OPTIMIZATION OF INFORMATION SYSTEM IN SELECTED ORGANIZATION

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The article deals with information systems in production and their optimization. The theoretical background provides an outline of the current status of issues solved at home and abroad, characterizing manufacturing enterprise information systems, quality management, ISO 9001, method of process optimization, optimization methods of information systems and risk management. Then the theoretical methods are applied to the modeling of Tube plant processes, their optimization opportunities and information systems. It is followed by a proposal of measures to optimize the information system which break down the requirements and alternatives of new information system as well as the functional description. The conclusion summarizes contributions and an overall view of optimization business processes and manufacturing systems.
Keywords: information system, optimization, modeling, risk

1 INTRODUCTION

Manufacturing companies that want to maintain and strengthen its position in the market must focus on efficient production and manufacturing processes. Manufacturing processes and product information must be fully monitored and deficiencies continuously removed. It is a way to cut production costs and maintain product quality. Integrated information systems are essential to supply the correct information for process optimization. Information systems organizations are designed so as to be in line with the needs and goals of the organization and their optimization is closely related to the optimization of business processes in the organization.

The process and it's IS optimization starts with an analysis of the current situation, identifying existing processes, defining bottlenecks and risk assessment. Next step is a proposal for new IS which eliminate risk and optimize business process.

The methodology of process modeling and risk analysis is used in the analytical phase. The standard ISA-95 and best practices from IT Service Management ITIL is used in the phase of IS design.

2 THEORETICAL BACKGROUND TO THE PROBLEM SOLUTION

2.1 IS manufacturing plant

Information systems (IS - Information System) of each manufacturing plant are divided into hierarchical levels in accordance with the organizational structure. The standard ISA-95th hierarchical structure is used in this paper. The ISA-95 is an international standard for the development of an automated interface between the enterprise and control systems. This standard has been developed for global manufacturers in all kinds of industries and processes. By the ISA-95 Information systems are divided into four hierarchical levels, see Fig. 1.

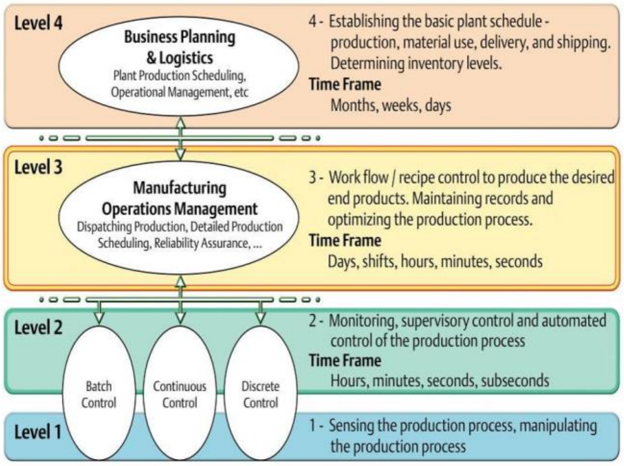

Fig 1. 1 Production IS hierarchy according ISA-95

IS Level 4 in the organizational structure of the company covers the corporation (enterprise) and production plant (site). These IS are designed as ERP (Enterprise Resource Planning) packages or similar IS for enterprise resource management. Typical activities IS level 4 in terms of production control are customer orders, weekly and monthly production planning, status of work in progress and status of orders, maintaining data quality according to customer requirements, maintenance management, purchase of raw materials and spare parts and stock status, records management and production costs , purchase and consumption of energy.

IS Level 3 covers division and manufacturing facility. These IS are designed as MES (MES - Manufacturing Execution System) or similar systems for production management. Typical level 3 activities are gathering and providing detailed information on production and consumption, warehouse management and movement of products, detailed daily and shift production scheduling, production management for production facilities, quality control and maintenance management.

IS Level 2 covers the level of production equipment and technological process. These IS are designed as SCADA (SCADA - Supervisory Control and Data Acquisition) systems with L2 models of technological processes. Typical Level 2 activities involve collecting and archiving data from production processes, monitoring and control of processes, detailed data models and management.

IS Level 1 covers the basic level of process control, automation machines, drives, programming, data imaging. Level 1 systems are represented by HMI (Human Machine Interface) PLC (Programmable Logic Controller) and DCS (Distributed Control System) systems. Typical IS level 1 activities are connection to the process equipment, monitoring and control, the startup and blocking sequence, the operator interface.

2.2 Functional model of a production plant

Functional model production plant according to ISA-95 is shown in Fig. 2
The main features of production IS are:
1 Order Processing
2 Production Scheduling
3 Production Control
4 Material and Energy Control
5 Procurement
6 Quality Assurance
7 Product Inventory Control
8 Product Cost Accounting
9 Product Shipment
10th Maintenance management
12th Sales and Marketing
13th Research, Development and Engineering

Thin named connectors between the main activities represent information flow - the main information interface between the IS. A wide dotted line represents the interface between MES (level 3) and ERP (level 4) IS.

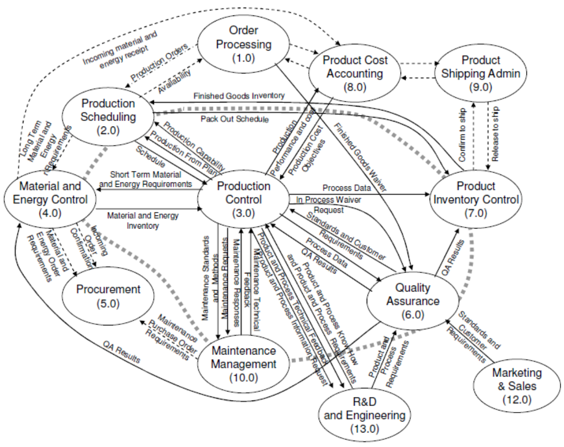

Fig. 2 The functional model of production plant according ISA-95

2.3 Methods for process optimization

2.3.1 Business process modeling

In most of the model creation process, the first step in improving business processes. Business process is a collection of activities or tasks that produce a specific service or product for the customer. Business process modeling is the representation of the business process in a form suitable for analyzing and improving their performance and quality. For process modeling are used different types of diagrams and programming languages, an example of flowchart is shown in Fig. 3

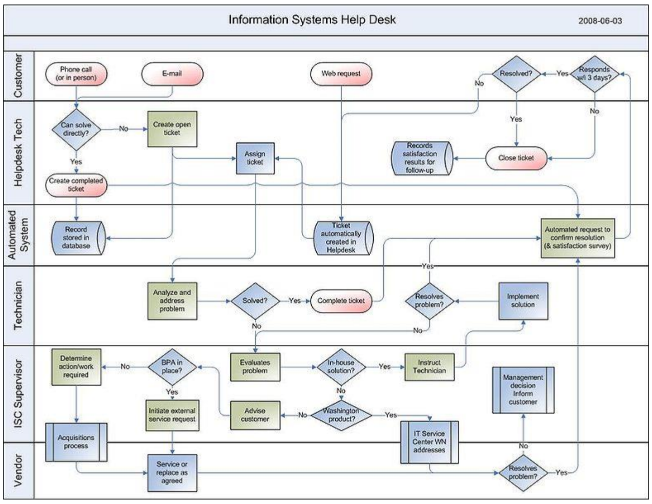

Fig. 3 Help Desk activity flowchart

2.3.2 Performance of business processes

Performance of business processes is the measurement of the activities of the organization and its performance. Performance measurement includes customer, shareholders and employee's needs. The development of performance metrics includes the following steps:
- Defining the critical process / customer requirements,
- Identifying specific measurable outcomes,
- Setting targets against which the results will be evaluated

SMART metrics mean:
- S (Specific) answers - what (I want to achieve), why (reason, purpose, benefits) who (who is involved), where (place), what (requirements and constraints)
- M (Measurable) - measurable
- A (Attainable) - achievable
- R (Relevant) - relevant at the time,
- T (Time-bound) - time period for measuring

2.3.3 Statistical method for quality control

The following statistical method for quality control can be used:
- Cause and effect diagram – Ishikawa
- Pareto analysis
- Histogram, Six Sigma
- Statistical process control diagram

2.4 IS optimization. ITIL implementation.

ITIL ® ("Information Technology Infrastructure Library", which translates as "Information Technology

Infrastructure Library") is based on best practices (best practices) from practice of IT service management. The basic element of the model ITIL ® V3 is a strategy by which we define the best services for business, which is based around the life cycle of services - their design, deployment and operation. Great emphasis is placed on the system of continuous improvement and service improvement, based on the PDCA cycle, see Fig. 4

1 Service Strategy - define the appropriate services for business

2 Design services - design IT systems, applications, ..

3 Deployment Services - IT implementation services to organizations

4 Operation Services - support and delivery of IT services

5 Continuous improvement of services - improving the cycle services

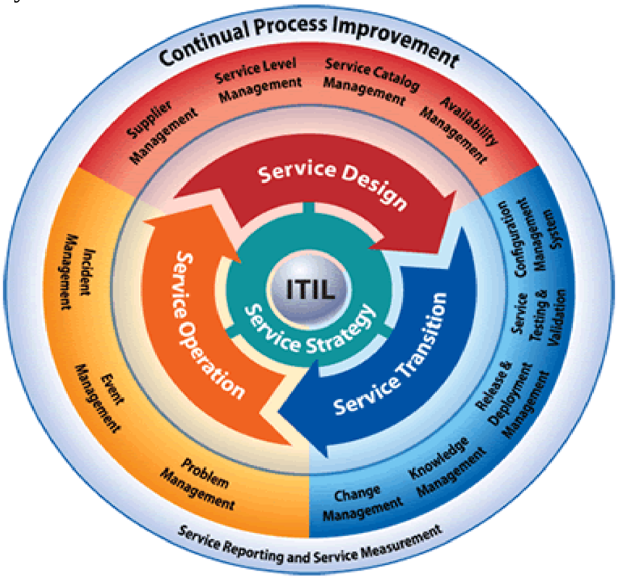

Fig. 4 The ITIL model

The benefits of ITIL implementation are:

- Saving the cost of operating IT services
- Improved quality and reliability of IT services (= satisfied customers)
- Fewer failures of IT systems

A higher level of communication (= better understanding) between sections of ICT workers and customers / users.

3 TUBE PLANT PROCESS MODELING AND INFORMATION SYSTEMS ANALYSIS

3.1 Tube plant description

Tube plant is part of the division of Radiators and pipes (DZ RAR) in the U. S. Steel Kosice, which produced spiral-welded pipes. Hot rolled coiled sheet passes through two welding units to make pipes of various diameters, wall thicknesses and lengths, for use by the construction industry in the building of oil, gas and water pipelines.

Fig. 5 Spiral-welded pipes

Tube plant material flow begins from supply of coils from of hot strip mill (TVA) to coil warehouse, see Fig. 6. Coils are supplied from warehouse to one of the two welding units, where are formed into a tube and are welded on both sides submerged arc see Fig. 5. Ultrasonic inspection of weld and base material is performed after welding. Subsequently, the tube from the welding unit is cut to the desired length by plasma cutting unit. The pipes are sampled for testing of the mechanical properties and chemistry verification. Samples are sent for testing to mechanical testing laboratory and quant meter laboratory. Each of manufactured pipe passes through a series of non-destructive testing: ultrasonic, pressure test and visual inspection of welds and surfaces outside and inside the pipe. If the pipe meets all requirements, it is moved into the warehouse, from where the finished products are shipped.

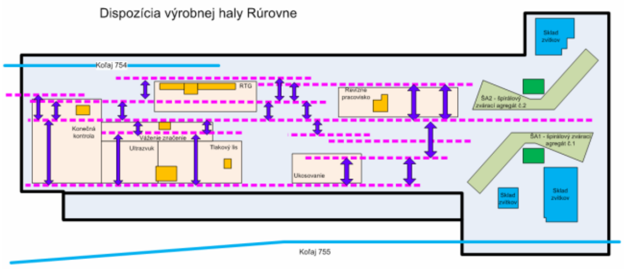

Fig. 6 Tube plant material flow

3.2 Possibilities for optimizing tube business processes

From the analysis of tube plant it follows that it is isolated from other business processes of U. S. Steel Košice, integrated quality module is missing for a comprehensive final inspection. Integration processes in accordance with the ISA 95 standard would allow optimization of planning and production scheduling process. It would eliminate the manual handling of double entry and tracking of internal orders, reduce the stock of work in progress prior to production lines and shorten the total time of order fulfillment. The condition is the introduction of an integrated system for the order entry and production planning and implementing detailed production scheduling.

3.2 Tube Information Systems

IS tube in Fig. 7 according with ISA-95 hierarchy consists of the following systems:
- At the level L4 system is IS Solid, covering business processes tube from entering orders, create purchase contract through delivery and invoicing
- At L3-IS system is Gemini, which covers manufacturing processes of planning, scheduling and monitoring production.
-At L1 and L2 are the process control systems and SCADA system tube.
-Tube systems are interconnected with other systems U. S. Steel Kosice.

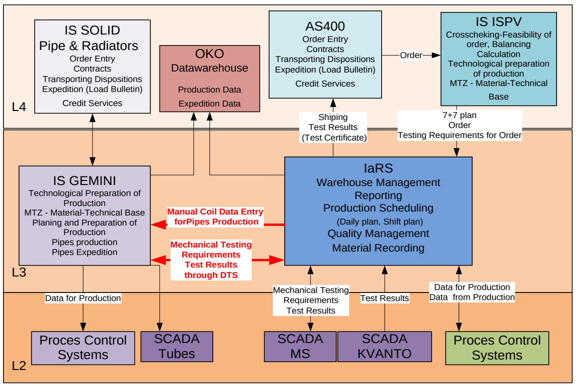

Fig. 7 Schematic of Tube Information systems

4 PROPOSES MEASURES TO OPTIMIZE IS

4.1 Requirements and alternatives for new IS

Based on an analysis of the tube plant processes and the risk assessment of the current IS, the following proposal is given to eliminate risks IS and tube plant process optimization.

Elimination of the risk of IS in Software category:
• Upgrade hardware and software system according to the present U. S. Steel Košice standard
• Integrate the system with the current U. S. Steel Košice systems sales, planning, production scheduling

Elimination of risks in IS Security category:
• Use database system with established access rights

Elimination of the risk of IS categories of people and knowledge:
• Use the same technology within the enterprise that allows sharing knowledge

Optimize processes Pipe:
• Integration of planning, production scheduling with business processes of U. S. Steel Košice
• Completion of quality modules

Considered alternatives for a new system of tube:

Alt.	Description	Advantages	Disadvantages
1	IS GEMINI migration to Visual FoxPro 9 and Oracle DB	Acceptable technology, direct technological migration of existing	Shortage of people with Foxpro knowledge, questionable future Foxpro support Isolated system
2	IS GEMINI migration to Java and Oracle DB	The same as Alt.1, Java remove Foxpro disadvantage	Labor intensive migration
3	New Oracle EBS (ERP modules from ORACLE)	EBS is corporate ERP system, integration with corporate processes	EBS requires to replace also IS Odbyt. EBS higher cost for license and customization for Tube
4	Replace IS Solid with existing IaRS system, AS400 for sales a ISPV for planning	Integrated system enable process optimization and eliminate risk, enable to share knowledge and people	Labor intensive enhancement of IaRS system, adding IS Gemini functionality to AS400 a ISPV

Alternative 3 was developed to the testing phase but due to the suspension of the implementation of the corporate ERP system EBS in U. S. Steel Košice this option was canceled. The recommended alternative is no. 4 for the following reasons:
1 Eliminating all risks of existing IS
2 Allowing for optimizing the processes of tube
3 Achieving relatively lower cost compared with Alt. 3
4 Supporting standards for HW / SW solutions in U. S. Steel Košice
5 Suitably incorporating the IS of the U. S. Steel Košice

4.2 Functional description of the new Tube IS

The new way of work in the Tube plant is proposed in this chapter with detailed specifications for new processes and changes in information systems. This proposal provides a number of optimization processes.

Figure 8 shows the interface of new information system Tube

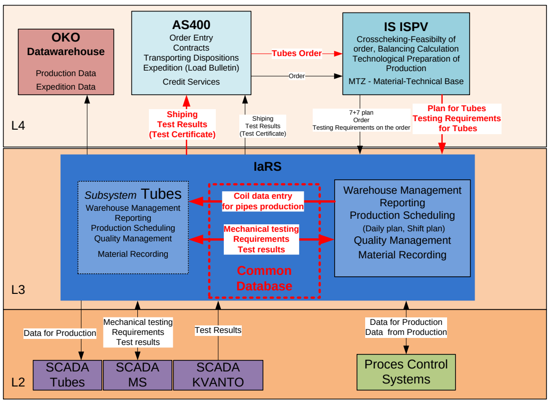

Fig.8 System interfaces

Implementation of new information systems in the Plant Division besides optimizing of IT systems also brings significant benefits in the process optimization. The current systems SOLID and GEMINI running on outdated IT platform FOX PRO will be replaced by AS400 systems fro order entry, ISPV for production planning and IaRS for production and warehouse management.

The main process benefits:

1 Elimination of double entering of the orders

The current system required a recording order to SOLID system as well as AS400 due to missing integration of systems. The sales order will be recorded only once after implementation, which will greatly simplify work and logistics business segment. Monitoring of contracts and communication between departments will be significantly improved.

2 Planning Optimization

The current planning system lies in the simple accumulation of orders in IS GEMINI, manual tracking and matching orders in IS SOLID and AS400. The user must laboriously gather information and options for the prompt response to changes in production are greatly limited. With ISPV implementation user obtains a sophisticated solution for fully-fledged production planning pipes from the casting to the final assembly. ISPV will also improve the functionality of determining order fulfillment as well as the yield rate of aggregates. Improvement planning can be achieved by minimizing of hot coil warehouse before Tube production units. Estimated savings is 40% compared to current existing warehouse.

3 Module Product Catalogue

Integration of the production parameters into the product catalog (ISPV) will standardize work in the quality department. Data with full specification of the requirements for testing and standards provide space for full integration into laboratory test U. S. Steel Kosice.

4 Production tracking, scheduling and warehouses.

The introduction of the new system in production will improve various activities. Detailed scheduling brings a unique sequence of tube production with clear integration into the existing plan with respect to the requirements of salesman and their customers. The introduction of the new tracking system should allow reduction of the tube production time resulting in a potential increase in unit capacity and faster order fulfillment. Implementation of advanced quality management system will reduce the error rate and the output quality while automating the evaluation of the test results will significantly reduce the labor intensity of workers. The introduction of enhanced functionality with bar code will optimize warehouse management of finished and work-in-progress products.

5 CONCLUSION

The paper provided an analysis of the business process optimization methods and related information systems also describing the ISA-95 model of the information system for manufacturing plant, its major functions and information interfaces. The different optimization methods are used for improving business processes.

Here we introduce some methods that are applied in modeling business processes, measuring and improving process performance, as well as ensuring statistical quality control. These methods are used in the U. S. Steel Kosice in improving technological processes and product quality, design of the new IS for production management and decision support.

Best practices in IT service management practices are given in the ITIL. The U. S. Steel Kosice has implemented some practices of the ITIL. This paper also introduces the KPI metrics. Standardization, centralization and integration of IS are the main factors to consider when to upgrade hardware / software infrastructure and applications of the IS software. The methodology of risk analysis points out the trouble spots that need to be eliminated, either by modifying the existing system or replacing it. Modeling processes through flowcharts clarify their functionality and reciprocal links.

The current state of Tube IS production operation was analyzed by the methodology of process modeling in terms of ISA 95 model. Comparing the current state of the Tube plant with the best practices we identified the missing functionality and interconnection between systems. We have identified the problem areas of the current system by the risk analysis methods, and proposed alternatives to their elimination. In the next section we introduced a proposal for new system.

The benefits of the new integrated system will include elimination of double order entry, optimization of production planning and integration of the tubes quality data that will lead to an increase in the product quality of pipes.

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