

IS/ICT of an SME in Auto Transport Services

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Abstract - This paper presents a model of an information system, developed within an integrated model (IM) of information system (IS) and process structure of an enterprise specialized in road transport of goods and passengers by motor vehicles. IM approach is important because of the increasing dependency between services and information and communication technologies (ICT) in this industry. Implementation of GPS/GPRS technologies are elaborated within IS/ICT system development. Besides, IM approach is a holistic approach that involves three important dimensions of contemporary enterprise: process orientation, IT support to operations and quality system requirements. Applied object-oriented analysis of main processes of an auto transport enterprise resulted in the design of common conceptual model of enterprise information system. Experimental research on the implementation of IS model of Transport services process in an SME was also conducted and results are presented in this paper. The research confirmed managerial value of IS model as a tool that provides data and information needed for real time management of transport services business process (BP).

I. INTRODUCTION

Integration of the core business processes in an enterprise becomes the key success factor in modern business environment. Process oriented enterprise is a highlighted characteristic of a modern enterprise that ensures greater flexibility, comparing to functional organizational structure recognized by management and administration hierarchy. Process modeling of Quality Management System (QMS) defined by ISO 9001:2000 (updated version from 2008) contributed to a strict definition of end-to-end processes of product or service realization (from customer demand to the delivery of product/service to a customer) and strict definition of performance measurement of processes and enterprises as such. Information system/ information and communication technologies (IS/ICT) are inevitable component of modern enterprises and a foundation of completely new enterprise business concepts. This specially relates to service oriented enterprises [1].

It is well known that service sector is widely present in GDP structure of developed countries, and lately, the same trend is noticed in the economies of developing countries [2].

ICT also contributed to connecting “end-to-end” transport process that spread over different enterprises, thus supporting the concept of sustainable development (in the sense of availability to maintain the balance among three areas: economics, ecology and social) [3].

This paper presents a model of an information system, developed within a business integrated model (IM) of information system (IS) and process structure of an enterprise, specialized in road transport of goods and passengers by motor vehicles. IM approach is important because of increasing dependency between services and information and communication technologies (ICT) in this industry. Identified “end-to-end” processes: Transport services; Technical maintenance and Calculation of income and cost per vehicle are the most important processes for the management in an auto transport enterprise. This is because services cannot be stored in a warehouse and one of the key success factors is a high level of vehicles’ availability [4].

Experimental research on the implementation of transport business process in an SME (small and medium enterprise) was also conducted and results are presented in this paper.

Project results are applied within Autotransport doo, Kostolac (further in text referred to as: Autotransport) [5].

The research confirmed managerial value of IS model within IM model as a tool that provides data and information needed for real time management of maintenance services business process (BP).

Besides Introduction section, this paper includes the following sections: IM model and approach (consideration of a problem and solution directions; developed model of integration), IS model (logical architecture of the IS), IS model implementation of Transport services process (experimental research in an SME), Future trends and further research and development (R&D) and Conclusion.

II. INTEGRATED MODEL AND APPROACH

It is important for a service oriented SME to integrate customer relationship management (CRM), resource management, service providing and financial management into a unified management process. All these processes generate and use large sets of different data to facilitate efficient enterprise’s operations and development. Integration of BP and IS has to be achieved.

Research on the relation between a process structure and IS within the development of an IM of an enterprise that provides services in road transport, is conducted on characteristics of an enterprise which scope of services include following services: services of public transport of passengers and goods and other services for which, own heterogeneous fleet is used; services of public transport of goods with own resources and subcontracting of services in the same domain.

IM approach is a holistic approach that involves three important dimensions of contemporary enterprise: process orientation, IT support to operations and quality system requirements. IM is an integration model of BP and IS which shows that BP and IS interact to realize business goal. This is illustrated at the Fig. 1 [1,6].

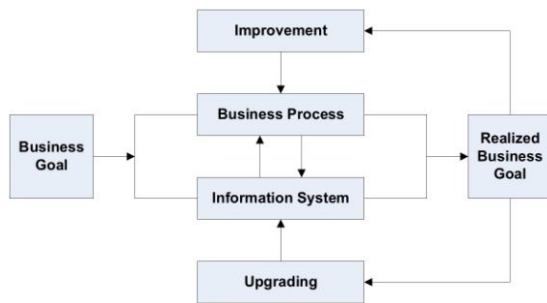


Figure 1. Global business integration model

III. IS MODEL

Information system modeling is an activity which products are models – various views on IS development. Modern IS are being developed by applying object-oriented method. Object-oriented modeling and Unified Software Development Process [1], present a development process of software-intensive systems, and enable achieving a stable architecture that allows iterative and incremental system development. Therefore, with the implementation of additional functionalities, the system is being upgraded without significant change in its architecture. So this object-oriented IS development approach is appropriate for IM development and implementation.

As it was previously said, IM approach is a holistic approach that involves three important dimensions of contemporary enterprise: process orientation, IT support to operations and quality system requirements. Applied object-oriented analysis of main processes of an auto transport enterprise resulted in the design of the common conceptual model of enterprise information system.

The group of main processes that contributes to the mutual goal is defined as a scope of a single IS. Logical architecture of an IS of auto transport enterprise (ISAT) consists of following constitutive subsystems [1,7] with studied relations (Fig. 2, [1]): S1 – Customer Requirements Fulfillment and Service Realization System, S2 – Integrated Logistics Support System, S3 – Vehicles Incomes and Costs Calculation and Analysis System, S4 – Financial Resources and Analysis and Documentation Management System, S5 – Information System Management, S6 – Top Management Decision Support System, S7 – Service Design and Development System, S8 – Document Publishing and Management System, S9 – Services Measurement and Analysis System, S10 – Human Resources Management (HRM) System.

System for Customer Requirements Fulfillment and Service Realization System – S1. The purpose of this system is to ensure efficient communication with customers and processes of an auto transport enterprise (AT) in order to ensure that the customer receives correct information on possibilities and commercial conditions of

AT for fulfillment of its order, status of realization of its order and solving potential problems (customer complaints) and to provide with data and information necessary for efficient realization of customer order and ensuring the quality of service, in accordance with expectations of both customer and AT. This system includes information support to transport services realization process.

Integrated Logistics Support System – S2. The purpose of this system is to provide necessary and sufficient data and information for the realization of processes “service sales” and “service realization” at any moment of their realization. Data and information include documents (licenses, travel orders...), physical subjects (drivers, vehicles, equipment...). To realize these requirements quickly and correctly in modern business environment is possible only through modern IS/ICT systems, i.e. application software. It should be pointed out that in this system, the most important is information support to technical maintenance process [4,8].

Vehicles Income and Costs Calculation and Analysis System – S3. The purpose of this system is to provide with calculation and analysis on income and cost of vehicles, in the shortest period, after realization of single transport service. So this system supports the process of calculation of income and cost per vehicle.

Financial Resources and Analysis and Documentation Management System – S4. The purpose of this system is to provide with accurate data on financial means of AT in every moment and to provide with accurate processing of financial documentation and automated bookkeeping in accordance to the legal framework in this field. This is how the enterprise ensures the efficient management of income, control of costs and makes other important decisions based on which the financial conditions for the successful management of AT are ensured.

Information System Management – S5. The purpose of this system is to administer ISAT and should provide with accurate data on components of the entire ISAT during its development and exploitation, to preserve system’s integrity and ensures the availability, security and protection of data, as resources of AT.

Top Management Decision Support System – S6. This system provides executive management with data and information necessary for identification of operational and business problems, based on enterprise and process performance indicators and for making operational and tactical management decisions.

Service Design and Development System – S7. The purpose of this system is to ensure intensive communication with environment and provide data (external and internal) in order to identify needs for new service, its economic justification and making conditions for realization of that service within AT.

Document Publishing and Management System – S8. The purpose of this system is to ensure managing of selected set of documents that are relevant for achieving AT’s business goals and to ensure electronic publishing and distribution of relevant information on the matter. System should also enable efficient issuance of other

relevant information form ISAT system. This system provides support to the QMS.

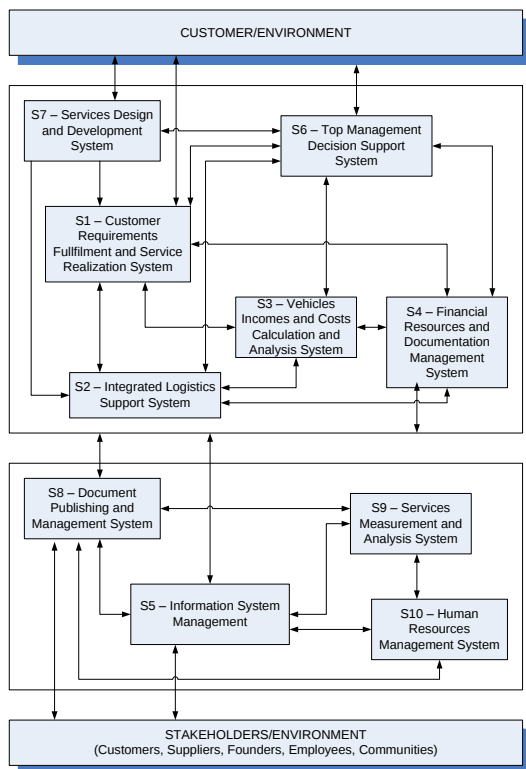


Figure 2. Logical architecture of ISAT

Services Measurement and Analysis System – S9. The purpose of this system is to contribute to the improvement of AT's services based on the measurement and analysis of realized services of AT (in accordance with QMS requirements), from the view of AT's business goals achievement.

Human Resources Management System – S10. The purpose of this system is to support HRM through ensuring that the staff is educated and skilled for assigned positions, as well as to organize further education during the employment. System needs to enable noting and keeping track of all relevant business data during the employee's engagement, analysis of elements of specification of positions and elements of improvement of effectiveness and motivation of employees.

Systems that are defined like this, in the IM's planning phase, support main business processes and main information flows between them, and are the basis for the planning of development and implementation of ISAT application software [1,5], based on defined business goals and priorities. ISAT logical architecture defined like this, with methodological and technological solutions in design and implementation of software solutions, ensures ISAT's flexibility and interrelation between business goals and IS goals, with regards to the IM approach and model depicted at figure 1.

Key concepts of ISAT domain model are: Transportation service, Business partner, Suppliers contract, Client service contract, Travel order, Vehicle, Employee, Travel order calculation, Invoice for client, Monthly calculation on income and costs per vehicle,

Spare part, Warehouse, Vehicle maintenance. For example, Travel order class, is responsible for providing with all data input for travel documents and travel documents itself (electronic and/or print paper form) for available vehicle from the class Vehicle and driver's availability from the class Employee [1,7].

IV. IS MODEL IMPLEMENTATION OF TRANSPORT SERVICES PROCESS

The application of developed IM approach and model itself is realized in the enterprise for transport services and maintenance of motor vehicles Autotransport, Kostolac, Serbia (further referred to as ATK). It is a „spin-off“ enterprise, established within a process of restructuring of the Electric Power Industry of Serbia, by separating organizational divisions that were providing support to core business processes in the field of transportation of passengers, goods, materials and freight, back in 2003 [6,8].

Defined priorities in business and IS development are aligned, aiming at creating a common ground for integration of CRM, resource management, service realization and financial management into a unified management process in order to reduce costs and increase income of this SME.

In ATK, the organizational structure follows the streamline business processes, in which, the data on business objects, activities and documents are available through IS and a modern ICT infrastructure. It is a dynamic component of a modern enterprise and enables flexibility and agility, which for an SME in service sector means “survival” and development.

It is observed those actors' responsibilities in business processes increase when business process is supported by IS. *Transport services* process is a business process of high priority for the IM realization in an SME in auto transport for the following reasons [6]:

- enterprise makes revenue with transport services,
- this process realizes contact with a customer and it remains in contact with a customer during service realization,
- this process must “know” how many resources are available (relation with Maintenance process) when accepting a customers' request and whether it needs to rent resources through outsourcing,
- this process must perform a service,
- this process must gather data for the calculation of cost of realized service.

Aiming at realization of business processes based on the quality principles and requirements, following documents are being defined and implemented through the application software [6,8]:

- input documents (e.g. Contract with customer, Order receipt)
- business documents relevant for the process (e.g. Travel order for a vehicle, Shipping document),

- reports and overviews - data on request (data on Key Performance Indicators (KPIs) and other data for management in real time).

Based on the direct insight into status of realization of a service (from the request to completion of transport service realization), realized vehicles and drivers schedules and insight into status of available resources (fleet), with flexible selection of vehicles and drivers, one can efficiently manage the process of realization of transport service for every customer.

KPIs in realized IM Transport Service (for e.g. data for KPI - Increased vehicle productivity or Reduced fuel consumption per vehicle) are components of set of data and information for making business decisions for operational and top management of the enterprise. The focus is on KPIs, data sets from processes in real time, that management uses for decision making and its availability through the application Management, so called "managers' application" (for example) [6,8] include:

- (current) availability of vehicle fleet in the ATK,
- (current) availability of drivers and working machine operators in the ATK,
- mileage and work expressed in motor-hours (for working machines) from the beginning of current year,
- number of opened travel orders for vehicles on a given date.

Elaborated implementation of IM and ISAT at the ATK has characteristic that ISAT applications are integrated at data level they reflect, but also at the level of business processes they support. To that effect, the correlation within application software for business processes Transport service realization, vehicle Maintenance (with vehicle fleet) has been provided. Key performance indicators of Transport services process and Maintenance process - vehicle productivity (in terms of number of tones transported multiplied by the number of kilometers) and availability of a single vehicle and vehicle fleet as a whole are available to the "owners" of stated processes and to the top management of the enterprise.

Experimental research on IS model development and implementation, based on IM model of Transport services process simultaneously and synchronized with vehicle Maintenance in the ATK – this SME had confirmed managerial value of IS as a tool that provides data and information needed for real time management of transport services business process.

V. FUTURE TRENDS AND FURTHER R&D

It can be expected that new technologies in transport industry, new business models in services industry in general and IT services in specific, will be developed further, with the stress to the following:

- IM and software tools for faster implementation of changing business processes in service-oriented architecture (SOA) environment,

- IM models and process "outsourcing" – the transport companies shall be connected to the extranet business networks,
- IM and business integration aspects research, having sociological aspect added to organizational and technological aspects of business integration.

IT development and IM research directions in the auto transport industry will refer to: application software (in the domain of predictive analytics and transport simulation); different location software (based on GPS/GPRS technology implementation, e.g. an example at Fig. 3) and the increased presence of RFID devices and software; IM maintenance and "Software as a Service" business model in cloud computing environment [9].

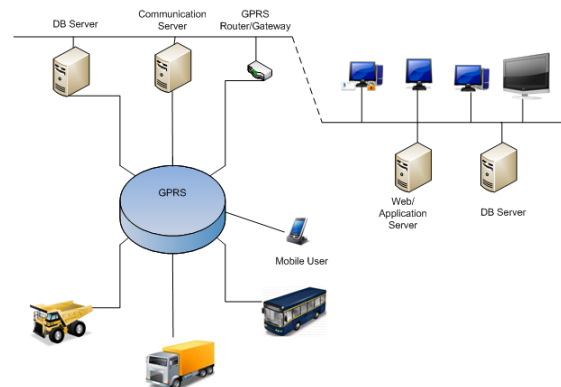


Figure 3. Integration of new technologies into IS/ICT system of an SME

VI. CONCLUSION

Transport services' system with ISAT includes business processes with integrated operational activities supported by application software through which the business documents are generated. This approach provides: data on realized events (activities) regarding transport services operations to be stored in databases, as well as data on vehicle maintenance operations and management. From that point data become available to the management in real time (e.g. vehicle and fleet productivity as KPIs of fleet effectiveness, as well as vehicle and fleet availability as an indicator of vehicle maintenance process performance, and availability of a certain vehicle for transport services).

Some of, already achieved, effects of data analysis obtained from IS for transport services management system relate to the introduction of new services and increase in enterprise income. Besides, transparent data on service realization increase confidence that customer has in a transport operator and improve cooperation between drivers and supporting staff during service realization.

Presented Transport services system of motor vehicles with modeled business processes and IS, i.e. conceptual solution of the system, can be applied in other transport companies because it is based on business process management approach and object-oriented IS.

ACKNOWLEDGEMENT

Research presented in this paper is realized within Projects TR 14021, TR 13004 and TR 35030 supported by the program of technological development of The Ministry of Education and Science of the Republic of Serbia.

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