DEVELOPMENT OF INFORMATION SYSTEMS IN ZASTAVA AND THE FUTURE WITH FIAT

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Abstract

ecessitate for information technology in business is undeniable. The company "Zastava" from Kragujevac realized this fact at the very beginning of its development and has improved business in the direction of continuous progress in the field of information technology. Following the progress of IT sector, "Zastava", we can practically follow the development of information technology.

The IT development in "Zastava" has started in early 1960 by establishing the Office for the organization and systematization. The first IT organizational unit in the factory "Zastava" was Electromechanical de partment. The first computer for automatic data processing ever installed in an industrial company in u goslavia, was in that department. End of sixties and the seventies were characterized by remote and auto matic data processing, while the eighties introduced distributed data processing. ineties followed the idea of information system based on the principles of integrity and data distribution. Today IS in "Zastava" relays on the integral PC and network technology.

This segment of company, unfortunately, has suffered great damage during the bombing in 1999, but then it continued development and now are based on a modern technological solutions.

The Memorandum of strategic cooperation between FIAT and "Zastava" has been signed on May 2008. According to estimates of leaders in the Zastava's IT sector, the main direction of development will contin ue, and they expect further investment in the IT. They also expect that FIAT will probably apply the model they already used in the similar arrangements a separation of IT department and forming a new company whose services will be used by the factory (outsourcing model).

Key words: *Zastava, FIAT, information systems, information technologies, computers, network*

Introduction

When we speak about information systems, we confuse that term with information systems support by information technology. It is common, since "it is hard these days to escape the hype and publicity surrounding information technology (IT) and its business applications. For business, IT has become a critical resource, and for many organizations it represents the 50 percent of capital spending. Information is a critical organizational resource" , p. 5 . But in early sixties was not like that. Information technology was at first stages of development, the machines were very large, very expensive and there were not enough educated staff to cover that field of business. Also, "the use of computers and information technology has brought many changes in organizations. Changes are felt in areas such as the structure, authority, power and content of jobs, progress in the career of employees, supervision and business managers" 2, p. 70 .

Today, the importance of development of information systems (IS) is widely accepted by both researchers and practitioners, but Zastava realized that fact in early sixties and start their long process of IS development.

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1. The phases of information system development in Zastava[6] - Kragujevac

The **first phase** of development of information system in Zastava can be called ***electromechanically data processing***. It began in 1960 when the company **concluded a contract with IBM** on the delivery of electromechanical set of machines for electronic processing of data. It was computers from II generation: IBM609, tabulator (WTC Computing Accounting Machine) IBM421, End Printing Reproducing Punch – IBM 519, Electric Punched Card Collator – IBM077, Card Sorter – IBM082 and the machines for punching and verifying cards. At that time, main memory medium for keeping and transmitting information was punch card. As a parallel process, Zastava need to educate working stuff, so they can use the acquired equipment and to provide the space with air conditioning and other adequate conditions for work.

Realization of the contract began in 1961 when IBM delivered first machines for data processing. Zastava got machines for material management and salaries, and then for processing tools, working orders, working units, registration number of workers[7], etc.

IBM 609 machine

They worked with those machines few years, but they were very slow and with low capacity, so existing needs in Zastava were exceeded their ability. As a result of that, during 1966 Zastava started preparations for introducing new machines from the III generation – electronic data processing (computers). After that, we can talk about **second phase** of development – ***automated data processing***.

In 1968 Zastava bought computer IBM 360/30 with 16Kb RAM and appropriate peripherals (4 hard disks, 1 printer, 2 control units, 1 reader and punch card machine). The configuration was very powerful at the time and provided integration of business data, which was very important for future development of information system. That computer was the first ever installed in a company in Yugoslavia. Zastava was a pioneer in that area as well. Acquisition of this computer changed an organization of IT sector and they started to develop new features, such as application and system programming. There were significant changes in data preparing, system analyzing and the way of IT organization. The biggest changes are, however, made in the way of using equipment.

Few years later Zastava indicated the need for expansion of equipment, so they obtain 2 units of magnetic tapes and with additional 16Kb of RAM, so they had 32Kb. The configuration enabled construction of first technological data bank in with BOMP[8] database management system. The system could produce over a 200 user's information.

Zastava has a very intensive development in those years, especially in the car industry, so the computer system they had was unable to satisfy the needs. In 1972 they decided to get new computer configuration with remote data processing.

Since 1973 we can recognize the **third phase** in information system development in Zastava – ***remote data processing***. In 1974 they obtained the IBM 370/145[9] computer with 212Kb RAM memory, updated existing IBM 360

IBM System with its associated equipment

[6] The full name of the firm, from 1946 was Crvena Zastava – Kragujevac and from 1990 just Zastava

[7] It required creation of first numerical code system for each segment of business.

[8] The BOMP (Bill of Materials Processor) was a specific-purpose system based on a network that had a much lower expressive power than Bachman's: 2-level network (may be characterized as a free network to which we add the following restriction: "children" are not "parents").

[9] The IBM System/370 (often: S/370) was a model range of IBM mainframes announced on June 30, 1970 as the successors to the System/360 family. The series maintained backward compatibility with the S/360, allowing an easy migration path for customers; this, plus improved performance, were the dominant themes of the product announcement.

to 64Kb and rented complete set of peripherals (4 hard disks, 1 printer, 2 control units, 1 reader and punch card machine). Equipment also included process computer IBM S/7 [10] with 33 terminals (IBM 2790) for remote data processing.

In the same year Zastava completed the construction of new building and they are using it for IT sector nowadays.

New building for IT sector in Zastava

Remote data processing enabled design of first online information for management process of car construction. The total amount of batch information for end users was approximately 800.

Growing number of information increased the need for more comprehensive and global automated data processing, especially in the area of planning and monitoring of production and commerce. Because of that, in 1978 Zastava rented and installed new computer - IBM 370/148, with 1Mb RAM memory, 4 HDD devices, 3 units for magnetic tape and 4 mini computers – series S/1 with 24 terminals for interactive work. Finally, the old computer, IBM 360/30, was finally excluded from the use, after ten years of proper work.

New computer configuration allowed installing DOS/VSE operation system, hierarchical organization of data – DL/1 and development of on line applications.[11] Since then we can talk about **fourth phase** of information system development – ***interactive data processing***.

On the basis of the above, we can conclude that Zastava, as a manufacturing and business system, changed and renovated its computer equipment every four of five year, according to trends of IT development in the world and conform it to its need. The same situation repeated in 1984, when they switched rented computers with new generation – IBM 4341/L11, with 4Mb RAM memory, 12 hard disk units (each of them had memory space of 9GB), 4 units for magnetic tape (each of them had memory space of 320Mb) and 102 terminals 3270 for on line monitoring of work process. These computers had VM/SP and DOS/VSE operation system, DL/1 and VSAM[12] data management system and VTAM communication system, with software for computer graphic design – CADAM[13]. At that time, the old computer was traditionally turned down after 10 years of use.

Previous phases of IT development in Zastava can be marked as centralized period. Whole manufacturing and business system was at one location. At 1984 Zastava accepted medium term development strategy of IT sector, which was characterized as ***distributed data processing on polycentric bases*** – **fifth phase** of information system development.

Zastava created new autonomous computers centers:

a. Center for distributed data processing for management of car spare parts (1984), with computer DELTA 4850-VAX[14];

[10] The first customer delivery of an IBM System/7 was made on September 16, 1971, to American Motors Corporation (AMC) at Kenosha, Wisc. Zastava bought it in 1974. There is no need to mention that the price of this computer was extremely high comparing with today prices. Purchase price was about $64.000.

[11] DOS/VS offered five partitions (later 7) and a relocating loader for effective multiprogramming. Database/Data Communication (DBDC) became a fundamental part of VSE as the use of CICS grew. A hierarchical database known as DL/1 was available as well. At this time, DOS/VS became something we would clearly recognize today as a VSE system. (**Source:** *http://www.ibm.com/servers/eserver/zseries/zvse/about/history1990s.html*)

[12] Virtual Storage Access Method (VSAM) is one of the access methods used to process data.

[13] CADAM (Computer Augmented Design And Manufacturing) is a CAD related product that was developed by Lockheed. CADAM is/was software originally written for IBM mainframes and later ported to UNIX workstations. A variant of CADAM called MicroCADAM was also developed, which also ran on PCs under DOS. /(Source: http://mbinfo.mbdesign.net/CAD-History.htm)

[14] This computer started to work at 1987.

b. In period from 1986 to 1987 few DELTA-400 computers had been installed in Belgrade, Sombor, Zagreb, Kragujevac and Sarajevo;
c. Center for distributed data processing had been created in 1986 for weapon factory, with IBM 4381/12M computer, terminal network, graphic points and plotters, so engineering and graphic calculations could be realized there;
d. During the astava, also created center for distributed data processing in Fabrika "Ramiz Sadiku" in Pec, as a first self-supporting center with IBM 4361/5 computer and a network with 23 terminals. From the main IT center in Kragujevac, they transmited applications for accounting, fixed assets, tools business and the main product and stuff databases;
e. During the 1987/88 the main building had been reconstructed and the second floor was added;
f. The second self-supporting and independent center was creating during 1988/89 in the HTD factory in Ohrid. They had an IBM 9375/60 computer and network with 41 terminals.

At the same period, in the field of engineering graphic, Zastava provided license rights from IBM for "DEMO presentations for using program packages CADAM and CATIA" and the rights for instructing a new users in the field of projecting and constructing.

Table 1. Development of IT in Zastava from 1960 until today

Phase	Type of data processing	Processor and memory	Operation system	Data organization	Progr. language	Comm. sys.	CAD/ CAM
First 1960-	Electro-machanicaly			Punched cards			
Second 1968-	Automated	IBM 360/30 (16, 32, 64 KB)	BOS DOS	Sequential, index and BOMP	ASSEMBLER PL/I RPG		
Third 1974 -	Remote	IBM 370/145 (208 KB)	DOS DOS/VS	BOMP	ASSEMBLER PL/I, RPG, FORTRAN	BTAM	
Forth 1978 -	Interactive	IBM 370/149 (1 MB)	DOS/VS DOS/VSE CICS/VS	BOMP DL/I VSAM	ASSEMBLER PL/I, RPG, FORTRAN, COBOL	BTAM	
Fifth 1984-	Distributed	IBM 4341 (8 MB)	VSE/SP VM/SP CICS/VS	DL/I VSAM	ASSEMBLER PL/I, FORTRAN, COBOL	VTAM	CADAM
Sixth 1989-	Integral and distributed	IBM 3090 (32 MB)	MVS/XA VSE/SP VM/SP CICS/VS	DB2 DL/I VSAM	CSP, PL/I, FORTRAN, COBOL	VTAM	CATIA CAEDS
Seventh 1999-	Integral based on PC technology	Do 1 GBy	Windows	Access, SQL Serever	Delphi, Visual studio	Windows	CATIA AutoCAD

The **sixth phase** of IT development in Zastava is the phase of ***integral and distributed data processing*** (1989-1999), and this period was based on *Project of information system of RO FAZ*[15] *supported with automatic data processing* (October 1987). New equipment had been installed during the September 1988 and was included: IBM 3090/150E computer with 32Mb of RAM and 80Mb of external memory in direct approach, OS MVS/XA, relational databases DB2, CSP program language of forth generation, software for business graphic AS and software for computer graphic CATIA and CAEDS. The terminal network had been extracting to 128 new terminals and during 1989/90 they added 66 more terminals, so the network had 405 terminals connected with the main center. That configuration provided ability for development of new on line software applications.

From 1999 started the **seventh phase** ***Integral phase based on PC technology***. Significant special feature that characterized the beginning of this phase was the destruction during the NATO bombing. The bomb hit the main building exactly on 7th April and destroyed all central resources, so the rest of the network became unusable. Soon after that event Zastava started to construct new information sys-

[15] RO FAZ was the name for Factory of Automobiles Zastava

tem in Zastava car factory according to *Investment plan of temporary solution and new information system of Zastava automobile*.

IT building after □ATO attack

They decided to relay on Delphi programme language, Windows operation and communication systems with Access and SQL for data management. Internet had become a part of everyday use with all supporting services and advantages for employed stuff and external users. The communication infrastructure today is based on combination of optical cables, UTP connectors and wireless technology.

Big problem of consistency of data was override by conversion of all databases which was supported with DB/2 to new Access and TXT format.

They created two languages web presentation for Zastava automobili, and that presentation can be found on url: http://www.zastava-automobili.com/sr/zastava.htm.

The future of IT development in Zastava depends on the attitude of their strategic partners FIAT.

□*eb presentation of Zastava*

2. Few words about IT in FIAT

The history of information systems in FIAT is as interesting as it is in Zastava. The main difference is that Zastava relay on their own resources from the first day and they were buying hardware and software for internal development of databases and data processing. Until 2000 FIAT has the same way of IT development, more or less, although the FIAT is much more extended system in compare with Zastava.

Then they decided to switch their information and communication development to technological services and solutions for **outsourcing** information systems and development of eBusiness solutions and telecommunications. The necessities for all required information in FIAT have been covered by the list of these firms:[16]

ITS S.r.l. This company offers its clients a **complete range of infrastructural services for the management of hardware systems and communications networks**. ITS is present directly or indirectly in all the countries where Fiat operates. Fiat

G.S.A. S.r.l. This company focuses on the **development and maintenance of application software**, providing knowhow in all the principal areas of information technology and covering every aspect of business operation. GSA is present directly or indirectly throughout the world.

[16] http://www.fiatgroup.com/en-us/shai/banns/budgets/Documents/BIL2000_Rel_Gest_ING.pdf

eSPIN S.p.A. This company was created toward the end of 2000 as a joint venture of Business Solutions (70%), Cap Gemini- Ernst&Young (20%) and Oracle (10%) to **provide companies with a complete, integrated and innovative range of business-tobusiness solutions and corporate management systems**.

Koinet S.p.A. Koinet is a communications and service portal created **to offer businesses and managers a wide range of information, news and professional services that can facilitate the handling of management tasks**.

Atlanet S.p.A. Created toward the end of 2000 by merging Telexis and Acea Telefonica, Atlanet is a joint venture of Fiat (about 30%), IFIL (3%), Acea (33%) and Telefónica de España (34%). It develops **telecommunications, data transmission and general connectivity services**. It also holds a 12% interest in IPSE 2000, which was recently awarded an UMTS license in Italy.

eb presentation of FIAT

Fast Buyer S.p.A. This company acts as a **procurement center for purchasing raw materials, corporate services, auxiliary production materials and commodities**. It handles a business volume that has already exceeded 1.5 billion euros. **Through its portal, it offers e-procurement, marketplace and value-added services to corporate users**, making a large array of industrial items available to its clients. Drawing on the expertise and technology the Fiat Group developed in this area, it delivers solutions that help clients improve the efficiency and effectiveness of their procurement systems.

The most recent significant step for IT development in FIAT was the decision of buying integral information system SAP[17]. Following its 2005 decision to reorganize and improve some of its key processes in accordance with the strategic guidelines of the FIAT Group, Fiat Auto chose SAP for Automotive as the foundation to harness and simplify the complexity of its business processes. Fiat Auto is now underpinning its core business processes with industry-specific functionality from mySAP ERP, integrating disparate legacy systems that it needs to keep online with the SAP NetWeaver® platform, and cutting out redundant data entry processes.

"SAP software is a key enabler helping us achieve the aims we've set for our business transformation," said Vincenzo Giannelli, CIO, FIAT Auto. "In the first wave of the rollout, we've gained tighter control on financial and procurement processes. With the rollouts of SAP's automotive suite applications, we'll have a worldwide standard set of end-to-end business processes."

With its January 2006 go-live with mySAP ERP and mySAP Supplier Relationship Management (mySAP SRM), the company achieved the first milestone in its global SAP rollout. The integrated enterprise resource planning (ERP) and SRM solution is helping Fiat Auto production sites in Italy gain centralized control over workflows in finance, analytical accounting and procurement, accelerating the processes of managing indirect materials, contracts and purchase orders.

"With the first wave, we have implemented the SAP solution covering seven legal entities and six manufacturing sites in Italy for a total of more than 5,000 users," said Vittorio Boero, SAP program manager, Fiat Auto. "The same solution also will be also implemented in our production sites in Poland and Brazil, for which the activities have been started already in April and are scheduled for completion in January 2007."

Supporting Fiat Auto's aims to keep all information and communications technology (ICT) systems linked for seamless workflows, SAP NetWeaver enables the interface of SAP applications to the software installations that Fiat Auto is keeping online for product development and manufacturing execu-

[17] The name SAP is acronym for Systems, Applications and Products in Data Processing (the original name was German: *Systeme, Anwendungen, Produkte*). It started in 1972 by five former IBM employees in Mannheim, Germany and it states that it is the world largest inter-enterprise software company and the world's forthlargest independent software supplier, overall. SAP is an extremely complicated system where no one individual can understand all of it.
(**source:** *http: searchsap.techtarget.com sDefinition 0,,sid21 gci21 190,00.html*)

tion. The SAP implementation at Fiat leverages the end-to-end process integration capabilities of the SAP NetWeaver® platform in particular, SAP NetWeaver® Exchange Infrastructure to simplify and unify purchasing processes and data exchange with suppliers.

When the rollout is completed, the ERP and SRM solution will be handling a half-million messages per day with Fiat's more than 20,000 key suppliers. These highly efficient and collaborative capabilities will play a key role in enabling the company's expansion plans. Following the rollouts of SAP applications powering core processes, Fiat Auto aims to extend the deployment of mySAP ERP. The company is now working on the integration of direct material in the materials management and procurement processes, a phase of the rollout project that soon will go live in Italy. The carmaker is also currently defining the next steps of the SAP implementation, both in terms of functional and geographical extension.[18]

3. Conclusion - as a a s f r IA

When we conclude this research there were no new steps in astava's IT development. The Memorandum of strategic cooperation between FIAT and Zastava has been signed on May 2008. According to estimates of leaders in the astava's IT sector, the main direction of development will continue, and they expect further investment in the IT. They also expect that FIAT will probably apply the model they already used in the similar arrangements - a separation of IT department and forming a new company whose services will be used by the factory (***outsourcing model***).

They also realized that some of operations they used are not according to FIAT standards. For instance, FIAT wants to follow each part in manufacturing process, in any time, but Zastava does not yet have sources to provide that information.

Integral software in Zastava today

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References

1. Piccoli, G, (2008), *Information Systems for Managers*, John Wiley & Sons Inc.
2. Turban, E, McLean, E, (2002), Wetherbe, J, *Information Technology for Management*, John Wiley & Sons Inc
3. Research material from astava's IT sector
4. www.zastava-automobili.com/sr/zastava.htm (visited on 3rd June 2009)
5. www.fiatgroup.com (visited on 5th June 2009)

[18] http://www.sap.com/about/newsroom/news-releases/press.epx?pressid=7080