Enterprise Resource Planning Systems –Theory and Practice

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Abstract: - Enterprise resource planning has proven to be an important part of industrial business. Several enterprises are using huge amounts of money to buy consultation services for designing better business processes as well as enterprise resource planning systems to run them. Rather often these investments have proven to be successful and they have paid back themselves in a long run. However, there are also many enterprises who have got disappointed on their new complex resource planning systems as they have not been able to improve their business performance. Disappointments have even got bigger when these enterprises have seen that implementation budgets of the new systems have been overrun.

Therefore, the purpose of this paper has been to construct a new reality and understanding of the resource planning systems by using research results which have in part been presented before. Theoretical part of this paper discusses constructively about the needed concepts of the Enterprise Resource Planning (ERP). The purpose of this discussion is to construct understanding of why ERP systems exist and how they are build. After constructing understanding of the ERP systems, this paper continues on constructing understanding of the value, cost and benefit of the ERP systems generally. The purpose of this discussion is to justify all those reasons why an enterprise should implement and use ERP systems.

The practical part of this paper bases on an industrial case study. The purpose of the case study has been to discuss in the industrial context about the theoretically stated beliefs, benefits and possible problems, to see whether they exist in the real life as well. Presented industrial case discussion takes into account comparatively different kinds of industrial sectors, companies and needs. It also looks to the change resistance related problems and constructs understanding on how different industrial personnel groups see the benefits of ERP systems.

Key-Words: - Enterprise Resource Planning (ERP), Enterprise Resource Planning Systems (ERPS), value, cost, benefit, implementation, industrial experiences

1 Introduction

Nowadays, Nowadays, it seems to be normal that enterprises are investing huge sums of money to speed-up and improve their supply-chain processes. Industrial investments for information technology (IT) and Enterprise Resource Planning Systems (ERPS) have risen and not all implementations have necessarily been very successful.

However, several ERPS vendors are promising huge improvements on supply-chain processes if enterprises are taking new ERP systems into use. Smaller and smaller companies are seriously thinking about these promised benefits and they are collecting information on real ERP benefits for decision making purposes [36].

In bigger theoretical picture, the implementation of the an ERP system can be considered to be one of the most effective ways to improve traceability of business transactions, since it facilitates integration between software modules, data storing/retrieving processes and management and analysis functionalities, combined with the typical functionalities of standalone applications [26].

Earlier with un-integrated systems information sharing was clearly slower and traceability of data and information was not providing audit trail as required by accounting laws in many countries nowadays.

Even ERP systems are often improving supplychain management and they clearly offer better audit trail for accounting information the final success of ERP implementation, guaranteeing the real business value [22, 23, 24, 25] might not be realized quickly. Therefore, it seems to be

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recommendable that companies thinking about taking ERP systems into use should have patient mind.

The complexity of ERP systems and their associated high costs and implementation problems should be discussed thoroughly before the final decision making [20]. Despite the significant benefits that ERP systems can offer, they often cost millions of euros to buy, and install, and, in addition by causing significant organizational changes [34].

In ERP world some companies seem to enjoy about higher return on investment whilst others need to scale back their initiatives and accept minimum benefits, or even need decide to give up on ERP implementation [30].

The theoretical part of this paper is constructive in nature. Therefore, the purpose is to construct new reality of the value, cost and benefits of using ERP systems by using research results which have in part been presented before. To build a new reality it is, therefore, interesting to try to answer to the following questions: (about constructive method see [14, 22]).

– Can we build a new reality of the value, cost and benefits of the ERP systems and how useful it is?
– What kind of information we will find from the value, cost and benefits of the ERP systems?
– How should we use this information in the future?

Typically, as constructive research is applied research, the purpose is not to try to develop "a final product" but provide a plan, model or prototype of the value, cost and benefits of ERP systems in theoretical and industrial context. In comparison to action research it is missing the idea of cyclic development process (identify problem, plan actions, take action, evaluate and specify learning) and bases on non-cyclic development of innovation [14].

The experimental part of this paper is a case study. In this paper, a case study is an empirical inquiry that meets the following criteria: (about case study method see [35]).

– It investigates ERP phenomenon's value, cost and benefit within its' real-life context, especially when
– The boundaries between phenomenon and context are not clearly evident.

The two-dimensional research structure has been seen important to use as the theoretical benefits of using ERP systems might differ significantly from the practical industrial ones.

In this study, presented case bases on experiences collected from enterprises and smaller companies having international business activities.

Naturally, the experimental part of this study can also be considered as case because the inquiry: [35]

– Copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as a result.

2 ERP Concepts and Theory

The definition of the ERP phenomena has been developing during the last years. The rather new phenomena has been defined from several different point of views including software package, enterprise system, enterprise business-system, vendor software and enterprise application point of views.

Rosemann's definition is rather typical as he defines ERP system as customizable, standard application software which includes integrated business solutions for the core processes (e.g. production planning and control, warehouse management) and the main administrative functions (e.g., accounting, human resource management) of an enterprise [27].

Gable seems to share many aspects of his definition by defining ERP as a comprehensive package software solution seeking to integrate the complete range of a business processes and functions in order to present a holistic view of the business from a single information and IT architecture point of view [10].

Historically, the early phases of ERP systems can be tracked to the manufacturing systems in the 1960s. During those years the development focus of software was to design software specifically for manufacturing operations, which led to the existence of material requirement planning (MRP) systems. [12] Since 1975, the MRP system has been extended from a simple MRP tool to become the standard manufacturing resource planning tool (MRPII) [3].

However, as enterprises saw the weaknesses of the MRPII in managing a production facilities, orders, production plans, and inventories, and they had the need to integrate these new techniques together led the historical development into the more integrated solution called ERP [3].

Nowadays, ERP systems work essentially at integrating inventory data with financial, sales, and human resources data, allowing organizations to price their products, produce financial statements, and manage effectively their resources of people, materials, and money. The changed accounting and auditing laws with business needs to have better Customer Relationship Management (CRM) have led to the last improvements of ERP in the 1990s with the inclusion of functions such as accounting and sales management. Therefore, nowadays ERP

advocates believe that it can combine both business processes in the organization and IT into one integrated solution, which MRP and MRP II were not able to provide [3].

In recent decades, the wider use of ERP systems has perhaps been one of the most significant changes in organizational use of IT. Therefore, more and more enterprises and smaller companies have welcomed the benefits of combining business management and IT concepts and integrating existing software systems together.

Nowadays, normal ERP system offers the potential to integrate the complete range of an organization's operations in order to present a holistic view of the business functions from single information and IT architecture perspective [10].

Indeed, enterprise systems have improved the organizational data and information flow through the supply chain to such a degree that they have become an effective operating standard [5, 6].

Nowadays, potentially ERP software is also able to automate and integrate such corporate activities, as manufacturing, human resources, finance, and supply chain management by validated industrial best practices and international managerial control as a result quicker decision making and huge reduction of business operational cost.

From IT point of view the basic success of ERP system bases on architecture that builds upon several business applications using one database, and a unified interface across all users and the entire enterprise. Naturally, this leads to situation where an entire enterprise is able to operate under one application standard where all applications serving human resources, accounting, sales, manufacturing, distribution, and supply-chain management aspects are firmly integrated.

3 ERP Cost and Benefit

Implementing Implementing an ERP system in an enterprise has many fundamental consequences. Typically, ERP implementation takes from one to three years and budgets are from ten to hundreds of millions of euros. Therefore, in any enterprise there is a clear need to understand the cost, benefits and value of ERPS before taking it into use.

As well as ERP system users need to understand the cost, benefit and value of their ERP system to their businesses, as well the ERP system manufacturers need to understand how their systems are benefitting their customers, what are the production costs of their systems and what kind of value they finally get from making these systems.

Even this reasoning is very logical for all businesses Erdogmus et al. [9] see that software engineers in organizations whose very existence is dependent upon the profitability of their software find themselves poorly equipped to make technical decisions that have significant but poorly understood economic consequences." Other disciplines, such as decision theory, game theory, and economics, have highly relevant concepts and well-established ideas that have the potential to contribute to the foundations of software engineering, but the typical software engineer seldom encounters this work. By viewing the software product like ERP system as an economic artifact as opposed to a strictly technical one, they find that much of this research from other fields has the potential to contribute to concepts, tools, and methods that align with the software industry's needs [9]. Kemerer [17] shares this point of view and states that: "Computer scientists too frequently fail to cite relevant work done by business school researchers that is published in business journals.

Software costs continue to be significant, and industry's understanding of how to reduce them has improved only very slowly for example in contrast to hardware… which is improving by producing smaller products and continuously decreasing prices."

Perhaps we are moving towards more economical software engineering. If it happens as Kaufman & Higgins [16] state, we will need the next generation of researchers from business school doctoral programs to carry out this work. Koskela & Huovila [29] have defined this situation and development by stating that the conventional software engineering and manufacturing approach is based on conversion and flow views, whereas the approach is changing nowadays in favor of a value generation view. Is this happening with ERP systems as well? In their opinion the nature of these different approaches can be understood as follows:

Conversion view

- Conceptualization of Engineering: As a conversion of requirement into product design
- Main Principles: Hierarchical decomposition; control and optimization of decomposed activities
- Method and practices: Work breakdown structure, Critical path Method, Organizational responsibility chart
- Practical contribution: Taking care of what has to be done
- Suggested name for practical application of the view: Task Management

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Flow view

- Conceptualization of Engineering: As a flow of information, composed of conversion, inspection, moving and waiting
- Main Principles: Elimination of waste (non-conversion activities), time reduction
- Method and practices: Rapid reduction of uncertainty, team approach, tool integration, partnering
- Practical contribution: Taking care of that what is necessary is done as little as possible
- Suggested name for practical application of the view: Flow Management

Value Generation view

- Conceptualization of Engineering: As a process where value for the customer is created through fulfillment of his requirements
- Main Principles: Elimination of value loss (achieved value in relation to best possible value)
- Method and practices: Rigorous requirement analysis, systematized management of flow-down of requirements, optimization
- Practical contribution: Taking care of that customer requirements are met in the best possible manner
- Suggested name for practical application of the view: Value Management

According to Boehm [1] past work in the software engineering and production field has focused largely on costs, not on benefits, thus not on value added; nor linking current technical software design criteria clearly into value creation. This is rather surprising because according to Brown [2]

Value Engineering (VE) as a theory already has a forty- to fifty-year history. Dell'Isola [7] has seen the use of it to be very common in many other industries.

Perhaps the slow approval for Value Engineering and value generation view in software engineering and manufacturing has something do with the business's maturity. When companies do not see value improvement as a priority, they focus mainly on "technical design." Is this the case with ERP system manufacturers as well? Are they giving reasonable value and benefit to their customers?

To be able to understand the recent development regarding the benefits and value creation of ERP systems it is necessary to discuss about relationships between value, cost and benefit. Even though value as force is rather variable it can be measured from several points of view. According to Shillito & De Marle [29], good consumer value exists when the product needed costs little and performs well (1):

$$\text{Customer value} = \frac{\text{performance}}{\text{price}} \quad (1)$$

This formula is based on idea that each product component or function has its own specific cost, which increases product price. In practice, the cost of manufacturing these functions varies between customers, as do individual customers' needs for them. Therefore, each product function should satisfy a customer need as described in the following formula (2):

$$\text{Value} = [(n \cdot a/c)\,1 + (n \cdot a/c)\,2 + (n \cdot a/c)\,?\,]$$

where:

n = the need for an object or service
a = the ability of an object or service to satisfy this need
c = the cost of the object.

In this formula, all the functions, which should fulfill customer needs, are presented in numbers and the final function as a question mark. Crum [4] has defined customer value using four types of value concepts, which are:

- Use value: the properties that accomplish a use, work task or service. (Note that the use value of a product can be no greater than the value of the individual functions performed.)
- Esteem value: the properties, features or attractiveness that make ownership desirable.
- Exchange value: the properties or qualities of an object that make ownership desirable.
- Cost value: the sum of labor, material and overhead costs required to produce something.

Using these concepts, price can be defined as (3):

$$\text{Price} = \text{Use value} + \text{Esteem value} \quad (3)$$

and therefore, in Crum's [4] opinion, the ratio (4):

$$\frac{\text{Use value} + \text{Esteem Value}}{\text{price}} \quad (4)$$

represents a measure of the value opportunity for customer.

The value of a product to a retailer may differ significantly from the value to a customer. This is

because, for one thing, according to Shillito & De Marle [29] the retailer is primarily interested in a financial return on his investments. Retailers are interested in quick profits, and products that they can sell quickly. Furthermore, retailers want to achieve maximum income with minimum investment. Therefore the value formula for a retailer differs from the value formula for a customer. A retailer's value formula shows that instead of calculating a cost-benefit ratio, retailers estimate the sales revenues they would expect to receive from selling their products. Retail product value is calculated using the formula of Shillito & De Marle [29] as follows: (5)

Retail value = unit sales (unit price – unit cost) (5)

The manufacturer of a product for a retailer or a customer also uses his own formula for value calculation. This is because his interest is slightly different than the others' interests. Compared to a retailer he has higher capital costs, related to the manufacturing plant and tools. This also forces manufacturers to keep manufacturing going on most of the time. Because the manufacturer is also interested in the return he will get on his money.

Shillito & De Marle [29] see that formula for determining manufacturing value is the following (6):

Manufacturing value =

$$\frac{[\text{Customer and retailer benefits (1 to n) }] + \text{profit}}{\text{Costs}} \quad (6)$$

Crum [4] has defined manufacturer value using four types of value concepts (use value, esteem value, exchange value and cost value), as follows (7):

Cost value = Use value + esteem value (7)

and therefore in his opinion the ratio (8):

$$\frac{\text{use value + esteem value}}{\text{cost value}} \quad (8)$$

represents a measure of the profit opportunity for the manufacturer.

Operationally ERP systems as products are aiming to be beneficial for customers because they can speed up decision-making, reduce costs and give managers international control over distributed business operations [11, 13]. ERP systems also offer a better customer service and market analysis. Using an ERP system an enterprise can also simulate better all business decisions and their impact to the markets and their customers.

Technologically ERP systems are able to harmonize and standardize disparate systems. They improve quality and visibility of information, integrate business processes and systems together and simplify existing technological infrastructure by replacing older, obsolete systems, and systems which are not able to provide 24 hours service seven days a week.

The basic architecture of an ERP system builds upon one database, one application, and a unified interface across the entire enterprise. An entire organization is therefore able to operate under one application standard where all applications serving human resources, accounting, sales, manufacturing, distribution, and supply-chain management aspects are firmly integrated.

As ERP systems offer clear operational and technological benefit and value it is quite natural that their implementation should be done in a best possible way to offer a maximum value-added [22, 23, 24, 25] and best possible return on investment to the company manufacturing them and using them.

According to Kalling the real benefits of ERP systems to their users come from the changes in the organizational activities that it gives [15]. Mabert et al. see that ERP systems improve performance by quickening response time, increasing interaction across the enterprise, improving order management, customer interaction, on-time delivery, supplier interaction and cash management [21]. In addition they see that ERP system lowers inventory levels and reduces direct operating costs. Stratman and Rothe notify that if an enterprise's ERP competency is used efficiently it increases competitive advantage [31]. Vemuri and Shailendra seem to share this understanding and they have developed a set of measurement formulas and models for measuring ERP competencies [33].

However, ERP benefits do not come only from the changes in the organizational activities and improved measurable performance. Shang and Seddon seem to state that ERP benefits are wider including five groups as: IT infrastructure, operational, managerial, strategic and organizational benefits [28]. Su and Yuang [32] share their understanding of five wider ERP benefit groups and they support the measurement framework developed by Shang and Seddon [28] for these five constructs using 32 different measures.

Generally one major benefit of ERP product seems to come from its enabling role in reengineering the company's existing way of doing

business. Therefore when implementing an ERP system all the processes in a company must conform to the ERP model provided. Therefore all organizations that do not adopt this philosophy are likely to face major difficulties [11]. This entails that the costs of aligning with an ERP model could be very high, especially when a company plans to implement the system worldwide.

The justification of ERP benefits seem to base on long rather long consensus as also according to the Deloitte & Touche ERP benefits refer to inventory reduction, reduction of personnel, increased productivity, improvements in order management, more rapid closing of financial cycles, reduction in IT and procurement costs, improvement of cash flow management, increase of revenue and profits, reduction in transportation and logistics costs, reduction in the need for system maintenance, and improvement in on-time delivery performance. [8]

One major benefit of ERP comes from its enabling role in reengineering the company's existing way of doing business. All the processes in a company must conform to the ERP model.

Organizations that do not adopt this philosophy are likely to face major difficulties [11]. This entails that the costs of aligning with an ERP model could be very high, especially when a company plans to roll out the system worldwide. However, ERP implementation results in significant benefits engendered from the integrated nature of the system as well as from reengineering business processes and the change in business culture.

However, even the benefits of taking ERP systems into use seem to be inevitable, according to the Deloitte & Touche these benefits seem to realize later after eight months use [5]. Koch et al. define this benefit in monetary terms explaining it to be in median annual savings of $1.6 million [18].

As the ERP software systems can cost from hundreds of thousands of dollars to several millions of dollars having long and heavy impact to the corporate business making, implementation decision should be thought carefully. According to the Gartner Group this seems to happen as companies may spend three times more money on consultants as they do on the ERP software system itself [1].

Naturally, software system and consultant cost are not the only cost of ERP implementation. Depending of the situation enterprise might need to increase human resources needed to work full time on the implementation project and it is also possible that the new software requires new hardware to run it. Naturally, as it might not be possible to renew all software systems at the same time enterprise might need to consider building temporary integration software to be able to use some old systems. In summary, every company that implements an ERP system is highly faced with the cost and complexity.

Therefore, end-user training and change management play a crucial role in every successful implementation. In Davenport's opinion the disastrous problems are usually those which relate to implementing an ERP system without thinking through its full business implications [4].

4 Industrial Benefits of Using ERP Systems: a Comparative Case Study

Several enterprises are using ERP systems and even more enterprises are thinking to take them into use. From theoretical and practical point of view it seems that ERP systems are able to help enterprises in many ways even their implementation can be troublesome, complex and long lasting process.

Therefore the purpose of this case study has been to collect deeper understanding of the industrial ERP implementation during the last years. For this purpose during the years 2011 and 2012 15 enterprises using ERP systems from different industrial sectors were interviewed and compared to each other. Interviewed personnel from each enterprise represented technical, business, production and management employees. All enterprises had thousands of international customers and several offices in different countries.

Case study method was selected for the research method in this part as it was seen to give deep qualitative understanding of the ERP phenomena with complex and wide consequences and often significant organizational change resistance. The interviewed possible benefits being discussed in the industrial context were formulated based on the theoretical discussion presented earlier in this paper.

Therefore discussed possible benefits included:

– Organizational benefits which were seen to be the result of the ERP system user's ability to provide better information and support for business learning and building of organizational visions and strategies,

– Operational benefits which were seen to be outcome of the ERP system user's better ability to provide real-time data, monitoring and control over different business operations including production, resources, inventories, financial situation, customers, and geographic businesses,

– Managerial benefits which were seen to be result of the ERP system user's deeper and better customer understanding, daily and long-term decision making, business process management

as well as ability to guarantee on-time product deliveries to the markets,
– Information technology (IT) and infrastructure benefits which were seen to be outcome of the ERP system user's and administrator's better ability to have more efficient, capable and maintainable integrated IT systems with better business support and cost reduction abilities.

Generally, all ERP business users, technical administrators and top-level managers from all enterprises saw that ERP systems are a necessity for them. Business users told that accounting legislation has been one of the biggest drivers to influence to their opinions. They had been following from public media several business crimes which would have been avoided by using integrated ERP systems instead of un-integrated standalone legacy systems.

The necessity of clear audit trail for all business transactions from the beginning to the end was highly required and ERP systems were seen to guarantee this clearly better than un-integrated systems. Business users also notified that as markets are changing nowadays extremely quickly and business systems need to be quicker for providing information of them. Integrated ERP systems were seen clearly a necessity for providing this information. Therefore, interviewed business users did not want to go back to the situation where data was moved and updated "once a month" between different un-integrated software systems using "transfer files."

Generally, technical ERP administrators shared jointly the idea of ERP systems ability to offer benefits with more capable, efficient and easier to maintain features compared to un-integrated systems. ERP administrators also saw that when system is better integrated and it bases on "de facto technical standards" it offers to them an ability to support better decision making instead of using their time to keep different systems up and running.

Focusing on de facto core technologies was also helping system administration from personnel point of view as it was easier to find people to replace each other if needed.

Generally, top-level managers shared the management benefits of ERP systems. They highlighted that as enterprises are growing to be bigger and bigger having more and more activities all around the world it would not be possible to have enough accurate information from the different market situations without ERP systems and their help. In their opinion ERP systems were clearly helping in daily decision making, controlling and long term strategy planning. In their opinion ERP systems were helping on telling "what is going on?"

Even all enterprises and different users shared generally many benefits of the ERP systems some differences existed as well. Manufacturing enterprises stated that for them the biggest benefits of the ERP systems are coming from the material purchases and manufacturing control which enable small storage needs and just on time (JOT) manufacturing. Financing companies saw that their biggest benefits are coming from the ERP systems ability to control and follow real-time markets of financial instruments and formulate new investment products for investors using this information.

Retailers notified that for them the ability to control which products were selling the most, when and to whom, is extremely useful. They also told that ERP systems together with "regular customer cards" form for them a useful tool to analyze customer buying behavior which enables a better ability to plan what kinds of products are bought to the shops for the customers. As discussed ERP systems are offering several different kinds of benefits to the enterprises.

However, all enterprises also told that they are extremely difficult to take into use and ERP implementation budgets are often overrun which challenges their ability to create value to their users. All enterprises stated that if an enterprise is thinking to buy and take ERP system into use they should first analyze their business processes extremely well. According to their opinion the better enterprise is able to define how its business process is producing profit as well as value [22, 23] to its customers the easier it is to take ERP systems into use efficiently. The worse enterprise is able to define these needs the bigger is the likelihood that implementation project faces several difficult problems and ERP system is perhaps not taken into use due to the organizational change resistance.

Even the use of ERP consultants was highly recommended by most of the enterprises it opened up a many sided discussion. Many enterprises saw that it would be better to work more with ERP vendor rather than use consultants who do not know how the specific ERP system is working. Other enterprises told that when there is a need to develop something really different compared to the old business processes it is useful to have a wider opinion rather than base definition work of new system only for limited amount of own opinions.

They notified that consultants have a lot of experience from different kinds of industrial sectors and ERP systems. This was thought to be very useful especially if an enterprise did not know

where to start the project, which vendor to select and how to define the new competitive business process for a basis of the ERP system.

All enterprises shared the idea that sometimes external eyes are needed to say that something is wrong and should be done in a different way in the future. Top-level managers told that for them these "external eyes" are important because they offer new possibilities and show where other companies are going and what they are doing. They continued that these new ideas are often extremely valuable and the sooner they are evaluated the bigger benefits enterprise will get by implementing them. It seemed that especially top-management in every enterprise highlighted the importance of the ability to benchmark opinions with a third party.

Business users of the ERP systems told that sometimes opinions of the top-management bother them as they feel that external consultants are heard more than them in decision making. Business users of the ERP systems told that they have a lot of "silent information" on how things should be done which would be extremely useful for the top-management if they would only be listened. They continued that perhaps if top-management is not having a strong self-consciousness, they perhaps rather ask for the consultant's opinion than listen their own organization. Few top-managers stated that this is not the case. In their opinion decision maker needs to think several different aspects of the problem before making the decision. Therefore, in their opinion good consultants were offering to them a good benchmark of the industrial situation and using this information they were neutrally able to justify the direction where enterprise was planning to continue. So it seemed that using consultants was a necessity for the top-management but listening business users should not be neglected either.

Technical administrators did not seem to be as sensitive for the using of the consultants as the business users. They stated that their role is perhaps more "specialized" than the business user's role. Therefore, the top-management had learned to listen them more related to IT decision making.

Topmanagers shared this opinion and they told that it is usually easier to work with IT personnel as they are welcoming easily new technologies rather than slowing down the development.

All together it seemed that for top-level management using consultants was important part of the decision making. For business users it was potentially a threat if they were not listened well enough by the top-level management as well.

Technical administrators were neutral and they seemed to welcome both the consultants as well as new technologies.

Even using the consultants in helping the decision making was opening up an interesting discussion it did not seem to dramatically change the attitudes of the employees. They all saw that finally it is their own responsibility to make the decision whether to buy or not to buy the ERP system. All enterprises shared the opinion that the better the personnel is involved in the first discussions of buying the ERP system the more motivated they are in participating to the implementation of it as well.

The discussion of consultants already showed that it is extremely important that ERP system projects are managed very well. All enterprises shared the idea that ERP vendor has a crucial role at this work. Enterprises were expecting them to be able to "go beyond" the normal functionalities of the ERP system. They were expecting that ERP vendors are able not only to explain how system works but are also able to apply it to the customer's business situation and understand existing change resistance.

All enterprises also shared the idea that the better ERP vendor is and the better it knows the business sector in question, the better performance and value [22, 23] the ERP system is giving to them as customers.

Timing of the ERP implementation project was not seen to be perfect in any of the enterprises. Therefore, a normative consensus or general agreement emerged across all enterprises that implementation timing was always unsatisfactory. Newer employees with less administrative experience showed greatest acceptance for the new ERP system and timing of its implementation.

Newer employees with more administrative experience were the second personnel group to accept the new ERP system. The slowest acceptances the new ERP system got from the older employees with longest administrative experience in the enterprise. This was perhaps happening because the newest employees did not have so much experience of similar management initiatives and big IT projects. So they had not formed negative attitudes about similar projects and their ability to increase business value and process performance.

Earlier it was notified that the top-management was seeing more benefit and value in using ERP systems than other personnel groups. Similar conclusion was also made when the lower-level managers were compared to the production workers.

They also saw that ERP systems were giving better controlling ability and business process performance than old un-integrated systems which

was not necessarily understood by production workers.

Finally, this was not surprising, since lower-level managers (as well as top-managers) are likely to be more familiar with the information systems and their capability to improve business making. When production workers were asked about their opinions they told that they were the personnel group whose opinions were asked the least when decision of the ERP system purchase was made. Finally, overselling the benefits using external consultant's opinions had just increased their negative attitudes.

Lower-level managers and technical administrators were in the same level in seeing the benefits and value of the new ERP systems.

Generally, they saw the new ERP system as both inevitable and likely to enhance their control over the business operations. Technical administrators saw their work getting easier when integration between IT-systems increased and their personal ability to control them increased as well.

In summary, all enterprises that participated to this case study saw that potentially ERP systems are able to give organizational, operational, managerial as well as Information Technology (IT) and infrastructure related benefits and value to the enterprises. These benefits were seen to be different to different industrial sectors as their main usage was often concentrating on different ERP software modules. Therefore, interviewed enterprises highlighted the importance of selecting appropriate ERP systems for each situation in question.

Enterprises also saw that small enterprises should favor ERP systems which are not too complex to take into use but are easy to update if enterprise grows bigger.

The discussion of the top-management's interests to use consultants for ERP purchase decision making opened up an interesting discussion were top-management justified their need to have wide amount of information for decision making.

Together both top-management and lower-level management justified their need to be able to control business better and to be able to estimate future business needs as well as possible. Technical administrators saw the biggest benefits and value of the ERP systems to come from the integrated system architecture. It enabled easier to maintain system environment with better ability to control and support all users globally. IT managers told that ERP systems with "standardized de facto technologies" are easier to control from IT –risk point of view than old un-integrated systems.

All enterprises saw that ERP system budgets are easily overrun, which challenges the value creation targets of using them. The ERP software license cost was easy to estimate as well the hardware cost. Enterprises also saw that the training cost was usually not overrun. The biggest budget problems were caused by the definition and planning work. In many cases enterprises were not able to see the full amount of work needed for defining the way how they want to use their ERP system. In their opinion too often they started ERP implementation without thinking deeply enough what they expect to get from it. Therefore, definition days got longer and they also needed more of them.

According to the interviewed enterprises ERP system vendors had highlighted for them the importance of defining the business processes before starting implementation work but this need had not been understood deeply enough. When enterprises were asked how long they saw that it took to see the benefits of ERP systems in practice, the answers varied from 9 months to 12 months.

When they were asked how long they calculated it to take when their ERP systems had paid back themselves, the answers varied from 1.8 to 4 years.

5 Conclusion

The problem of this paper was to examine the cost, value and benefits of using Enterprise Resource Planning (ERP) systems. To do so, firstly, this paper discussed about the concepts and theory of ERP systems. This was done because ERP systems are often understood to be complex and difficult to understand. Based on defining ERP systems the discussion continued on examining the value, cost and benefit of implementing and using them in the industry.

Due to the constructive nature of the theoretic discussion the purpose was to construct new reality of the benefits of using ERP systems by using research results which had in part been presented before. Therefore, it was interesting to try to answer especially to the following questions:

– Can we build a new reality of the value, cost and benefits of the ERP systems and how useful it is?
– What kind of information we will find from the value, cost and benefits of the ERP systems?
– How should we use this information in the future?

The research results show that ERP systems are giving many different kinds of benefits to their users. One possible way to classify these benefits was in theoretical discussion understood to contain

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organizational, operational, managerial, information technology and infrastructure related benefits.

Theoretically, all these benefits were seen to be results of ERP systems ability to provide a better real-time data and information, which enabled cost savings and better control of business operations. In addition, it also enabled better decision making as well as strategy building. From technical point of view simplified technical ERP architectures and harmonized "de facto technical standards" offered more capable, efficient, business supporting and cost saving Information Technology (IT) solutions.

The results of the comparative industrial case study show that the theoretically developed understanding of the ERP system's implementation cost, value and benefits were realizing in the industrial life as well. Generally, all interviewed enterprises saw ERP systems giving theoretically defined benefits for them. However, industrial differences on benefits rose when discussing which application modules of the ERP systems were giving these benefits to each enterprise in question.

Enterprises saw that different employee groups see the ERP benefits and value differently. The managers saw the biggest benefits and value in the ERP systems. In their opinion ERP systems gave them clearly a better possibility to control, manage and estimate the international business and know "what is going on?" Technical administrators saw

ERP system benefits and value as second big because they understood that it can simplify the amount of used technologies as well as improve the system and user control. The most negative employee groups towards the ERP systems were the business users and production users. Their skepticism was rather often caused by the bad motivation which in their opinion was caused because their opinions were not heard so much and often decisions were not explained for them either.

Research results are confirming the needs of using ERP systems. If an enterprise is able to define its business processes very well, possibly use consultants and communicate very well with all employees, it seems that the change resistance is smaller, implementation easier and benefits bigger.

The most significant weakness of this study is perhaps related to the big amount of different industrial sectors and ERP systems which were included in it. ERP systems seem to be highly specific in many industrial sectors and constructing a deeper understanding of their benefits would mean a necessity to analyze each sector and ERP system separately.

However, it was encouraging to see that there were many topics were enterprises using different ERP systems from different industrial sectors were sharing their opinions so easily.

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