

Implementing an Innovation Management System at National Research and Development Institute for Industrial Ecology - ECOIND

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Original research

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Abstract

The paper presents the activities performed for the implementation of the innovation management system integrated into the existing quality, environmental, and occupational health and safety management system of the ECOIND institute. The basic terms used in the project are defined and the international and Romanian standards are explained.

The results obtained consist in identifying, introducing and describing the processes related to innovation and establishing the interaction of these processes with the other processes of the management system, establishing the policy and objectives related to innovation, reviewing the system procedures and the quality, environmental and occupational health, and safety management manual to include the innovation processes and elaborating the occupational procedures to keep these processes under control. The paper shows the main benefits of the innovation management system and the impact of this system for NRDI ECOIND in several aspects: technical, technological, economic, social, and environmental.

Keywords: *standard, management, system, innovation*

INTRODUCTION

The management systems are complex tools through which the management at the highest level of an organization transposes its policy regarding a certain aspect into practice by achieving the established objectives. A management system is designed, developed, implemented, maintained, and continuously improved following the reference management standard.

The standard is a document adopted by consensus and approved by a recognized body, which provides guidelines, rules, or characteristics on common and repeated uses, for their activities or results, aiming to obtain an optimal degree of order, in a given context [1].

The reference management standards are international standards related to the organization developed by specialized technical committees and approved by the International Organization for Standardization (ISO). These standards have the ISO indicative. Over time, there have been approved several families of standards regarding the management systems for different fields, the most known and applied in organizations being as the following: ISO 9000 and ISO 10000 - for quality management, ISO 14000 - for environmental management, ISO 22000 - for food safety management, ISO 27000 - for information security management, ISO

45000 - for occupational health and safety management, ISO 17025 - for the competence of testing and calibration laboratories.

The international standards are adopted at European level by the European Committee for Standardization (CEN) and the European Committee for Electrotechnical Standardization (CENELEC) as European standards (norms) in three official languages: English, French and German and bear the EN ISO indicative. International and European standards are adopted at the national level by the standardization bodies from each country by translating or publishing the English version. In Romania, the national standardization body is the Romanian Standardization Association - ASRO which approves Romanian standards and adopts international and European standards with the following indicatives [2]:

STAS - Romanian standards approved before 8/28/1992

SR - Romanian standards approved after 8/28/1992

SR ISO - Romanian standards which adopt international standards

SR CEI - Romanian standards which adopt international standards in the electrotechnical field

SR EN - Romanian standards which adopt European standards

SR EN ISO - Romanian standards that adopt European standards that adopted international standards.

The management system is a set of correlated or interacting elements of an organization through which the policies and objectives are established, as well as the processes through which those objectives are achieved [3]. The elements of the ensemble refer to the internal and external context of the organization, the infrastructure, the work environment, the organization, the personnel with roles and responsibilities, the organizational culture, resources, etc.

Organization policy: intentions and direction of an organization as they are officially expressed by its management at the highest level [3].

The objective is the result to be achieved [3]. An organization can and must set objectives: 1. in several fields: quality, environment, health and safety at work, innovation, financial; 2. at different levels: by the organization, by the process, by the department, by project, etc.; 3. with different terms: strategic, tactical, immediate, etc.

A process is a set of related or interacting activities that use the input elements to deliver an intended outcome that may be a product or service [3]. The input elements are composed of the output elements of the upstream process and all the categories of resources necessary to carry out the activities. A process is identified by name, has a designated manager, and is delimited by the other processes/ activities.

The innovation management system is defined as a set of correlated or interactive elements of an organization through which the policies and objectives related to innovation are determined, as well as the processes through which these objectives are achieved [4].

What is innovation? Innovation is everything new or improved. The opposite of innovation is stagnation. Innovation is the process that begins with generating an idea and ends with its valorisation as a new or significantly improved product/service/process. Innovation is the use of the final result, new or improved, of the research-development and technological transfer activities, realized in the form of knowledge, product, service, or process, in the activity of the

organization and/or its commercialization on the market. The innovation process includes evaluation and acceptance of the new idea, research, and development activities for determining the production technology/methodology, the actual production, marketing, and valorisation of the obtained product/service. Regarding the innovation management system, the reference standard ISO 50501:2019 Innovation management-Innovation management system-Guidance was approved at the international level but has not yet been adopted at the European and national levels. At the national level, ASRO approved and published the Romanian standard SR 13572:2016 Innovation Management Systems (SMIn). Requirements, which constitute the reference standard for the development and implementation of the innovation management system in Romanian organizations. According to this standard, innovation is the activity that results in the successful obtaining and implementation on the market of a product/service/process/technologies/marketing methods/organizational methods/new business model or significant improvement of the existing one/ones in different fields of activity [4].

To carry out an optimal and systematic innovation process in the institute, the management of the institute decided to implement innovation management. According to the adopted strategy, the development of innovation management at National Research and Development Institute (NRDI ECOIND) includes: setting up a technological transfer center, training a body of innovation managers, and implementation of the innovation management system.

Thus, in 2015, the Technological Transfer Centre ECOIND (CTT ECOIND) was established in the institute and was approved by MECS, order no. 5298/24.09.2015, and then in 2016 it was certified, following the verification audit, as an innovation and technological transfer infrastructure (MECS certificate no. 82/11.07.2016). The main objective of the centre is to increase the degree of valorisation of the research and development activity results.

The main activities of CTT ECOIND to increase the degree of valorisation and transfer of the research-development activity results (methods, methodologies, technologies, models) to

economic agents consist of: assisting in the field of industrial property (patents, trademarks, designs); recording and managing the research-development activity results; intensifying and improving the marketing activity for disseminating the research results with potential for valorisation (organizing workshops to promote knowledge transfer); promoting at European level the research results in the Research for Industry platform and the Enterprise network; and development of projects in partnership with organizations from the business environment for the direct transfer of the research-development activity results.

To provide the technology transfer center with qualified human resources for capitalizing the innovative technologies and promoting the innovation, the institute has prepared a body of innovation managers by training two series of 10 researchers, the first series in 2015 (IRECSON Technology Information Centre) and the second in 2017 (Technological and Business Incubator INMA-ITA).

Regarding the innovation management system, the staff from the management systems department was given the responsibility for developing and implementing this system in ECOIND Institute.

As in the institute is implemented and certified an integrated quality (according to EN ISO 9001: 2015), environmental (according to EN ISO 14001:2015) and occupational health and safety (according to ISO 45001:2018) management system, the working team decided that the innovation management system will be developed and implemented within the existing integrated management system. The reference standard (SR 13572:2016 Innovation Management Systems (SIMn). Requirements) meets the requirements established for the revised international standards starting with 2015: identical framework structure, identical main texts, and common terms with identical main definitions. This facilitates the integration of the innovation management system with the management systems already implemented in the institute.

Any change in the integrated management system must be done in a planned manner. Thus, for the development and implementation of the innovation management system, a design and implementation program was drawn up, in which the activities to be performed, the deadlines, and the responsibilities were established in three work stages.

Table 1. Design and implementation program SMIn SR 13572:2016

No.	Stage / Activities	Term	Responsibilities
STAGE I : Organizing NRDI ECOIND for the implementation of SMIn			
1.1	Appointment of the head of the work team, Identifying processes and interactions between processes	30.08.19	CEO Manager of the Department of Management Systems (DMS)
1.2	Training in the field of innovation management		
STAGE II : SMIn planning			
2.1	Establishing the policy and objectives in the field of innovation Establishing the list of procedures necessary to be elaborated or revised; Preparation of the Work Plan for the elaboration of documents	30.09.19	CEO Manager DMS
STAGE III : Design and implementation of SMIn			
3.1.	Elaboration/revision of procedures according to the work plan	31.10.19	Manager DMS
3.2	Revision of the management manual	30.09.19	
3.3	Training on the implementation of procedures Implementation of elaborated procedures	30.11.19	

RESULTS AND DISCUSSION

Stage I Organizing NRDI ECOIND for the implementation of SMIn

The activities started by acquiring the reference standard and appointing the Management Systems department chief as responsible for the theme, who later, within the system, will be the representative for the innovation management.

The responsible for the theme attended the training course "Innovation Management System" organized by ASRO during May 6-8, 2019.

Following the analysis of the reference standard requirements, the work team found that, in general, they are known to researchers, while some were already implemented. NRDI ECOIND represents a research-development institute, the concept of innovation being familiar to researchers, there is an ingrained culture of innovation and a practice of protecting research results by patenting and valorising the research results both within the institute by using them in the portfolio of services offered to clients and in proposals for new research projects, as well as by external transfer to beneficiaries. The statement of the institute general manager refers to the innovative and creative spirit of the researchers. The requirements of the reference standard regarding innovation must be formalized within the integrated management system implemented in the institute.

Stage II SMIn planning

At this stage, the following documents were reviewed and approved: 1. the vision and mission of NRDI ECOIND -09/16/19, 2. the integrated policy on quality, environment, innovation, occupational health, and safety - 09/16/19, and 3. the declaration of the general manager - 09/16/19. NRDI ECOIND policy in the field of innovation is: "Transforming research results into new and better services to remain competitive in the market".

The management commitment at the highest level was completed as follows: to stimulate creativity and encourage trust, diversity, and tolerance among employees, and to support intellectual property and intellectual property rights on the results of research-development-innovation activities.

The processes of the integrated management system implemented in the institute are divided into two main categories: key processes and support processes. The support processes include the following categories: management processes, product realization processes and measurement, analysis, and improvement processes.

Under the requirements of the reference standard, the work team identified innovation processes to be addressed by the integrated management system: innovation management - from the category of management processes, idea management and the innovation project - from the category of product realization processes, and evaluation of the innovation process - from the category of measurement, analysis, and improvement processes.

These processes are introduced in the list of processes from integrated system management manual chapter 4.4 "Integrated management system and its processes". The interactions between the system processes are established and can be found in the "Scheme for identification and interaction of processes in the NRDI ECOIND organization" attached to the management manual.

The general and specific objectives of ECOIND Institute have remained unchanged as they include aspects related to innovation, of which we mention: 1. increasing the number of patented and transferred technologies, 2. valorising the results of the research-development activities: methods, methodologies, techniques, and technologies by providing specialized technical assistance and services, and 3. carrying out activities to promote the results of the research-development activities.

To document the innovation process integrated with existing management system documentation, the team has identified the need to review the system procedures and the integrated system management manual introducing the processes related to innovation, and to elaborate on three new working

procedures: “Management of Ideas”, “Innovation Project”, and “Analysis of the Innovation Project and its Results” to control these processes.

To review the procedures and the management manual and to elaborate the new procedures, the working team prepared, according to the general

procedure “Development and management of SIM procedures” code PG-01, the work plan in which for each document is specified the identification code and are established the responsibilities and terms for revision/elaboration, verification, endorsement, approval, dissemination, and implementation.

Table 2. Works plan for revision/elaboration of SIM documents

Procedure	Cod	Revision/ Elaboration	Verification	Endorsement	Approval	Dissemination	Implement- ation
Internal and external communication	PS-01	Manager DMS	Vice manager DMS	Deputy CEO	CEO	Manager DMS	Manager DMS
	Term	16.10.19	25.10.19		31.10.19	08.11.19	15.11.19
Management responsibility	PS-02	Manager DMS	Manager DMS	Deputy CEO	CEO	Manager DMS	Manager DMS
	Term	16.10.19	25.10.19		31.10.19	08.11.19	15.11.19
Management analysis and improvement	PS-03	Manager DMS	Vice manager DMS	Deputy CEO	CEO	Manager DMS	Manager DMS
	Term	16.10.19	25.10.19		31.10.19	08.11.19	15.11.19
Documented information	PS-04	Manager DMS	Vice manager DMS	Deputy CEO	CEO	Manager DMS	Manager DMS
	Term	16.10.19	25.10.19	30.10.19	31.10.19	08.11.19	15.11.19
Competence, training, and awareness	PS-06	Manager DMS	Vice manager DMS	Deputy CEO	CEO	Manager DMS	Manager DMS
	Term	16.10.19	25.10.19	30.10.19	31.10.19	08.11.19	15.11.19
Internal SIM audit	PS-14	Manager DMS	Vice manager DMS	Deputy CEO	CEO	Manager DMS	Manager DMS
	Term	16.10.19	25.10.19	30.10.19	31.10.19	08.11.19	15.11.19
Processes and product monitoring and measurement	PS-15	Manager DMS	Vice manager DMS	Deputy CEO	CEO	Manager DMS	Manager DMS
	Term	16.10.19	25.10.19	30.10.19	31.10.19	08.11.19	15.11.19
Records control	PS-17	Manager DMS	Vice manager DMS	Deputy CEO	CEO	Manager DMS	Manager DMS
	Term	16.10.19	25.10.19	30.10.19	31.10.19	08.11.19	15.11.19
Analysis of the innovation project and its results	PL-15	Manager DMS	Vice manager DMS	Deputy CEO	CEO	Manager DMS	Manager DMS
	Term	16.10.19	25.10.19	30.10.19	31.10.19	08.11.19	15.11.19
Management of ideas	PL-16	Manager DMS	Vice manager DMS	Deputy CEO	CEO	Manager DMS	Manager DMS
	Term	16.10.19	25.10.19	30.10.19	31.10.19	08.11.19	15.11.19
Innovation project	PL-17	Manager DMS	Vice manager DMS	Deputy CEO	CEO	Manager DMS	Manager DMS
	Term	16.10.19	25.10.19	30.10.19	31.10.19	08.11.19	15.11.19
Management manual	MM-CMISSM	Manager DMS	Vice manager DMS	Deputy CEO	CEO	Manager DMS	Manager DMS
	Term	20.09.19	25.09.19	30.09.19	30.09.19	08.11.19	15.11.19

Stage III. Design and implementation of SMIn

According to the plan, the work team revised the system procedures to include the innovation management process as well as the management manual which became the "Quality, Environment, Innovation and Occupational Health and Safety Management Manual" code MM-CMISSM edition 10 / 20.09.19. Chapter

8.4 “Innovation management process” describes the process and states that in ECOIND the product innovation is mainly applied, the model of the innovation process is linear, "market pull" type and includes the following main stages:

- identification, collection, and selection of innovative ideas,

- transposing ideas into results/objectives obtained through research and development activities:
 - methods for determining pollutants/contaminants
 - water treatment, wastewater treatment, soil treatment technologies
 - training courses/training programs
 - validation of the research-development results/patenting activities,
 - practical application of the validated results by services offered to the beneficiaries through contract/valorisation of patents.
- At this stage, the work team developed the three newly planned work procedures.
- The “Management of Ideas” procedure code PL-16 establishes the rules and responsibilities for the management of innovative ideas. The newly selected ideas are registered in the “Table of ideas” and constitute the portfolio of ideas of the department/laboratory/compartment.

Table 3. Table of ideas

No	Name	Brief presentation	Applicability	Valorisation	Potential collaborators/ beneficiaries	Observations

The “Innovation Project” procedure code PL-17 is applied for the transposition of a valuable idea into a set result/ objective. The planning of the innovation project is done in the “Innovation Plan” which includes:

1. The objective of the innovation plan
2. Members of the work team and related responsibilities
3. Expected terms and results on execution stages
4. Need for raw materials, materials, equipment, and apparatus
5. Internal and external collaborations
6. Planning the work stages
7. Planning the analysis and verification stages
8. Potential risks and actions to reduce or eliminate risks
9. How to valorise the results

According to the research project and the related subsidiary research contracts.

The procedure “Analysis of the innovation process and its results” code PL-15 serves for the Representative for innovation management to do the annual analysis of the innovation process and to evaluate the obtained results compared to the established objectives, to prepare the analysis performed by management.

CONCLUSIONS

The innovation management system was implemented in the institute according to the design and implementation program. The documentation of the system was integrated into the previously implemented management system by reviewing the management manual and the

In the institute, the protection of the intellectual property is ensured by patenting. According to the CTT ECOIND procedure “The patent” code PSP-24 there is a person designated to be responsible for the technical archive and patent records, a person who is also in contact with OSIM and maintains all documented information regarding patents.

The implementation process of the innovation management system was completed by training the researchers from the institute. The training and evaluation program at ECOIND level for 2019 was completed with two pieces of training given by the Representative for Innovation Management in November: “Innovation Management System” and “SMIn Operational Procedures”.

The results of the innovation process are valorised on one hand in the current activity of the institute by using them in commercial contracts concluded with economic operators and as activities in research projects and on the other hand by ceding the use of patents by sale, the grant of a license, etc. through the Technological Transfer Centre according to the “Technological Transfer” procedure code PSP-23.

system procedures and by developing new operational procedures.

Implementing and maintaining the innovation management system brings to the institute numerous benefits such as:

- developing the capacity to promote the “new” in products, services and technologies that meet customer requirements and applicable regulations, leading to increased competitiveness and improved performance;
 - increasing the possibility of adapting to changes in the business environment and of standing out in the market;
 - developing the capacity to identify new opportunities through innovation, associated with the context and objectives of the institute;
 - facilitating adaptation to crisis and/or unforeseen circumstances;
 - providing support for sustainable development initiatives.
- The following aspects distinguish the impact of the innovation management system for ECOIND Institute:
- technical impact - development of the portfolio of working methods with new or substantially improved methods for determining pollutants or classes of pollutants and various new or substantially improved methods to highlight the impact of various pollutants on environmental factors;
 - technological impact - development of new or substantially improved technologies for water treatment, wastewater treatment and soil remediation, which ensures the water and soil quality indicators;
 - economic impact - expressed by the financial value obtained by capitalizing on the results of the innovation process: the value of contracts concluded with economic operators and the market value of patents;
 - social impact - is manifested by increasing the quality of life ensured by the quality of water (potable, bathing, used), air and soil;
 - environmental impact - ensuring environmental protection by reducing/eliminating polluting factors, improving the quality indicators of environmental factors, ensuring compliance with legal requirements, and other environmental regulations.

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