

Integrated Management System in construction company-effective tool of quality, environment and safety level improving

Jozef Gašparík

Slovak University of Technology in Bratislava, Faculty of Civil Engineering
jozef.gasparik@stuba.sk

CONTRIBUTION PRESENTS THE STRUCTURE OF INTEGRATED MANAGEMENT SYSTEM (IMS)

according to international standards ISO 9001:2008, ISO 14001:2004 and STN OHSAS 18001:2009, which consists of 3 management systems focused to quality, environment and safety of building processes. The purpose of paper is to describe basic steps concerning the development of IMS. Paper analyses basic processes of IMS like company vision, IMS planning, implementing, monitoring, revive and improving. The paper presents documents concerning the IMS as result of IMS standard analysis. Special part of contribution is IMS planning and brief steps of environment and safety risk evaluation and management. This methodology was successfully implemented into 20 Slovak construction companies. Author, on the bases of practical experiences, during the process of IMS development and implementation in construction firms and buildings, informs about effects influenced by this management system during the process of building planning and realization.

Keywords

management, system, quality, environment, safety

INTRODUCTION

One of the most important factor for construction company to be successful on market is assuring :the quality and reliability of buildings, health and safety of all employees, the quality of environment on site and in region, where building is construct. The key for effective management of all these aspects is development and implementation of effective *Integrated Management System* (IMS) in construction company (FIG.1). In contribution there is presented structure of *Integrated*

Management System (IMS) according to international standards ISO 9001, ISO 14001 and OHSAS 18001, which consists of 3 management systems: Quality Management System (QMS) according to ISO 9001:2008, Environmental Management System (EMS) according to ISO 14001:2004 and Health Protection and Safety Management System (HPSMS) according to STN OHSAS 18001:2009. Author on the bases of practical experiences during the process of IMS development and implementation in construction firms and buildings informs about effects

influenced by this management system during the process of building planning and realization. Development, implementation and improvement of effective integrated management system (IMS) in construction companies can lead to quality production improving, safety of all employees of construction company, application of all national and international standards concerning the environmental aspects and finally to customer satisfaction. It is essential, that IMS must be understood and implemented by all employees. IMS is not an aim, but a way to satisfaction of construction company clients, better work conditions of company employees, success on market and reputation in own country and abroad.

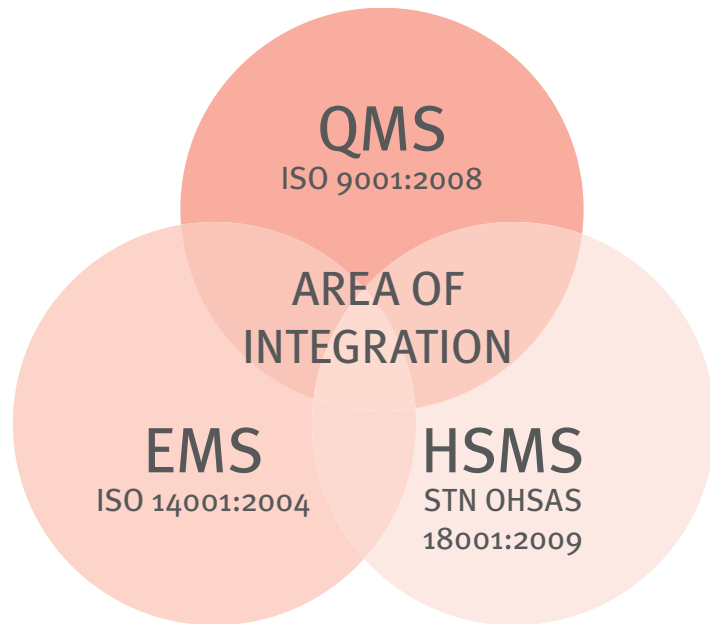


Figure 1: Integrated Management System

Development of IMS

During the process of IMS development is useful start with QMS according to requirement of ISO 9001, because most of the documents required by this standard is possible to implement also for next two management systems: EMS and HPSMS. The basic processes of EIMS are in table 1. The whole process of IMS development starts by input audit of existing company system (FIG 2). This audit can be provided by trained employee in all three management systems, or by external qualified expert. The result of this input audit is level of confidence of existing management system of construction company to requirements of ISO 9001, ISO 14001 and OHSAS 18001. The key person in whole process of IMS development and implementation has director of construction company (Szalayova, 2004). This person is responsible for vision of his company defined in IMS by:

- ▶ quality policy,
- ▶ environmental policy,
- ▶ health and safety policy.

All employees of construction company must be informed about these policies and try to keep it in practice.

Director of company determines one person of top management for function: manager of IMS. This person is responsible for development, implementation and improvement of IMS. Manager of IMS must be trained in all three management systems before starting his or her work at this very important function.

During the process of IMS planning is useful start with QMS and analysis of all processes according to ISO 9001 (Jarsky, 1996), create interaction of these processes, approve quality documents and forms of future records (see table 2). The most important steps concerning the development of EMS are:

- ▶ design of register of environmental aspects and impacts in all important areas of company: administrative building, machine park, buildings etc. (example of environmental aspects – emissions to air, releases to water and land, waste and by products etc.)

- ▶ determination of environmental aspects and impacts with high and middle level of risk,
- ▶ setting of environmental targets for aspects with high and middle level of risk,
- ▶ determination of programme, how to meet environmental targets.

During the process of HSMS we can go by similar way:

- ▶ design of register of dangers and threatens in all important areas of company: administrative building, machine park, buildings etc. (example of dangers and threatens – mechanical, physical, chemical, biological etc.)
- ▶ determination of dangers and threatens with high and middle level of risk,
- ▶ setting of health and safety targets for dangers and threatens with high and middle level of risk,
- ▶ determination of programme, how to health and safety targets fulfilled.

IMS documentation

The basic document of integrated management system is IMS manual, in which are described these information:

- ▶ profile and basic information about construction company,
- ▶ organization vision including quality, environmental, health and safety policy ,
- ▶ organizational structure with presentation of all key employees including representative person for IMS,
- ▶ brief description and interaction of QMS processes with reference to related documents (procedures, internal instructions, QMS documents and records etc.)

- ▶ brief description of elements and processes of EMS and HSMS with reference to related documents (procedures, internal instructions, EMS and HSMS documents and records etc.)

In organizational instruction are except of organizational structure said competences (responsibilities and authority) of all company members in area of all three management systems. All, by ISO 9001 required work procedures, like control of documents and records, internal audit, control of non-conformity, corrective and preventive actions, can be implemented for all management systems. In table 2 there is list of documents and records required by ISO 9001:2008. Those docu-

ments and records, which can be used also for next two management systems, are signposted by symbol IMS.

For EMS are useful except of IMS manual procedures concerning the environmental aspects related to building processes and site conditions. For HSMS is useful health and safety building manual, in which are described necessary health and safety preventive actions for building employees.

The basic documents concerning the quality, environment, health and safety monitoring on building is *inspection and test plan*, in which are described these information:

- ▶ brief description of quality, environment , health and safety tests,

N.	Basic processes of IMS	SUBPROCESSES		
		QMS (ISO 9001:2008)	EMS (ISO 14001:2004)	HSMS (STN OHSAS 18001:2009)
01.	Construction company vision	Quality Policy	Environmental Policy	Health and safety Policy
02.	IMS Planning	<ol style="list-style-type: none"> 1. QMS processes analysis 2. Interaction of QMS processes 3. Legislation 4. Quality targets 5. Quality Plans 	<ol style="list-style-type: none"> 1. Analysis of environmental aspects and impacts 2. Registration of law and other requirements 3. Risk evaluation 4. Environmental objectives and targets 5. Environmental programme 	<ol style="list-style-type: none"> 1. Identification of dangers and threatens 2. Registration of law and other requirements 3. Risk evaluation 4. Health and safety objectives and targets 5. Health and safety programme
03.	Implementation and operating of IMS	<ol style="list-style-type: none"> 1. Resources, roles, responsibility and authority of employees 2. Competence, training and awareness of employees 3. Communication 4. Documentation 5. Control of documents 6. Operational (building) control 7. Emergency preparedness and response 		
04.	Checking, corrective and preventive action	<ol style="list-style-type: none"> 1. Monitoring and measurement 2. Evaluation of compliance 3. Nonconformity, corrective action and preventive action 4. Control of records 5. Internal audit of IMS 		
05.	Management review	Management review of IMS		
06.	Improving of IMS	Continually improvement of IMS due to its analysis		

Table 1 Model of IMS

QMS – Quality Management System

EMS – Environmental Management System

HSMS – Health and Safety Management system

IMS – Integrated Management System

- ▶ quality, environment , health and safety criterion (legislation, law, notices, European and state standards),
- ▶ the result of tests (conformity or non-conformity to criterion)
- ▶ name, datum and signature of persons responsible and competent for test realization and evaluation.

ImS planning and risk evaluation

One of the most important document on building site is Project Quality Plan (PQP) and its part Inspection and Test Plans (ITP). The content of these documents is in Figure 3. The most important steps concerning the development of EMS and HSMS are described in chapter 2. Risk evaluation “R” depends on probability of incidence of environmental aspect and impact (EMS) and dangers and threatens (HSMS):

$$R = P \times C \quad (1)$$

where:

- R – environmental or safety risk
- P – probability of incidence of environmental aspect and impact (dangers and threatens) – see table 3
- C – consequence to environment and to health of employees – see table 4

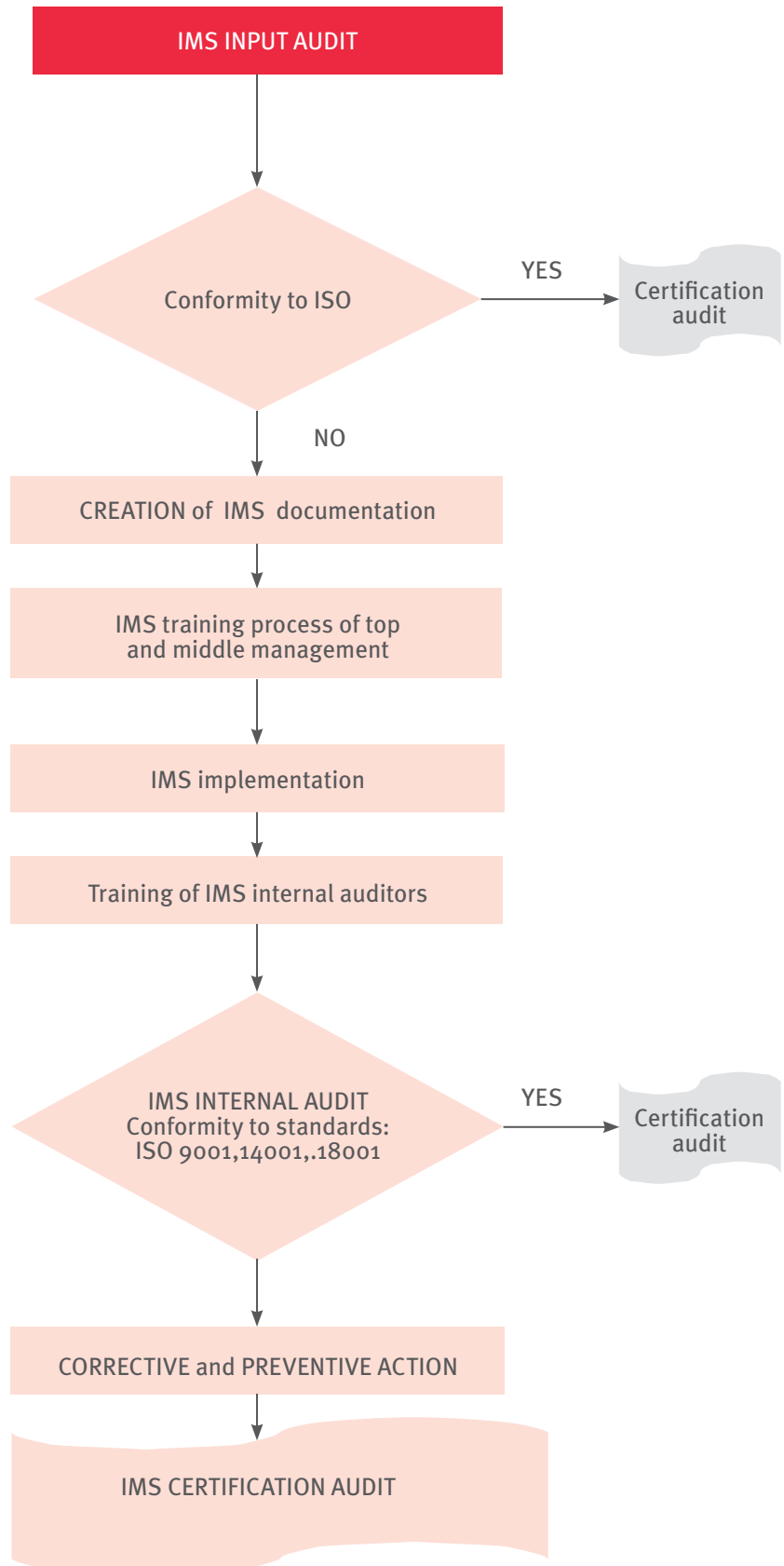


Figure 2: Basic steps concerning the IMS development

N.	Document or record	Document or record description	Responsible person
01.	D –IMS 4.01	List of documents and records	IMS MANAGER
02.	D 4.02	Interaction of QMS processes	IMS MANAGER
03.	R –IMS 4.03	Distribution list of documents and	IMS MANAGER
04.	R – IMS 4.04	Declaration about document study	IMS MANAGER
05.	D- IMS 4.05	List of internal and external operating documents	IMS MANAGER
06.	D – IMS 4.06	Overview of organization readings	IMS MANAGER
07.	R – IMS 4.07	Document remark	IMS MANAGER
08.	R – IMS 4.08	Overview of document changes and revision	IMS MANAGER
09.	D 5.01	Strategy of quality management and improvement	Director, IMS MANAGER
10.	D–IMS 5.02	Quality, environmental, health and safety policy	Director, IMS MANAGER
11.	D–IMS 5.03	Quality, environmental, health and safety targets	IMS MANAGER
12.	D –IMS 5.04	Decree (certificate) for IMS manager	IMS MANAGER
13.	R –IMS 5.05	Records of management consultation	IMS MANAGER
14.	R –IMS 5.06	IMS management review	IMS MANAGER
15.	D –IMS 6.01	Competences of organization employees	Personnel manager
16.	D–IMS 6.02	Plan of employee training	Personnel manager
17.	R–IMS 6.03	List of trained people	Personnel manager
18.	R–IMS 6.04	Evaluation of training process effectiveness	Personnel manager
19.	R–IMS 6.05	Records from internal training process	Department manager
20.	D–IMS 6.06	Infrastructure of organization	Economist, Director
21.	R–IMS 7.01	Contract review	Director
22.	R 7.02	List of material needs	Site manager
23.	R–IMS 7.03	Selection and evaluation of material and work suppliers	Purchaser
24.	R–IMS 7.04	Evidence list of monitoring and measuring devices	Person responsible for metrology
25.	R–IMS 7.05	Evaluation of software topicality	Employee working with software
26.	R–IMS 7.06	Inspection and test plan	Site manager
27.	R–IMS 7.07	Building effectiveness evaluation	Site manager
28.	R–IMS 8.01	Timetable of IMS internal audit	IMS MANAGER
29.	R–IMS 8.02	Report from internal audit	IMS MANAGER
30.	R–IMS 8.03	Corrective action	IMS MANAGER
31.	D–IMS 8.04	Preventive action	IMS MANAGER
32.	D–IMS 8.05	Monitoring and measurement of IMS processes	Department manager
33.	R–IMS 8.06	Evaluation of organization by customer	IMS MANAGER
34.	R–IMS 8.07	Records concerning the complaints, environmental problems and work injuries	IMS MANAGER
35.	R–IMS 8.08	Analysis of IMS readings	IMS MANAGER

D -document R – record

Table 2 List of IMS documents and records (Gašparik, 2005)

PROJECT QUALITY PLAN

1. Building Characteristics
2. Building Site Characteristics
3. Organization of building processes
4. Building process participants and their competences
5. Description of building quality assurance system
6. Inspection and Testing plans:
 - Building process indication
 - Identification of testing or inspection needed for building process
 - Person responsible for inspection process
 - Testing method description
 - Quality criterion (standards, regulations)
 - Result of test (conformity or non conformity)
 - Name of person responsible for testing, datum and signature
 - Records (certificates, audit opinion etc.)

Figure 3: Project Quality Plan

Probability	P (points)
low	1
middle	3
high	9

Table 3 Probability „P“ of incidence of environmental aspect and impact or dangers and threatens (example)

Consequence to environment	Consequence to health and safety of company employees	C (points)
Minimal (non important)	Small hurts Ability not to work max. 1 day	1
Small influence to environment	Small hurts with treatment Ability not to work (1 day-2 weeks)	3
Important influence to environment Temporary transcendence of limits	Health damage without permanent consequence Ability not to work (2 weeks- 6 months)	9
Very important influence to environment Seriously damage of environment	Heavy damage of health, death Ability not to work (more than 6 months)	15

Table 4 Consequence „C“ to environment and to health of employees (example)

On the value of risks we can determine risk categorization and management –see table 5.

Index	Risk „R“ (points)	CATEGORIZATION OF RISK	RISK MANAGEMENT
I.	1-14	Insignificant risk	Not required
II.	15-80	Plumbless risk	Is required
III.	81-135	Seriously risk	Is necessary

Table 5 Risk categorization and management (example)

IMS implementation and operation

Before IMS implementation and operation there is necessary to assurance training of top and middle management of construction company in all three management systems to better understand requirements of ISO 9001, ISO 14001 and OHSAS 18001. The trained members of top and middle management in IMS through internal training process give necessary information to other employees. There is important during the IMS implementation and operation to understand IMS documentation in all function of organization and managing and keeping of all required records through the year. IMS must be implemented and operate in all buildings and plants. Another important feature during the implementation and operating of IMS is fulfilling of IMS programme, which arise front out of determination of aims of all three management systems. The requirement of EMS and HSMS is to prepare employees of company to possible emergency situation.

Internal audit of IMS

after some time of IMS implementation and operating (min. 3 months) is necessary before external audit by certification body to do internal audit of IMS according to ISO 19011:2002 “Guidelines for quality and/or environmental management systems auditing”. Construction company shall ensure that internal audits of IMS are conducted at planned intervals to:

- ▶ determine whether IMS conforms to requirements of ISO 9001, ISO 14001 and OHSAS 18001 and has been properly implemented and is maintained,
- ▶ provide information on the results of audits to management.

Internal audit of IMS can be done by trained internal auditors in all three management systems or by external qualified auditor. For nonconformity finding out by internal audit must be receive corrective actions.

The last step before certification process of IMS is its management review. The top management of company shell review of IMS at planned intervals (min. once a year) to ensure its continuing suitability, adequacy and effectiveness. Reviews shall include assessing opportunities for improvement and the needs for changes to IMS including the quality, environmental, health and safety policy, objectives and targets.

Effects influenced by IMS development and implementation

By the process of integration of 3 management system into one we can reduce documents about 40 % (see table 1 and 2) against three separated management systems. Practically all procedures required by ISO 9001 for QMS we can implement for IMS (control of documents, control of records, corrective and preventive actions, internal audit etc.). In a case of internal and external audit of IMS in departments and buildings we can do it at the same time take into account quality, environment and safety aspect.

Another effects of IMS development and implementation:

- ▶ continually satisfaction of external and internal customers,
- ▶ building quality assurance right the first time with the aim of minimization of finance loss due to corrective actions during the building process realization,
- ▶ minimization of reclaims during the building guaranty time,
- ▶ respect of valid technical standards (EN, ISO, national) involving them into technological procedures and inspection and test plans,
- ▶ increasing the culture of building management and realization by application of modern information technology,
- ▶ consistent respect of valid legislation documents concerning the environments and safety,
- ▶ elimination or minimization of problems concerning the quality, environment and safety by effective application or preventive actions,
- ▶ prevention of ecological accidents and problems during the building realization,
- ▶ prevention of fatal accident or long term incapacity to work of construction company employees,
- ▶ order on building site, waste separation and recycling, prevention of land and ground water contamination, air and noise protection, elimination of dustiness etc.,
- ▶ consistent application of health protection and safety of all persons (employees, suppliers, visitors) in building site by application of personal protective work tools.

CONCLUSION

Development, implementation and improvement of effective integrated management system (IMS) in construction companies can lead to quality production improving, safety of all employees of construction company, application of all national and international standards concerning the environmental aspects and finally to customer satisfaction. It is essential, that IMS must be understand and implement by all employees. IMS is not aim, but way to satisfaction of construction company clients, better work conditions of company employees, success on market and reputation in own country and abroad.

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