An Approach to Business Improvement by the Development of an Information System

Zoran Nešić*, Nebojša Denić **, Jasmina Vesić Vasović*, Miroslav Radojičić*

* University of Kragujevac, Faculty of Technical Sciences, Čačak, Serbia

** Faculty of Information Technology, Belgrade, Serbia

zoran.nesic@ftn.kg.ac.rs, denicnebojsa@gmail.com, jasmina.vesic@ftn.kg.ac.rs, miroslav.radojicic@ftn.kg.ac.rs

Abstract — **This paper presents a methodological approach to the development of intelligent decision support systems in small and medium enterprises which respond to the requirements of modern management businesses via sophisticated information technology tools. The analysis has been performed with the purpose of introducing business intelligent systems into Serbian small and medium enterprises dealing with the sale of products and the provision of after-sales services. A segment of the system development has been presented on the specific example through the process of database creation.**

I. INTRODUCTION

It is increasingly necessary for managers of Serbian enterprises to be provided with information for conducting their activities of business decision-making in order to successfully and efficiently achieve organizational goals through the process of planning, organizing, leading and controlling the resources which are available for the organization [1]. It is obvious that small and medium-sized enterprises in Serbia will be faced with business changes in the business environment and such conditions that, in an increasingly competitive global business environment, often lead to changes and different needs for information for the business decision making process in companies [2]. Known authors have defined the functions of the high quality of the decision-making process in small and medium-sized enterprises in this direction. Mador (2002, p.4) primarily focuses on the importance of the rationality, scope and speed of decision making [3]. Filinov (2003, p.3) [4] indicates that solving the problem of decision making in a company depends on the type of management, the type and structure of the problem and the types of choices as to why certain decisions are made. The project development of intelligent business systems in small and medium-sized enterprises can be defined as the union of a sequence of complex and interrelated activities which have their goal or purpose. It must be carried out within a specified period, with a limited budget and must be in accordance with predetermined specifications [5]. The project is a temporary venture; therefore, in order to create a unique product, service or result, each project has its defined beginning and end. Wysocki & McGary, (2003 p.7-9) [5] argue that a project is determined by five parameters, i.e. the width, the quality, the price, the time and resources (human, financial, etc.). An investment is an important part and the right way to have a project implemented so as to introduce and implement business intelligence in small and medium-sized enterprises. In the context of the introduction of business intelligence, there are two different approaches that are commonly used. The first is the incremental or linear approach, in which approach each phase of the project is monitored. When the phase of the project is complete, the next phase is started. So, different phases of bringing a project to an end are monitored. The main drawback of this approach is its long duration, so users only receive the final solution, which means that errors and deficiencies are only discovered at the end, when the elimination of negative factors is complex and usually costly [6]. Such an approach is difficult. At the beginning of the project, future users of business intelligence should be well-defined. It is particularly suitable when an external contractor introduces an intelligent business system in accordance with specific requirements and specifications [7]. Many authors (Atre and Moss, 2003 [8]; Adelman and Mos, 2007 [9]; Howson, 2008 [7]) recommend the iterative approach to developing business intelligence in small and medium-sized enterprises as it is a much more flexible one (Sabherval & Becerra - Fernandez, 2010, p. 230-231) [6].

Small and medium enterprises opt for the most appropriate approach supported by a variety of factors, such as the size and complexity of the system, the resource availability and the like. A decision to apply the most appropriate approach is encouraged by various factors, such as the size and complexity of the system, resource availability etc. Apart from that, smaller companies usually have small budgets allocated for information technologies. In their practice of introducing business intelligence, small and medium-sized enterprises have often chosen a middle path, combining the features of both approaches [6]. The introduction and implementation of intelligent business systems include development tools and techniques for collecting, storing and accessing data for decision making at various levels of the company. Such sophisticated solutions are often costly, complex and long-term projects that require significant volume sources [10]. In this context, traditional approaches focus on the technical aspects and elements, while newer ones put an emphasis on the business impact [11].

The reason for the introduction of business intelligence into small and medium-sized start-ups is the business value, where such an introduction will be beneficial for the company. In the economic context, the commercial value of the investment is expressed as the net present value of cash flow after the deduction of tax per individual investment [11]. Also, Williams and Williams (2006, p. 12) [11] believe that we should take an attitude in spite of numerous business benefits business intelligence brings, that not every type of the business value of investment in

business intelligence can be assigned, while an advantage does not result in an increase in cash flow after tax deduction. Business intelligence is an area where traditional business-value-assessing techniques, particularly financial criteria, are not conducted well since many business advantages business intelligence brings are of a strategic type, for which very reason they are also difficult to measure [12]. There is a high probability that business benefits at a strategic level are the most important effects of the acquisition business intelligence brings [13].

II. DEVELOPMENT OF AN INFORMATION SYSTEM FOR SALES AND AFTER-SALES MONITORING

Further in this paper, the development of decision-making supporting information systems in small businesses in Serbia is presented, with the task to show the original and innovative process of creating the database of the company "Simonida"-Gračanica. The company specializes in selling and distributing automobile equipment and parts for large passenger cars and commercial vehicles on the territory of Kosovo and Metohija. As a tool for creating the database, the relational database management system for MS Access 2007 and Visual Studio 2008 has been used, being appropriat for the information system of small and medium-sized enterprises such as the company "Simonida". The presented approach is the development of a prototype system in a small company that does not have financial resources to initiate the introduction of expensive systems. It has been shown that this approach is introduced the fastest and that it immediately produces satisfactory results that their own intellectual resources can be utilized for the purpose of upgrading and maintaining itself, without additional financial costs. The management of "Simonida" Gračanica have conducted a detailed analysis and concluded that more information is necessary for business decisions given the increased workload. Auxiliary software solutions for decision support systems are massively available within the Microsoft Office package (MS Access and MS Excel) as well as sophisticated and complex tools such as Visual Studio 2008, which are particularly suitable as a solution to a large number of small and medium-sized enterprises in Serbia, which significantly reduces operating costs, enables the successful operations of the company and generates a profit. Considering that the economic and business development in Serbia is based on small and medium-sized enterprises, subject matter of the analysis carried out in this paper represents opportunities for the development and implementation of new software solutions to decision support in these companies. The business world implies the way in which people communicate, represent, transmit and share their knowledge with others in order to improve their operations and the achievement of common goals. Managers and employees can go through information about the market, customers, competitors, partners' internal activities, products and services in order to contribute to the creation of the business value and improve the business impact [14].

"Simonida's" sales of cars and spare parts are a challenging and complex activity. Among the cars, there are many differences such, as whether the car has a gasoline engine or used diesel fuel, whether it has power steering etc. Figure 2 shows the algorithm of the business processes in the sales of new vehicles.
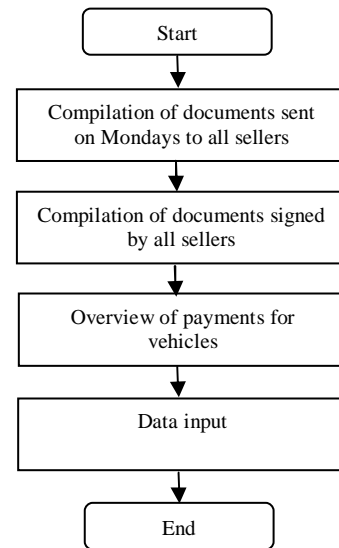

Figure 1. Monitoring the sale of new cars [15]

The biggest problem is the buyer's desire r to buy a car with a certain type of equipment. In order for "Simonida's" sellersor sellers on auto markets to know which car has a certain type of equipment, they should know what each car separately has. The customer would spend a lot of time to find a car that suits him. Because of this, it was necessary to find a practical solution to searching "Simonida" company's cars.
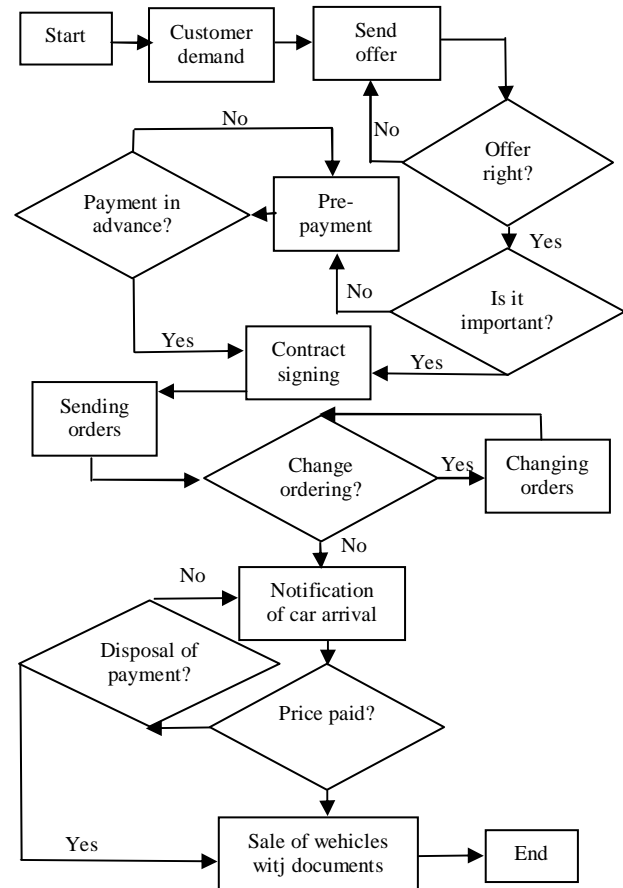

Figure 2. The algorithm of the business processes [15]

The solution lies in creating a database of the company that will contain all the information about the cars and equipment they have. It is necessary to make an interface, i.e. the type of the software program which will enable customers to quickly locate the desired car. The program should be able to perform the searching of the entire database of the company "Simonida" and to present the results to the user. The program should be as simple as possible so that the customers who have never used anything of that kind could use very quickly.

III. DATABASE

Before the very beginning of the development of decision support systems in "Simonida"-Gračanica, a company for car sales and the distribution of spare parts and equipment, a detailed analysis of the company was made. the company's needs were taken into account and the best ways to have those needs realized were discussed. There are three tables that have been created in the databas: the *Car Table* – which contains information about cars. The *Customer Table* – which contains information about customers. The *Transactions Table* – which contains information about completed transactions.
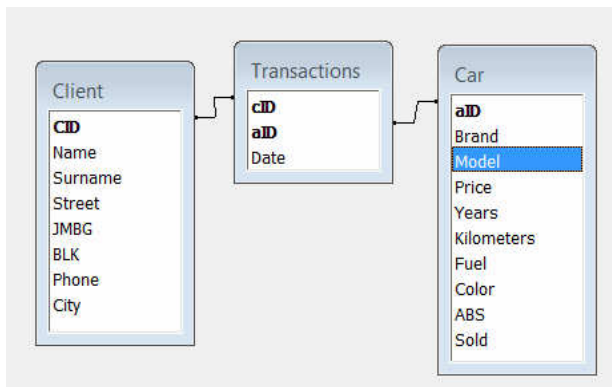

Figure 3. The relational database model [15]

The *Car Table* consists of the following fields: *aID* – the primary key table and the unique identifier for each car in the database; *Brand* – the car brand, *Model* – the model of car, *Price* – the car price, *Years* – the year of the car production, *Kilometers* – the car mileage, *Fuel* – the type of the car fuel, *Color* – the car color, *ABS* - additional equipment, *Sold* – whether the car has been sold or not.

The *Client Table* consists of the following fields: *Name* – the customer personal name, *Surname* – the customer surname, *Street* – the address of the buyer, *JMBG* – the personal unique identification number of the customer, *BLK* – the ID card number of the customer, *Phone* – the phone number of the customer, *City* - the city where the buyer lives.

The *Transactions Table* consists of the following fields: *aID* – the unique identifier for each car in the database. *Date* - the time when the transaction was completed.

The information solution implemented by using the "Microsoft Visual Studio 2008" program allows the user to perform the basic interaction with the database. These are the following options: input, edit, search and delete cars and clients. Additionally, it enables the storage of the client's transactions.

IV. APPLICATION SOLUTION

The application consists of several forms, the most important ones being as follows:: *Form1.cs* – the form gives the user an opportunity to review all cars in the database and open all other forms of the application. This functionality is implemented by using datagridview control. *FrmNew.cs* – the form gives the user the option of adding a new car in the database. *frmUpdate.cs* – the form gives the user an option to change the car data. *FrmSearch.cs* – the form gives the user the ability to search the car database. *FrmList.cs* – the form that displays a list of clients, where the user has an option to delete data or obtain the forms for editing a particular client. *FrmCustomers.cs* – the form gives the user the option of adding a new client and a new transaction in the database. *FrmClient.cs* – the form gives the user an option to change data in the client base. *Transaction .cs* – the form provides the user with the ability to preview the list of all transactions, print those lists and delete individual transactions.

The datagrid is the main control on the Form1.cs. Each row represents one car. One row is composed of 9 columns: *ID* – the field that displays the number of the car. *Brand* – the field that displays the brand of the car. *Model* – the field that displays the model of the car. *Price* – the field that displays the price of the car. *Sold* – the field that displays the status of the car. *Shopping* – the button which, when pressed, opens the form FrmKupci.cs. *Delete* – the button which starts the process of deleting the selected cars from the database.

Figure 4 shows the design of the "Form1.cs" form. In the header of this form, control is used, consisting of the following elements: *The new car* – displays the frmnew.cs form. *Search* – displays the frmSearch.cs form. "Transactions" shows the "Transaction.cs" form. "Clients" – shows the "FrmList.cs" form, and "Close program" – closes the program.
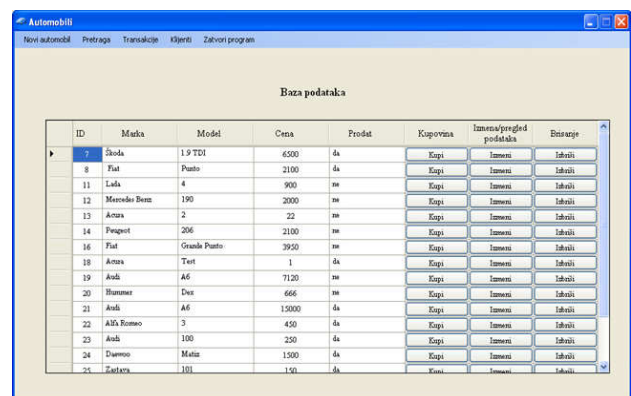

Figure 4. The form for the review of all cars [15]

The "frmUpdate.cs" form (Figure 5) allows changes of the basic characteristics of the cars and includes the following controls: "Mark" – the list of the predefined cars. The user is only obliged to choose a particular brand of the car when entering data changes for the car. "Model" – the standard text field where the user enters the car model. "Price" – the standard text field where the user enters the price of the car. "Year" - a list of predefined years. "Mileage" – the standard text field where the user enters the mileage of the car. "Fuel" – the list of the

predefined fuel. "Color" - the standard text field where the user enters the color of the car. "Sold"– the standard text field where the user enters the status of the car. The control for changing accessories consists of 15 "checkbox" controls. The same validation is applied as the form for adding a new car, i.e. all the fields in the control for changing the basic characteristics of the car are mandatory whereas all the fields from the other sections are optional.

Figure 5. The form for editing and changing data [15]

Figure 6. The form for the registration of customers [15]

Figure 7. The form for transactions [15]

The "FrmCustomer.cs" form (Figure 6) is displayed by the "Buy" action on the Form1.cs form. The main control includes the following controls: *Name* – the standard text field where the user enters the first name of the buyer. *Last Name* – the standard text field where the user enters the last name of the customer. *The City* – the standard text field where the user enters the city of the customer. *Street* – the standard text field where the user enters the the

customer's street. *Identification number* – the standard text field where the user enters the ID number of the customer. *BLK* – the standard text field where the user enters the ID card number of the buyer. *Telephone* – the standard text field where the user enters the customer's phone number.

The "Transaction.cs" form (Figure 7) is displayed when the user activates the "Transactions" link in the main navigation on the "Form1.cs" form. The Form consists of the following controls: "Client combobox" – so programmed that this list only shows the ID number of the clients that are in the database. When the user selects an ID number in the list in the "datagrid", the control displays the selected client's transactions. Each transaction consists of four columns: "Auto ID" – the unique identifier of the purchased cars; "Transaction Date" – the date of the completion of the transaction; "Customer JMBG" – the personal unique identification number of the buyer. "Delete" – deletes transactions from the "Transactions" table.

Figure 8. The form for the registration of clients [15]

The "FrmList.cs" form (Figure 8) is displayed by using the "Clients" link in the main navigation on the Form1.cs form. Each row in the control stands for a single client. One line consists of six columns: *Name* – the field that displays the first name of the client; *Last Name* - the field that displays the surname of the client; *Street* – the field that displays the client's street; *JMBG* – the field that displays the personal unique identification number of the client. *Edit/view data* – the button which opens the "FrmClient.cs" form. *Delete* – the button that starts the process of deleting the selected client from the database.

V. EFFECTS OF APPLICATION AND FURTHER IMPROVEMENT

After the improvement and implementation of the IS and after having performed the analysis according to the particular target group of customers, their requirements in purchasing vehicles, their expectations and the distribution and sale of spare parts, the "Simonida" company for the sale of vehicleshas adjusted its range of vehicles and spare parts. Based on the parameters, amongst which the specifications of the vehicles and spare parts are one of the most important ones, and according to the customer's interest and the time (certain periods of the year), the company has adapted itself to their business; with such a range of customized sales, significant savings in unnecessary procurement (storage) costs of vehicles and spare parts have been achieved. Applying the IS after the six-month financial report, the company for the sale of vehicles "Simonida" has realized income in the sales of vehicles and spare parts and has also reduced the

associated costs (of the transport of vehicles, the storage rental of space for parking vehicles etc.).

The graphic report in Figure 9 accounts for the growth of the vehicle sales and profits in relation to the period prior to the implementation of the company's information system.
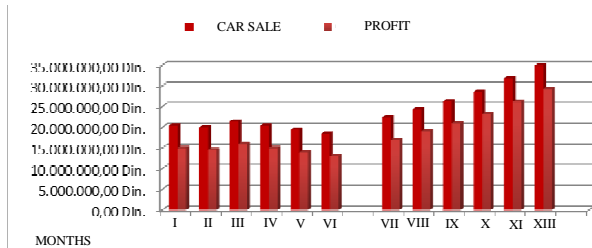

Figure 9. The graphical financial report of business [15]

From the above-presented graph, it can be concluded that the information system of the company "Simonida", a company dealing with the sale of vehicles, only contains parts for an entry, search and edits of the data about the vehicles, the customers and the transactions. The improvement of the information system can be accomplished by introducing the so-called modules for decision support i.e. by creating graphical representations and reports such as:

- The report on the sale of the vehicles in the selected time interval
- The report on the total sales of certain brands of vehicles
- The report on the customers and the like

The proposed dimensions of the OLAP (On-Line Analytical Processing) cubes for the implementation of the elements of business intelligence and creating a previous report are shown in Table 1.

Table 1.
The description of the OLAP cube dimensions [15]

Cube – CarSale	
Dimension	Description
Time	The dimension constructed on the basis of the *date* field from Fact_SellingVehicles based on the data source; the dimension only includes data on the days when the sale was made. The hierarchy of the dimensions can be determined in the year, quarter, month, and day.
Car	The Car Dimension allows the monitoring of vehicle sales. The hierarchy of the dimensions can be determined according to the brand and model of the car.
Client	The Clients Dimension is created on the basis of the "Name" field in the Customers table. The hierarchy of the dimensions can be determined by the city.

Also, taking into account the fact that the considered company is engaged in the distribution of spare parts, a module for recording spare parts and equipment can be added. On the basis of transactions, an analysis of the client's needs for certain parts and equipment can be carried out, on the one hand, and, on the other hand on the basis of the results of the analysis, a strategy related to the purchase of equipment and spare parts that clients usually claimed can be created.

VI. CONCLUSION

This paper presents the key segments in the development of the information system of the company "Simonida", a company dealing with the sale of vehicles and aftersales. The present economic results of the company after the introduction of the information system are indicative of the positive impact on its overall business. The practical results of the application of the present system have shown the improvement of the data management in the enterprise and that it can satisfy all the needs for information necessary for the management of the enterprise. In addition, this has provided a connection of the key business functions (finance, accounting, distribution, manufacturing and sales). The flow of information between those key business functions ensures that the enterprise has a complete and full control over the business, which provides it with effective management and decision making, which gives an additional aspect of applicability. Thanks to its features and functions, the decision-making process has been facilitated and accelerated, which increases the competitiveness and has a positive impact on the efficiency of operations and creates significant savings for this company.

The advantages of the above information system are, among other things, reflected in the fact that the processes of entry, editing, deleting and searching are very easy and enable a quick and easy use of this system. To add, it allows a great interaction with the end-user. This paper presents a concrete example that can universally be applied as a starting point in the formation of an information system with companies engaged in car sale and after-sales.

REFERENCES

[1] R. L. Daft, *Management,* South-Western College Pub, 2007

[2] P. Poon, and C. Wagner, "Critical Success Factors Revisited: Success and Failure Cases of Information Systems for Senior Executives," *Decision Support Systems,* Vol. 30, pp 393-418, 2001.

[3] M. Mador, "Strategic Decision Making Processes: Extending Theory to an English University", 2002 Available at: http://ecsocman.edu.ru/images/pubs/2002/12/25/0000 033000/str_des_making.pdf

[4] N. B. Filinov, "Business Decision-Making in the Era of Intellectual Entrepreneurship", 2003, Available at: http://www.wspiz.pl/~unesco/articles/book3/tekst7.pd f

[5] S. Williams, and N. Williams, *The Profit Impact of Business Intelligence*, Morgan Kaufmann Publishers, San Francisco, 2007.

[6] R. Sabherwal, and I. Becerra-Fernandez, *Business Intelligence: Practices, Technologies, and Management*, Wiley, Hoboken: NY, USA, 2010.

[7] C. Howson, *Successful Business Intelligence: Secrets to Making BI a Killer App.,* McGraw-Hill Osborne Media, 2007.

[8] L. T. Moss, and S. Atre, *Business Intelligence Roadmap: The Complete Project Life cycle for Decision-Support Applications,* Addison-Wesley Professional, Boston: MA, USA, pp 77-81, 2003.

[9] S. Adelman, L. Moss, and M. Abai, *Data Strategy,* Addison Wesley: United States, 2007.

[10] R. K. Wysocki, and R. McGary, *Effective project management: traditional, adaptive, extreme,* Wiley Pub: Indianapolis, 2003.

[11] M. Valle, "Visualization and art", 2006. Available at: http://www. isedj. Org /isecon/2007 /2523/ISECON.2007.Segall.pdf http://www.cscs. ch/~mvalle/visualization/VizArt.html

[12] Z. Irani, and P. E. D.Love, "The Propagation of Technology Management Taxonomies forEvaluating Investments in Information Systems", *Journal of Management Information Systems,* Vol. 17, No. 3, pp 161-177, 2000.

[13] M. Gibson, D. Arnott, I. Jagielska, and A.Melbourne, "Evaluating the Intangible Benefits of Business Intelligence: Review & Research Agenda", Proceedings of the 2004 IFIP International Conference on Decision Support Systems (DSS2004): Decision Support in an Uncertain and Complex World, pp. 295-305, 2004.

[14] D. Marchand et al., Mastering Information Management Harlow, *Financial Times*. Prentice-Hall, UK, pp. 295-300, 2000.

[15] Internal corporate documents of the company "Simonida" Gračanica