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METHODOLOGY OF ENVIRONMENTAL MANAGEMENT SYSTEM PROCESS MODELLING

Abstract:

Requests of interested parties, amongst which the customer has the central position, are starting points of quality management system that complies with requirements of ISO 9000ff and ISO 14000ff international norms. Regardless of the fact whether we want to arrange management system to meet the requirements of these norms, one should be able to recognize exact requests of interested parties. Classic structural model of organization must be upgraded through developed, documented and implemented processes. Processes are one of structural elements of each management system, and environmental management system, too. Scientists and experts do not agree about generally accepted methodology of process modelling.

Key words: Environmental Management System, methodology of process modelling.

OBJECTIVE

Despite the fact that only a small number of 332 organizations in Croatia possess ISO 14001 certificate as international confirmation of requested quality level of environmental management system (EMS), the idea of organisation, as marketing orientation and as business philosophy and everyday practice, is more and more existing in Croatians organizations.¹ Independently of the degree of awareness of management in organization, processes can be developed in any of the following ways: 1) in a long-established manner - which is based on „know-how“ of the most important parameters of business processes, with interventions only in situations when reliability of business process is seriously affected, 2) without any control, when in extreme cases the business process develops in completely uncontrollable conditions, 3) in partly controllable conditions – characterized by business process model according to chosen methodology, in conditions which are controlled in the same amount as the basic parameters that define them, and 4) in completely controlled conditions - those business processes whose basic parameters of definition are under complete control.²

In order to create completely controlled environment for developing of all processes in an organization, and EMS too, it is necessary that organizations processes be: 1) named, 2) described, 3) structurally/organised, 4) controlled, 5) managed, and 6) always improving. In order to fulfil it, business processes in organization need to be conceived, i.e. developed

¹ At the end of 2008 there were 332 organizations with certificate ISO 14001. The first one in Croatia issued to the organization Split Ship Management on 12th May, 1997. Quality Pages, Croatian Society for Quality.

² Basic parameters of definition of business processes are: a) *object of activity* (material, information, product, service and similar), b) *frequency of operation* (continually, sometimes only once, and similar), c) *area of activity* (state, city, company/organisation, part of company, and similar.), d) *manner of operation* (usual, uncontrollable, in partly controllable conditions, in completely controllable conditions).

according to chosen methodology. The problem lies in the fact that ISO 9001:2000 norm (*Quality Management Systems – Requirements*), an ISO 14001:2004 (*Environmental management Systems – Requirements and guidance for use*) requires the proof that business processes are managed, but methodology of business processes developing is not being suggested.³ The choice of methodology, and often its definition, is left to be made by the organizations management.

METHODS

The word „process“ evolves from Latin word „procedere“, which originally means „move“ or „go ahead“. This word form was followed by noun „processus“, which is translated as „process“ and means „... a series of actions, phases or events, development (in any direction or form) and transformation (inputs → outputs) of anything that was took under consideration (element, structure, sub-system, system, etc.).“

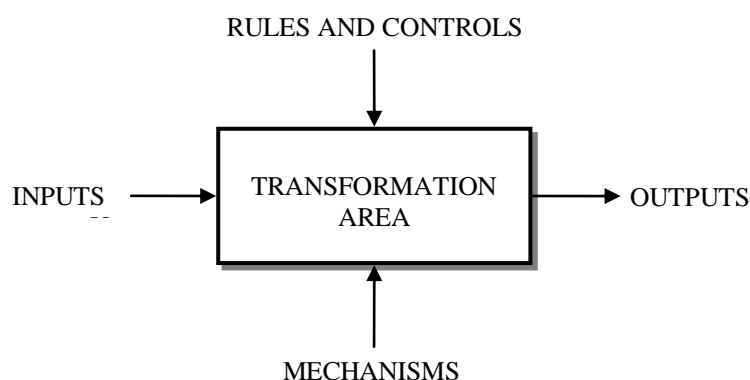


Figure 1. Process presentation

Source: According: Miroslav Drljača, „Methodology of Business Process Development in a Hotel Industry“, 18th Biennial International Congress Tourism & Hospitality Industry 2006, *New Trends in Tourism and Hospitality Management*, Faculty of Tourism and Hospitality Management, Opatija, 2006, p. 752-763.

Process can be also defined as “a course, evolution or manner through which something was born or transformed, it is a development, a procedure ...”⁴ HRN EN ISO 8402:1996 norm defines the process as a “group of mutually independent resources and actions which

³ At writing about methodology of business process development the authors avoid presenting final solutions, because methodology of business process development represent intellectual ownership (*know how*) of the author or consultant. Rare examples in Croatian literature are: Ivan Mamužić, "Procesni pristup u sustavu upravljanja kvalitetom", *Kvaliteta*, Broj 3, Infomart, Zagreb, 2002, p. 3-4, in which author presents possible methodology of business process development and shows part of diagram of process flow; Miroslav Drljača, "Proces kao ishodište modela ISO 9001:2000", *Kvaliteta*, Broj 3, Infomart, Zagreb, 2002, p. 5-6, in which the author presents methodology of business process development and shows break-up of one business process; Živko Kondić, *Kvaliteta i ISO 9000*, Tiva, Varaždin, 2002; and partly: Nenad Vulić, *Sustavi upravljanja kvalitetom*, Veleučilište u Splitu, Split, 2001. Total presentation of methodology of business process development is written in: Nenad Injac i Marko Bešker, *Metodologija izgradnje poslovnih procesa u sustavu kvalitete*, Oskar, Zagreb, 2003.

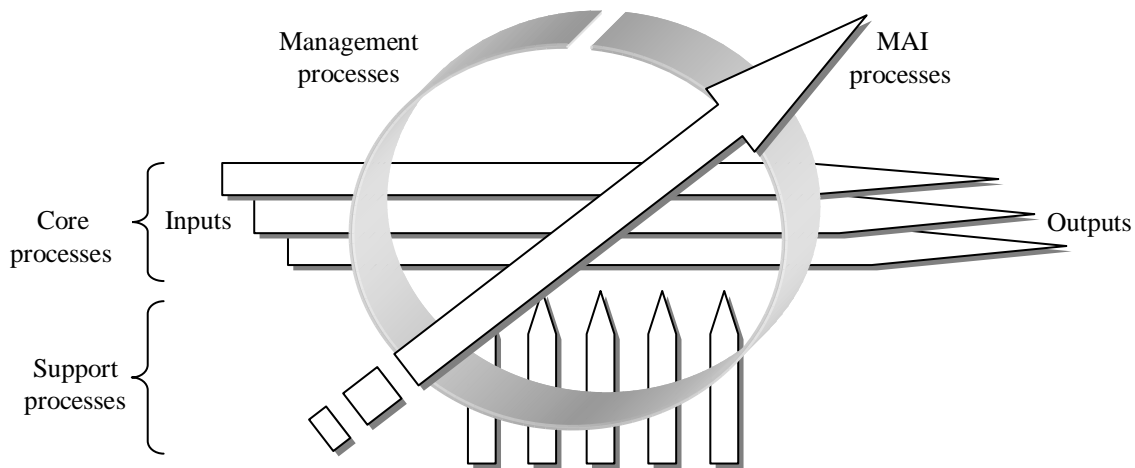
⁴ Želimir Domović, Šime Anić i Nikola Klaić, *Rječnik stranih riječi*, SANI-PLUS, Zagreb, 1998, p. 1163.

transform input elements into output elements.”⁵ Transformation of input elements into output is in fact a transformation of one into the other. Each process thus becomes unique and special. Transformation of input into output is a system of complex interactions of operations and resources. It is a technology. It is “*know how*.” International norm ISO 9000:2000 defines the process as „group of connected or mutually dependent activities which transform input into results.“⁶ The application of process system in a company, its definition and mutual interaction, as well as the management of process system – can be called „process approach.“⁷ The process approach has the advantage of permanent managing of links *between* – particular processes (within the process structure), which is the structural element of management system, –*and*– combination and mutual interaction of these elements.⁸ When applied in the EMS context, this process approach underlines the importance of the following:

- understanding and meeting of interested parties requests,
- need of supervision of EMS in value added conditions,
- achieving results of EMS and its efficiency, and
- permanent improvement of EMS, based on impartial estimation.

Regardless of many possible types of processes, and many diversities of process structures, all processes in organization can be divided into four types:⁹

- processes for the management processes of an organization (*management processes*),
- processes for managing resources (*support processes*),
- realization processes (*core processes*), and
- measurement, analysis and improvement processes (*MAI processes*).



Source: Made by author.

Figure 2. Four typical types of business processes

⁵ HRN EN ISO 8402 *Quality management and quality assurance – Vocabulary*, (ISO 8402:1994; EN ISO 8402:1995), *Quadrilingual version*.

⁶ International norm HRN EN ISO 9000:2002 *Quality management systems – Fundamentals and vocabulary* (ISO 9000:2000, EN ISO 9000:2000), *Version quadrilingue*, p. 40.

⁷ International norm HRN EN ISO 9001:2002 *Quality management systems – Requirements* (ISO 9001:2000, EN ISO 9001:2000), p. 14.

⁸ Except process structure, structural elements of management system of every organization are:: 1) strategic documents of company (mission, vision, strategy, politics, general and special managerial aims), 2) organisation, 3) resources, 4) partnerships, and 5) communication and notification.

⁹ After the revision in international norm ISO 9001:2008 on 15th November 2008, we are talking about four typical processes that can be identified. Before that revision we had three types of business processes: management processes, core processes and support processes.

Many industries have more than one core or „macro“ group of business processes, including: management of business system, management of resources, realisation of products and services, measurement and control.¹⁰

Management processes are important for progress of core processes, as well as of support process. These are processes of development, planning, quality management, management of organisation, environmental management, too. Because of entirety and directions of their influence onto core processes – Management processes are called – *vertical* processes.

Support processes which are also called logistical or resourceful processes, are directed towards producing satisfaction of internal users within organisational structure. They are able to create added value for the customer. However, this influence on making added value is indirect and is fulfilled through support of core processes. Support processes are auxiliary business processes and represent a support to core processes. With regard to direction of activities onto core processes, they are also called – *vertical* processes.

Core processes are focused on the achievement of satisfaction of customers, (buyers/users). They directly add new value to the product, meaning service. They meet requests of the customer and are generator of their contentment. Core processes, processes of fulfillment or realization, are processes whose result – in form of product or service has direct value confirmation on the market. The plan and the product in their creation are in core processes strongly integrated. Core processes are called – *horizontal* processes.

Measurement, analysis and improvement processes (MAI) include the processes needed to measure and gather data for performance analysis and improvement of effectiveness and efficiency. They include measuring, monitoring, auditing, performance analysis and improvement processes (e.g. for corrective and preventive actions). Measurement processes are often documented as an integral part of the management, resource and realisation processes, whereas analysis and improvement processes are treated frequently as autonomous processes that interact with other processes, receive inputs from measurement results, and send outputs for the improvement of those processes.

Numerous *management, support, core* and *MAI* processes develop within this process structure simultaneously. They have a series of interactions. Each interaction in certain measure affects the business process result in terms of meeting the interested parties request.

RESULTS

At identifying of processes in an EMS as an integral part of integrated management system in organization and dividing them into types, it is necessary to avoid identification of business function and business process in an organization, too. Essential differences are at least these as follows:

¹⁰ Herbert C. Monnich, Jr., *ISO 9001:2000 for Small and Medium Sized Businesses*, American Society for Quality, Milwaukee, Wisconsin, USA, 2001, p. 3.

Table 1. Types of business processes of environmental management system

1. Process of indentifying environmental aspects.
2. Process of indentifying and updating legal requests.
3. Process of environmental management program development.
4. Process of education about EMS.
5. Process of providing internal communication.
6. Process of providing external communication.
7. Process of EMS documentation development.
8. Process of documentation management.
9. Process of waste management.
10. Process of waste water treating.
11. Process of ecological monitoring of purchasing.
12. Process of work protection in emergency situation.
13. Process of air and ground treating.
14. Process of noise treating.
15. Process of danger identification, keeping and response in emergency situation.
16. Process of measurement and control.
17. Process of calibration of measurement equipment.
18. Process of preventive activities providing.
19. Process of corrective activities providing.
20. Process of quality statements management.
21. Process of internal audits providing.
22. Process of management review.
23. Process of environmental costs management.
24. Process of EMS improvement.

Source: Made by author.

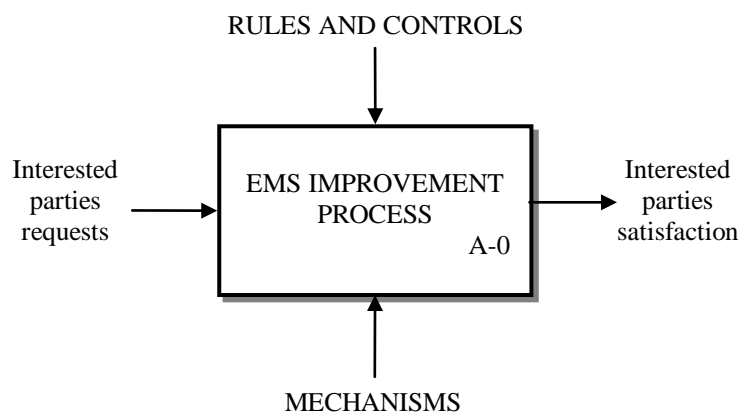
- business function is static category, while process is dynamic category,
- business function is mostly operated within one structural unit of an organization, and is usually named after it, while process implies more participants from more structural units in an organization,
- business function is operated within an organization, while process can have participants from outside of the structural organisation, but who are important for progress of concrete process,
- business function is run by functional manager, and process is run by process manager, and identification of these roles must not be a rule but an exception,
- process is one of the possible inner aspects of supervision of costs, quality costs as well, while function is not,
- due to all these differences, function is a narrower concept than process.

Basic task of management of an organization during of processes development is in fact establishing, directing and describing of events during transformation process of input into output. In order this task could be accomplished, we must have suitable methodology of business process development within the quality system, an EMS, too. Different companies use dissimilar methodologies. Modelling of methodology in great measure depends on knowledge about quality and environmental management, too. Regardless of which

methodology is used by teams who developing processes, they should remain consistent when they apply it in developing all processes in an organization. The management in an organization must create its own methodology or choose already existing methodology of process development and process of EMS, too. Teams for process development in practice often encounter the problem of verification of correctness of their own solutions. This paper presents one of the possible approaches of methodology of process development including processes of EMS, too.

1. Identification of business processes of EMS is initial task in process developing and demands (from the team): naming of the process, appointing of the leader (manager) of process, defining of its objective(s), defining of input and output requests, description of mechanisms, rules and controls. Afterwards, they must determine outer and inner users of process results, as well as designate process steps as consisting parts of the processes in an EMS, too.

2. Diagram of the context of process is simple display of process of EMS at the highest level from which an interaction can be seen: rules, controls and mechanisms during transformation of input into output.



Source: Made by author.

Figure 3. Diagram of the context of business process in EMS

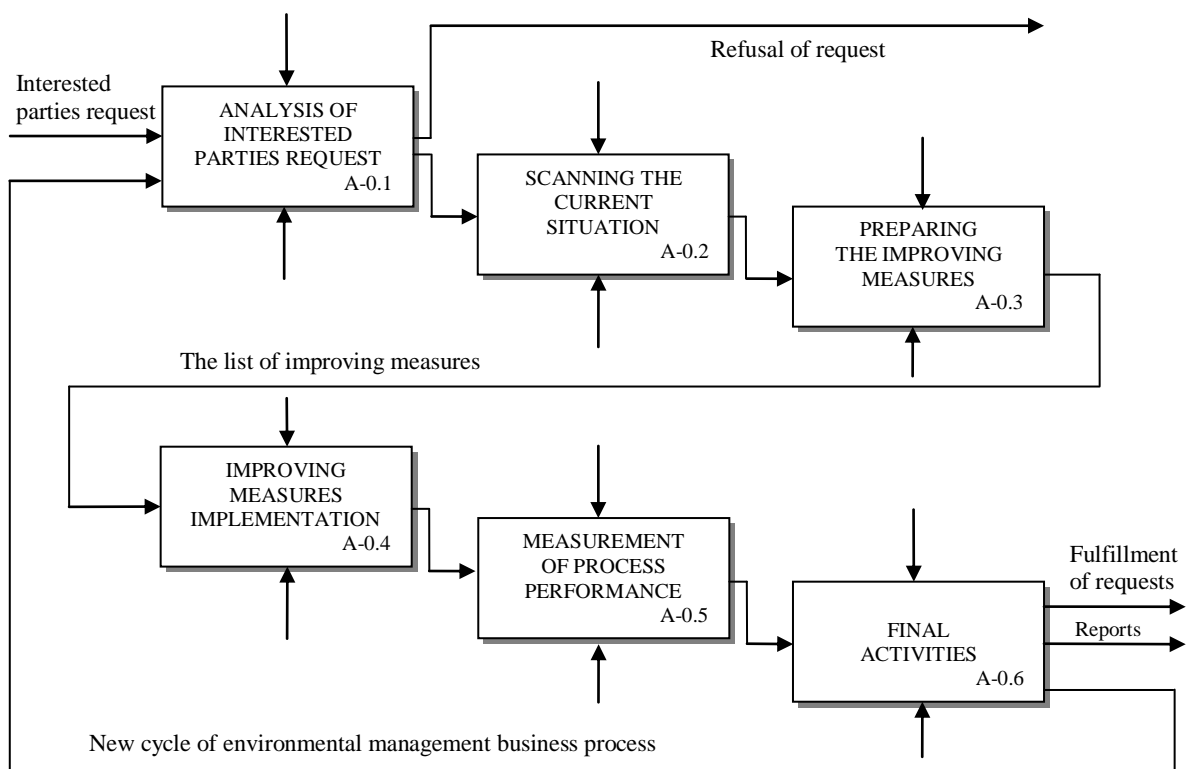
3. Display of static model of process presents logical sequence of process steps development as consisting parts of processes of the EMS. This phase of process development identifies structural units where individual process step develops, and locates control points at which measurements will be performed – and thus manage the process of EMS.

4. Process description describes requests that result from requests and needs of interested parties, then from specifications, norms, regulations, elaborations, methods and resources. Here are also identified requests, objectives and descriptions of their fulfillment, as well as allowed deviations. By defining of allowed deviations we in fact determine the minimum quality level of processes of EMS.

5. Diagram of process decomposition is methodologically confirmed graphical representation of the process with all its consisting parts - process steps. It represents logical sequence of process steps development. It specifies input, rules and controls, mechanisms and

output of each process step. Diagram of decomposition represents a technology. It shows process of EMS per process steps that logically develop in sequence. At least one exit from a process step is also an entry into the next. Process steps in the processes of EMS improvement (for example) are identified as follows:

- A-0.1 Interested parties requests.
- A-0.2 Scanning the current situation.
- A-0.3 Preparing the improvement measures.
- A-0.4 Improving measures implementation.
- A-0.5 Measurement of process performance.
- A-0.6 Final activities.



Source: Made by author.

Figure 4. Decomposition of EMS improvement process

6. Description of process steps in processes of EMS must specify input, output, mechanisms, rules and controls of each process step, as well as locate structural organization unit in which certain process step develops. Also, written procedure is named, if any of process steps should be additionally documented.

7. Presentation of dynamic model of the process is plan of implementation of developed process of EMS into functional structure of organization. The plan shows in which structural organization unit develop activities of each process step, and which unit of organization is responsible for their execution. Making of presentation of dynamic model of process is a precondition of the process organisation itself.

Table 2. Dynamic model of EMS improvement process

Structural units Process steps												Partners
		General Manager	Quality / Environmental Manager	Human Resources Divis.	Production Division	Financial Division	Commercial Division	Purchasing Depart.	Sales Department	Marketing Division	Maintenance Division	
Analysis of interested parties request A-0.1			■		□	□		□	□	□	□	
Scanning the current situation A-0.2			■		□			□	□	□	□	□
Preparing the improving measures A-0.3	□		■		□	□	□			□	□	□
Improving measures implementation A-0.4			■		□		□			□	□	□
Measurement of process performance A-0.5			■		□			□	□		□	□
Final activities A-0.6	□		■	□	□	□	□			□	□	□

Source: Made by author.

8. Establishing of responsibility for the process is logical continuation of work on EMS process development. It implies exact establishment of responsibility of concrete executor of individual process step. After establishment of responsibility, the conditions for establishment of management team for concrete process are prepared. Management team is headed by manager of process of EMS. It can be Quality Manager or Environmental Manager or other competent person. In this way we have a model of process organisation, based on team work.¹¹

9. Plan of measuring within the process is based on description of process in EMS, i.e. defined limits of allowed deviations, up to which process still shows reliability as one of its crucial characteristics. The plan of measuring defines names of control points where certain measurements will be performed. It also defines target value, allowed deviations and measuring method. By all these measurements, comparisons with target values, and possible application of corrective measures and activities – we manage the process in EMS.

10. Plan of providing information within process of EMS is necessary in order to clearly define: which participant of process provides the information, who receives it, what its contents is, and when is the information sent and received.

11. Making of further process documentation implies writing of procedures for particular process step which definitely needs it, and writing of lower level documents, like work instructions, check lists, plans of corrective measures and activities, etc.

¹¹ Pere Sikavica, "Procesna i timska organizacija", Slobodno poduzetništvo, br. 18/98, Zagreb, 1998, p. 108-116.

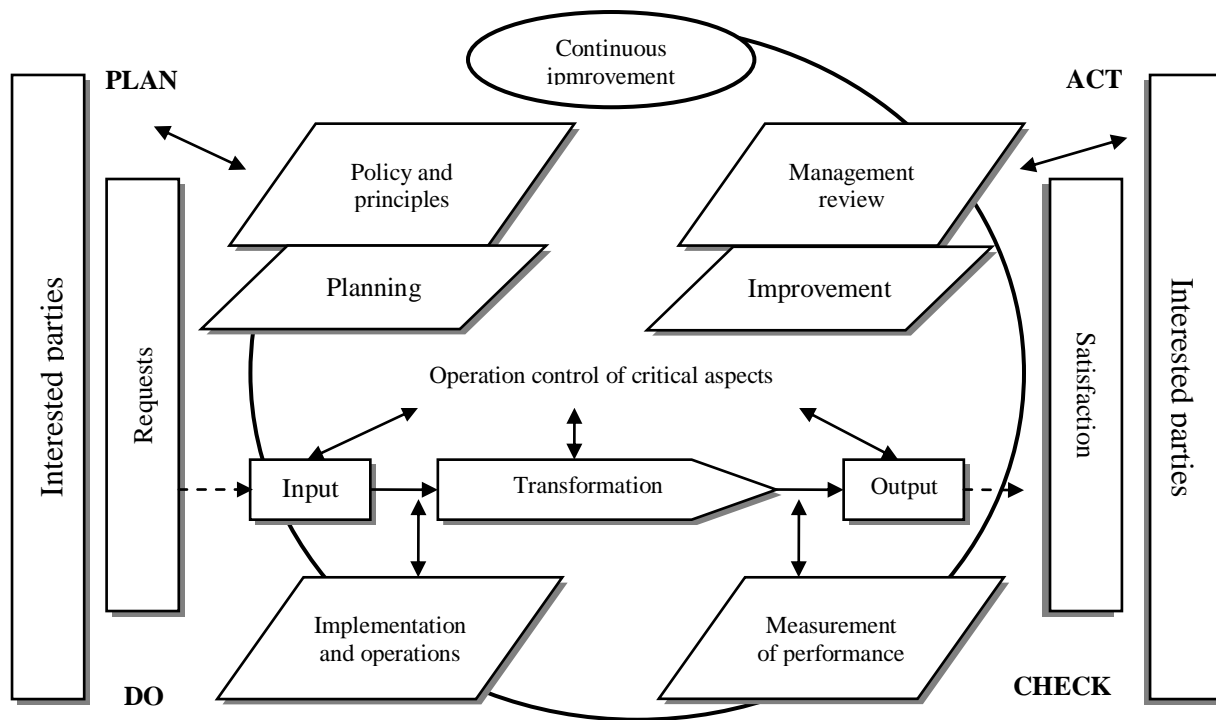


Figure 5. The generic model of integrated management system

Source: Dick Hortensius, Louise Bergenhenegouwen, Rene Gouwens and Annemarie De Jong, "Towards a generic model for integrating management systems," ISO Management Systems, Vol. 3, No. 6, 2004, p. 21-28.

CONCLUSION

In the audit of EMS it is necessary to document and prove the request for process approach and process management. The difficult question for organizations is: which methods were used to name, describe and organise structural units of processes, and how were these processes controlled, managed and constantly improved. There are no ready universal solutions. Imitating of another company's solutions or adoptions of lesser adjustments of these solutions as their own optimum solutions are – delusions, and in practice will be causing entropy. Every process is different. It can even have the same name, same number and same names of process steps, same inputs and outputs, but still there are no identical processes. Differences and originalities are happening in the interaction of inputs and outputs, rules, and controls, as well as mechanisms in each process step - in the area of transformation of inputs into outputs. In the context of quality management systems we may conclude that ISO 9001:2000 international norm and ISO 14001:2004 does not suggest methodology of process development, but demands the proof that processes are being managed. It can be concluded that every methodology of process developing is satisfactory, if it can prove the management of processes.

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Sažetak:

METODOLOGIJA MODELIRANJA PROCESA U SUSTAVU UPRAVLJANJA OKOLIŠEM

Zahtjevi zainteresiranih strana, pri čemu centralno mjesto ima kupac, polazište su sustava upravljanja kvalitetom sukladno zahtjevima međunarodne norme ISO 9000ff i ISO 14000ff. Bez obzira na to želimo urediti sustav upravljanja sukladno zahtjevima ovih normi kako bi bio sposoban prepoznati stvarne zahtjeve zainteresiranih strana. Klasični model organizacijske structure mora biti poboljšan razvijenim, dokumentiranim i implementiranim poslovnim procesima. Oni su jedan od strukturnih elemenata svakog sustava upravljanja među kojima i

sustava upravljanja okolišem. Među znanstvenicima i stručnjacima nema suglasja oko opće prihvaćene metodologije modeliranja poslovnih procesa.

Ključne riječi: Sustav upravljanja okolišem, metodologija modeliranja procesa.