

# The Influence of Legislative Changes on the Maintenance of Generic and Parameterized ERP Software

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**Abstract** – Software maintenance, in regard to the consumption of time and financial resources, is an extremely important phase in its life cycle. This paper explores the problem of the influence of legislative changes on the scope of maintaining a financial module of an ERP information system. The research envelopes the analysis of legislative changes in a Central European country through a period of almost three years. A software company spends time on ERP system maintenance as a result of these changes, and this time is monitored. The purpose of this research is to evaluate and predict resources needed to cover ERP software maintenance and implementation of changes based on legislative changes.

**Keywords** – Software Maintenance, ERP, SaaS, Legislative Changes, Software Development.

## I. INTRODUCTION

The finalization of software development project does not mean that work ends there for software engineers. The deployed software needs to be maintained and upgraded in order to serve the user needs over time. A special challenge for software engineers are ERP systems. An Enterprise Resource Planning (ERP) system is a complex software applications pack used in the management of a wide range of processes that run in a company" [1]. According to IDC (International Data Corporation), ERP application software support needs to have at least three out of the four following segments of business [2]:

- Accounting
- Manufacturing
- Material management/distribution
- HR management, payroll.

Manufacturers differently define the composition and structure of ERP software programming modules, both in presentation as well as in the functionality schedule. In general, we can say that ERP software, for the needs of an organization which is in the business of manufacturing, can be divided into functionality groups [3]:

- Business Analyzing
- Product Planning
- Supply Chain Management (SCM)
- Inventory Management
- Supplier Interaction
- Sales Automation
- Financial Account Managing

Software maintenance involves changing software after delivery due to errors, performance improvements,

improvements of other attributes, or adjustment of software to changes in the environment [4].

According to Lientz and Swanson [5], there are four types of maintenance: preventive (updating documentation, adding comments to the code, writing additional software used to prevent errors), corrective (removing errors), adaptive (adapting existing software to the better hardware, new operating system, new database) and perfective (functional software enhancement). Their research concluded that adaptive and perfective maintenance comprises about 75% of work in maintenance, while error correction comprises about 21% of work in software maintenance. If we observe all types of maintenance then we get the following information: corrective maintenance accounts for more than 20% of the time, adaptive maintenance takes a little less than 25% of the time, while the perfective maintenance takes over 50% of the time, and only 5% of the time goes to preventive maintenance. This research was conducted on 487 companies that have systems for data processing [5]. The same research was repeated by Nosek and Palvia 10 years later with almost the same results [6]. A similar research was conducted on generic ERP systems. In summary, this study shows that maintenance of ERP software has both similarities and differences compared to maintenance of traditional systems. Similarities were found in trends in perfective maintenance, preventive maintenance, and user support. The main differences are noticed in new activities unique to ERP systems that were grouped into a new category "external parties", and the relation that the new category has with other maintenance categories [7].

It is evident that the majority of time in maintenance is spent on adaptive and perfective maintenance. As said, there are various reasons that cause changes of software, i.e. adaptive and perfective maintenance. One part of the source of requirements for adaptive and perfective maintenance is caused by a change in business environment, namely the change of legislation in the mother country.

The legislator regularly introduces various changes in the state laws; some of them have an impact on the functionalities of ERP systems: as a result, functionalities of an ERP system have to be changed, added or moved. Considering this fact, the problem for a software company during maintenance of ERP systems is planning of sufficient resources in order to adapt existing functionalities to legislative changes, because even if there are no other changes, legislative changes need to be built into ERP systems or an ERP system becomes unusable for users regardless of the richness of other functionalities.

In addition, some of the manufacturers / vendors of ERP systems include legislative changes in the price of the monthly fee. For them, legislative changes, i.e. maintenance costs required by these changes, can significantly affect the profitability of sales / product and should be taken into account in the calculation of monthly flat rate price, together with all other fixed costs such as overhead expenses, data center costs, etc.

Specific research questions that arise from these facts are:

(i) What is the average monthly amount of resources needed for the maintenance of an ERP system so that its functionalities comply with legislation of the country for which it is customized?

(ii) What is the minimum average monthly cost of programming work that has to be taken into account in the calculation of the price of maintenance that covers legislative changes?

What is the percentage of time that is spent on adaptive and perfective maintenance of an ERP system under the influence of legislative changes in relation to the total time spend on ERP system maintenance?

## II. RESEARCH METHODOLOGY

This study was conducted on the ERP system FAROS which was built using the MIRIS methodology [8] and is being produced as a commercial software since 2009. The system is delivered to the users as SaaS (Software as a Service). The application and the database are located in an ISO 27000-certified data center. The application is accessible from various client devices through a thin client interface [9]. The application is maintained centrally, so the research will not take into account the time needed to deploy versions on the user's location. Modules of the observed ERP system are: Finance, Accounting, Commercial Operations, Warehouse Operations, Fixed Assets, HR and Payroll, Lease Management, POS, Travel Order Management, Billing System, Business Reporting, Document Management.

To support the process of maintenance management, a software tool ESTIMUS is used. It contains all change requests and programming orders for maintenance and work performed based on the orders.

Legislative changes in the Republic of Croatia whose date of application was between January 1<sup>st</sup>, 2012 and September 1<sup>st</sup>, 2014 were observed, i.e. the criterion was not the date of the legislative change but the date of the actual application of the legislative change. There are 265 maintenance activities registered in total due to legislative changes in the observed period. The subject of this research are modules Finance and Accounting and legislative changes that directly and significantly influence those modules. However, when implementing changes in these modules during maintenance it is sometimes necessary to correct other modules as well, such as Fixed Assets, HR and Payroll or Travel Order Management. In the analysis of the total time spent on maintenance due to legislative changes, this research took into account the time spent on correction of other modules that needed to

be adjusted. In addition, the research also considered changes in the payment transactions that were not enacted by the legislator but by the CBA (Croatian Banking Association) and that refer to the exchange of payment orders. Such modifications can be considered as legislative changes since they are initiated by a changing business environment on which the ERP system user has no effect. The research did not take into account all legislative changes, but only those that required adaptive and perfective maintenance.

Like most modern commercial ERP systems, the observed ERP belongs to a group of generic software products that are not custom-made. They consist of a part which is called core and is built with maximum parameterization. Parameterization is the process of modeling in which meta-models are created for variable components so that changes do not result in the modification of programming code and/or organization of database [8]. For example, to record a business event in Accounting, the posting date of the business event must be entered into the ledger and that date can have a default value in order to speed up performance. To set up the default value for the posting date, the parameter Posting Date is defined. Depending on the settings of this parameter, the user can choose one of three possible default values for the posting date, and these are: posting order date, date of the document to be posted, or free entry. Changes in the software that are resolved exclusively by adjusting parameters in the user interface were not observed in the research. Due to the methodological approach in the construction of the ERP using MIRIS methodology and modeling data by using prescribed methods, one part of the changes caused by legal regulations can be easily implemented only by updating the specific meta-tables or lists of values. Such changes will also be excluded from the analysis because they require a negligible amount of time (less than one hour to update data).

Given the fact that the maintenance work on the observed ERP system is a team task, apart from the synchronization of tasks that need to be performed, a development environment that meets the team's needs has to be provided through synchronization of software versions. Support to team work on the project was given by the tool Builder [10]. During the analysis of employees' work engagement, the following types of work were taken into account: Analysis (including design) and Programming (including testing). The time spent is grouped by type of work that employees perform and by workplace or professional rank of employees (Programmer/Designer, Programmer, Programmer/Trainee, ERP Consultant, ERP Consultant/Trainee).

A Programmer/Trainee is an employee who has less than three years of experience in programming business applications. A Programmer is an employee who has more than three years of experience in programming business applications, but is not a certified designer of IS. A Programmer/Designer is a programmer who has over 5 years of experience as a developer of business applications

and is a certified designer of information systems in some of the methodologies. An ERP Consultant/Trainee is an employee who has up to 6 years of experience as an ERP consultant. Such a way of grouping data on the time spent was chosen because the differences in the time required for completing programming tasks can be accounted to programming experience and knowledge. For example, a more experienced and better programmer can complete work several times faster than the less experienced one. The time used for the preparation and delivery of a new production-release version will not be observed, given that a new version that is prepared and delivered typically includes numerous other changes apart from legislative changes

### III. RESEARCH RESULTS AND DISCUSSION

Data that was extracted in the context of Section 2 Research methodology served as the basis for analysis and conclusions. The obtained data on changes in software which had to be implemented due to legislative changes is grouped by the year of application of a legislative change. This view provides visibility into the dynamics of changes. Fig. 1 shows the total time by year that employees in maintenance spent on adaptive and perfective maintenance caused by legal changes. 51% of the time for the observed period is spent on changes that have been in effect from January 1<sup>st</sup>, 2013 to December 31<sup>st</sup>, 2013. Significantly less time was spent on changes whose date of applications was in 2012. 37% of time was spent on software changes that were caused by legislative changes with the date of application in the first three quarters of 2014.

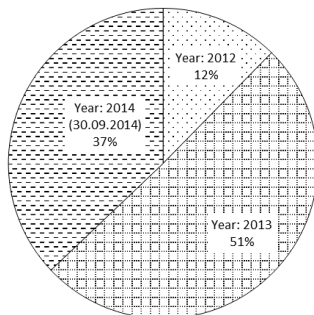


Fig.1. Total time spent on adaptive and perfective maintenance of ERP system caused by legislative changes in m/h

The total time spent on adaptive and perfective maintenance of an ERP system under the influence of legislative changes in the observed period (from January 1<sup>st</sup>, 2012 to September 30<sup>th</sup>, 2014) amounts to 712 man/hour, which is approximately 13% of all time spent on maintenance in that period (Fig. 2).

If we divide the number of hours with the number of working days in the observed period (687 working days), we can conclude that an average of 1.04 man/hour was spent daily on adaptive and perfective maintenance that were caused by legislative changes (Fig.3).

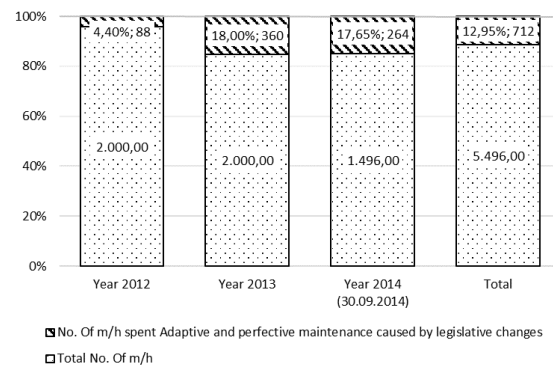


Fig.2. Percentage of total time per year spent on adaptive and perfective maintenance of ERP system caused by legislative changes in m/h

### IV. CONCLUSION

The research has shown that in the observed period an average of 1.04 man / hours per day or 22.88 man / hours per month needed to be spent on legislative changes, which is certainly not a negligible amount.

According to the results of the analysis, approximately 13% of time in the maintenance was spent on legislative changes.

If this time spent is converted into EUR, it reaches the amount of €20-€30 per day or €400-€600 per month. This is certainly a cost that should be kept in mind when negotiating the use and maintenance of ERP systems, so this finding is important for a software company which provides the service of maintaining an ERP system.

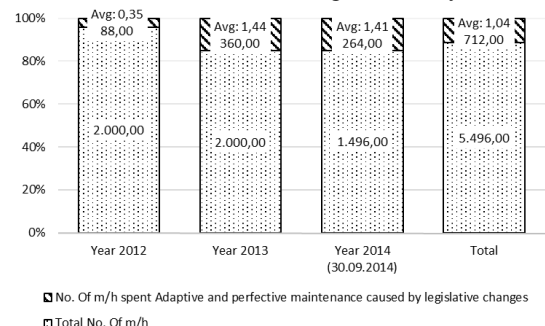


Fig.3. Average time per day spent on adaptive and perfective maintenance of ERP system caused by legislative changes in m/h

The results showed that the needs for resources in maintenance are not always the same; there were years (as in 2013) when the legislative changes had a greater impact on changes in the software. However, according to previous experience, when a legislative change occurs that has an impact on the ERP system in maintenance, these changes need to be carried out within a short period of time and without delaying the date of application. It is therefore necessary to plan sufficient human resources to be able to implement the required changes in a given period. This problem requires a significant commitment of management and rational planning of the monthly fee for the use of ERP system.

Certain limitations should be noted when considering these findings. One of the limitations arises from the fact that the research was performed on a single ERP software with a certain degree of parameterization. Depending on the degree of parameterization some changes can be performed in a shorter or longer period of time and for some changes no programming work is required. This research was performed on software under Croatian legislation and cannot be generalized to other countries of Central Europe. In addition, more precise results could be obtained by observing changes in country legislation in a period longer than 3 years.

Our further research will be extended to a longer time period and it will include other Central European countries that are members of the European Union. Moreover, further research will include another similar ERP system that is distributed as SaaS. This new proposed research will provide conclusions that will be more generally applicable.

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