre (that are developed by taking production into consideration). Lead time can be decreased into its half, and this decrease is in fact and data recording, based on which the system can make an automatic offer for the required items, are recorded manually. The extent of the decrease is illustrated by Figure 6.

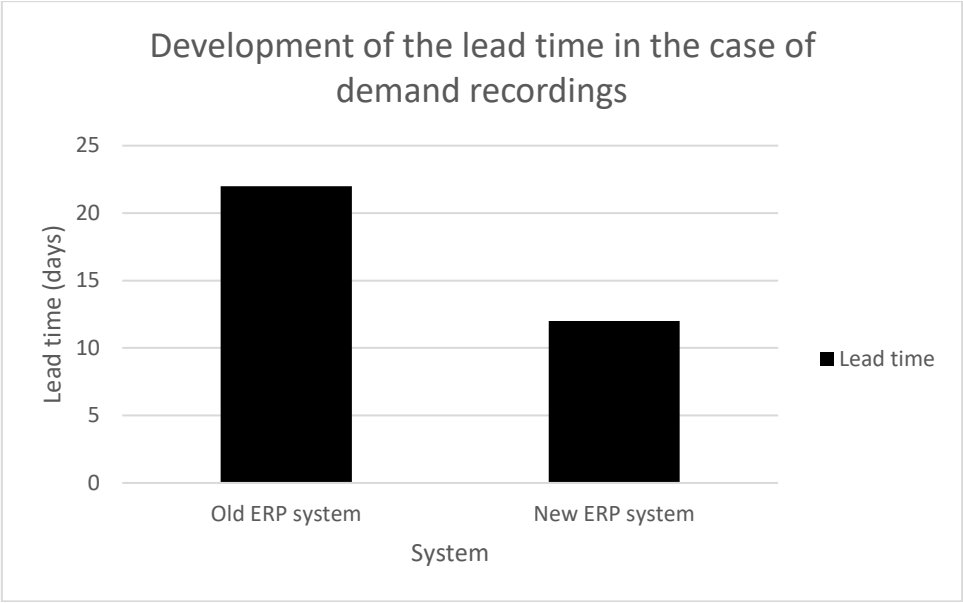

Figure 6.: Development of the lead time in case of demand recordings

The new methodology examines the quality of data more thoroughly taking the changes of quality categories into consideration. Correlation with each other in the case of the outstanding processes, the measurable quality of the produced data become more reliable and predictable (close to 4) due to the fact that system makes predictions from up-to-date data. It is easier to provide more realistic data with improved quality data, so the efficiency of the process (measured in percentage) can also improve. As a conclusion it can be stated that the new software can cover the majority of enterprise activities, the processes can be realised fast, the quality and the reliability of the provided data are closer to reality than with the old software. Being aware of all this, meeting customer demands at a higher level is a legitimate expectation. The suggested methodology offers an opportunity to make such statements.

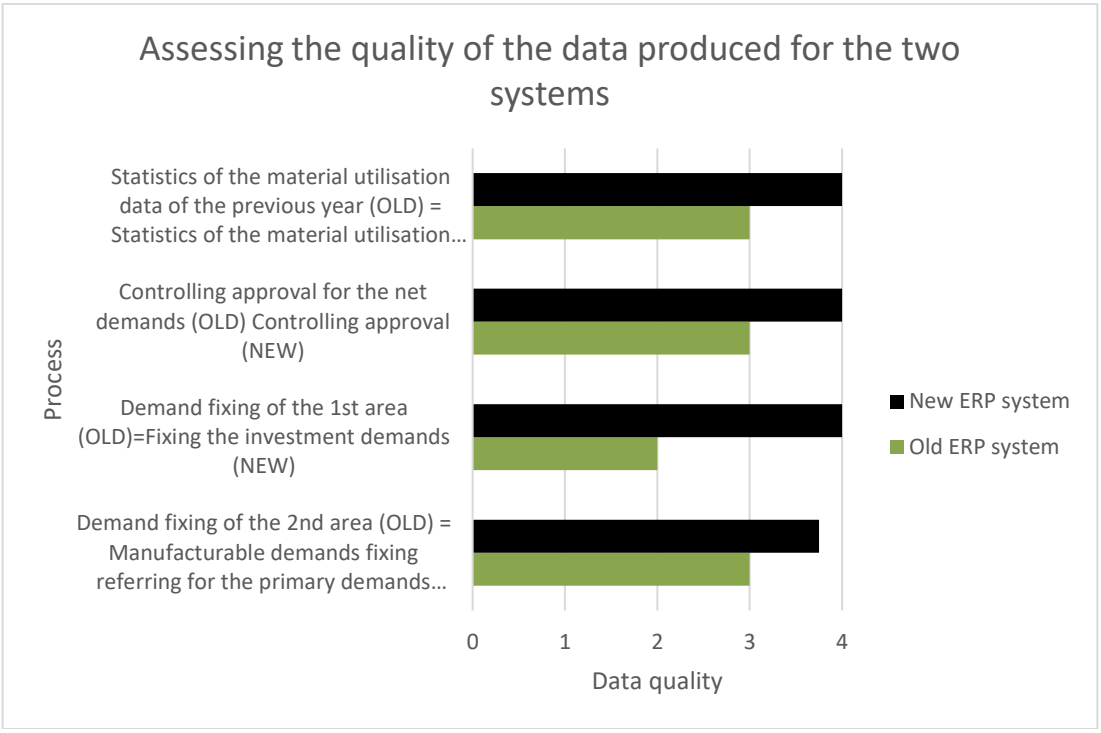

Figure 7: Assessing the quality of the data produced before and after system implementation

5.2. Comparing the new solution with the models in the literature

Gable and Infinedo models support the new method because practical experience has proven the applicability and validity of these models. However, it is important to state that not only the factor listed by them has an effect on ERP system and its usage, but the system has an effect on the listed factors as well, so they are not significantly separated.

The BSC-based approach is strongly related to the developed methods and this approach can give a good structure and further indication to develop further measuring system, on the other hand the system provides the information basis for choosing BSC indicators.

The TTF model offers a very general overview; therefore it needs a SIPOC based system – just like in the suggested sample solution – to bridge the system and the user. Moreover, the information content of the system introduced in the article, for example, is also important for the measured factors offered by task-technology fitment model.

6. CONCLUSION, RESULTS

The article introduces what obstacles may come up in an ERP change project, and where connection points can be found in these errors. The enterprise's responsibilities are to insecure emergency resources and define their available extent at the optimum level. There are several factors that cannot be foreseen, however, the most important goal of this article is to show enterprises how to do their best in several areas (regarding staff, resources, information, etc.); how to make the whole system be able to meet expectations, and the new system support the operation of that particular enterprise.

With the suggested process survey and development technique the employee's work effect on the next step and its doer, the participants' role in the process can be identified before the new system implementation. If a similar table is precisely designed on time, the employees can be prepared for the changes, and handling the number of participants, distributing and managing authorities will also be easier. Moreover this system can be used during transfer and for the correspondences of processes and concrete system functions. Finally, when the transfer is finished, this technique can be a good basis for a follow-up on the effects and efficiency of the swift, the quality of the handled and produced data, and the definition on the change of cooperation and communication in the organisation.

Of course, the suggested new method could only be applied with all the enterprise processes only with great expenditures, therefore it is advisable to apply them with those main processes that involve many participants, affect several departments and have a great role in the successful operation of the company.

The new model proves and validates Gable' and Infonedo's models, with some improvements: not only the factors mentioned by these two authors have an influence an ERP system, but this influence is reverse; it is a very significant amendment to the models. The new method introduced in the article is close to the assessment of the introduction of a BSC-based ERP; however, an important difference is that the task here is the successful management of ERP system change instead of its introduction. Moreover, the method can serve as a robust basis of calculating BSC calculators, therefore it has BSC aspects.

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