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CONTENTS

1. MONITORING OF ACTIVITIES IN THE FIELD OF INDUSTRIAL WASTE MANAGEMENT
   Karina HERMANN, Witold BIAŁY 7

2. VALUTAZIONE DELLE NON CONFORMITÀ NELL'ESEMPIO DI UN'AZIENDA ITALIANA
   Maria HORODECKA, Radosław WOLNIAK 18

3. DECISION SUPPORT SYSTEMS IN WASTE MANAGEMENT – A REVIEW OF SELECTED TOOLS
   Karolina JĄDERKO, Barbara BIAŁECKA 32

4. ANALYSIS OF THE CAUSES THE QUANTITATIVE CHANGES AND TRENDS IN CONFERRED ISO 9001 CERTIFICATES IN POLAND. RESEARCH BASED ON THE DATA FROM AUDITS
   Agata JUSZCZAK-WIŚNIEWSKA, Mariusz J. LIGARSKI 42

5. BENEFITS OF MCHP XRGI USE IN THE BREWING INDUSTRY
   Piotr KALETZ, Tomasz WAŁEK 51

6. THE ROLE OF LEADERS IN SHAPING THE QUALITY IN THE CONTEXT OF PREPARATION OF SELF-ASSESSMENT FOR THE POLISH QUALITY AWARD COMPETITION
   Dorota KSIĄŻEK, Mariusz J. LIGARSKI 58

7. AN ANALYSIS OF DEGRADED POST-MINING AREAS TO BE RE-DEVELOPED – CASE STUDY: SLIME SEPARATORS
   Krzysztof MICHALSKI, Bartosz SZCZĘŚNIAK 67

8. STRUCTURE AND FUNCTIONING OF THE EUROPEAN CONFORMITY ASSESSMENT SYSTEM OF PRODUCTS
   Michał MOLENDZ 79

9. НАПРАВЛЕНИЯ ПОВЫШЕНИЯ ЭФФЕКТИВНОСТИ СКЛАДСКОЙ ДЕЯТЕЛЬНОСТИ ПРЕДПРИЯТИЙ
   Victor NORDIN, Bella BEISULTANOVA 90
10. THE ESSENCE OF COMMUNICATION PROCESS IN WASTE MANAGEMENT SYSTEM
   Monika STĘPIEŃ, Barbara BIAŁECKA  
   98

11. ANALYSIS OF PRODUCTION PROCESS AND COMPLAINTS IN AN AUTOMOTIVE COMPANY
   Beata SZCZERBA, Barbara BIAŁECKA  
   109

12. WORKPLACE QUALITY DURING THE WELDING PROCESS
   Dorota WANDZICH, Grażyna PŁAZA  
   117

13. THE RELATIONSHIP BETWEEN THE IMPLEMENTATION OF CSR AND THE DISTANCE TO AUTHORITY
   Radosław WOLNIAK  
   128

14. QUALITY MANAGEMENT AND CORPORATE SOCIAL RESPONSIBILITY
   Radosław WOLNIAK, Patrycja HĄBEK  
   139

15. SELECTED METHODS AND TOOLS FOR ANALYSING PRODUCT NONCONFORMITY IN THE AUTOMOTIVE INDUSTRY
   Michał ZASADZIEŃ  
   150

16. DISAGGREGATION OF SO₂ AND PM₂.₅ EMISSIONS FROM SMALL DOMESTIC COMBUSTION SOURCES LOCATED IN SOUTHWESTERN POLISH PROVINCES - CASE STUDY
   Damian ZASINA, Jarosław ZAWADZKI  
   160
MONITORING OF ACTIVITIES IN THE FIELD OF INDUSTRIAL WASTE MANAGEMENT

1.1 INTRODUCTION

The production of waste is the integral part of human economic activity and the recovery of waste is a problem of all societies. The wastes are a threat for all components of environment: the surface of the earth, hydrosphere, biosphere and atmosphere. Industrial wastes are by-products from mining processes and industrial processing. They usually arise within the industrial plant and they are harmful or dangerous for the environment [14].

In Poland, the amount of industrial waste in recent years has decreased significantly, but they still account for over 90% of all generated waste. There are produced 120 mln ton of waste per annum [5], and consequently Poland belongs to the group of major producers of industrial waste in Europe. Thanks to modern technologies there is a growing possibility of the use of industrial waste, mainly in construction and road works. Unfortunately, there is still a large amount of waste that goes to the landfill as well. The most of waste that going to the landfill are either unsuitable for the use or disposal, or left to the discretion of such entities as steelworks or coal mines and cannot be traded [14]. In order to rationally use of the generated waste and prevent the threats connected with their disposal it is necessary to monitor the activities undertaken by entities in all stages of industrial waste management (i.e. during their generation and collection, transportation, utilization and treatment as well as during their storage). Therefore it is needful to develop a new methods and tools that supporting the process of monitoring and control of entities which dealing with the industrial waste.

1.2 THE ESSENCE OF INDUSTRIAL WASTE MANAGEMENT

The industrial waste that are generated in the economic sector are the dominant stream of all produced waste in Poland. In 2013 the total number of generated industrial waste was 128.3 mln ton, that accounts for approx. 90% of all produced waste [5]. More than 80% of these wastes come from mining industry (especially from bituminous coal mining) and energy industry and metallurgy [12]. Hence, the largest amount of wastes is generated in regions where the mining industry, energy industry and metallurgy are located (primarily in the Upper Silesia, Lower Silesia and Małopolska Province).

The largest share in waste are primarily the waste from washing and cleaning of minerals (34,4%), waste from floatation dressing of non-ferrous metal ores (30,2%)
and dust-slag compounds from wet treatment of furnace waste (11.5%) [5]. The percentage share of particular groups of waste in 2013 is shown in Tab. 1.1.

**Tab. 1.1 The percentage share of the largest groups of produced industrial waste in Poland in 2013**

<table>
<thead>
<tr>
<th>Waste by group</th>
<th>The amount of produced waste</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[mln ton]</td>
</tr>
<tr>
<td>TOTAL</td>
<td>128.3</td>
</tr>
<tr>
<td>Waste from washing and cleaning of minerals</td>
<td>34.4</td>
</tr>
<tr>
<td>Waste from flotation dressing of non-ferrous metal ores</td>
<td>30.2</td>
</tr>
<tr>
<td>Dust-slag compounds from wet treatment of furnace waste</td>
<td>11.5</td>
</tr>
<tr>
<td>Coal fly ash</td>
<td>4.5</td>
</tr>
<tr>
<td>Soil and stones</td>
<td>4.0</td>
</tr>
<tr>
<td>Mixtures of fly ash and solid waste originating from limestone methods of desulphurisation of waste gases</td>
<td>3.8</td>
</tr>
<tr>
<td>Waste from mineral non-metalliferous excavation</td>
<td>3.5</td>
</tr>
</tbody>
</table>

Source: Own elaboration based on: [5]

The areas of industrial waste utilization can be different depending on their physic-chemical properties. Thanks to new technologies the possibilities of the use of industrial waste are getting larger. At present, the most of industrial waste is applied in construction, road works, mining industry and agriculture, among other to [9]:

- production of Portland clinker,
- production of cement,
- production of building ceramics and aggregates,
- fertilization and soil melioration,
- recovery of coal,
- neutralization of sewage and wastes,
- engineering works,
- reclamation works,
- other works in mining technologies.

The level of recovery of industrial waste in Poland in 2009-2013 is shown in Fig. 1.1. The percentage share of recovered industrial waste in recent years is about 70%. Approximately 5% of waste has undergone treatment and, unfortunately, up 25% of unused economically waste are still landfilled or temporarily stored.

Production companies that generate the waste are legally obliged to pursue a policy of management of produced waste. Each of these entities implements their own, individual waste management system. Dealing with such a large amount of industrial waste is related to undertaking many activities. According to the Waste Act of 14 December 2012 waste management is considered to be “waste gathering, transport and processing, including supervision over such activities as well as further conduct on the places of waste treatment and activities undertaken by waste seller or intermediary
in waste trade (…)" [13]. Therefore, the individual waste management system of each company consists of many processes. Implemented in company the waste management system should take into account the type and quantity of produced waste, the existing technological solutions and the applicable standards, legal acts and regulations [15].

In accordance with the objectives and tasks (related to waste management) that are contained in National Waste Management Plan should aim to [6]:

- reduce to a minimum the movements of waste,
- increase the share of recovered waste,
- increase the share of treatment of waste (without storage),
- reduce the amount of waste stored in landfills,
- increase the degree of the use of industrial waste in underground mine workings (including recovery).

Additionally, companies that implement the waste management system should take into account the objectives which are included in provincial waste management plan. The systems of particular companies are a secluded systems. In the most cases, the companies are managing only those residues from which they obtain the financial benefits [15]. At the moment, does not exist one complex industrial waste management system on the national or even provincial level. Incomplete use of waste generated by the different companies causes the stream of waste directed on the landfill is a problem on a large scale. There are many legal obligations incumbent on the companies. These include above all [13]:

- conducting waste documentation (waste transfer note, waste record card),
- handing a yearly compiled list of waste produced in to the Marshal of Voivodeship until 15th March each year,
- possessing of the relevant decisions (permission for waste transport, permission for waste production or an integrated permission in the case of conducting installations that causes the environmental pollution).
However, often the regulations are not being fully respected and the efforts to protect the environment and waste management are taken improperly. The most common reasons of this situation are: economic aspects, ignorance of regulations and insufficient control of the supervisory authorities.

1.3 THE ROLE OF MONITORING OF INDUSTRIAL WASTE MANAGEMENT

According to the Polish dictionary, the notion of “monitoring” is understood as a continuous observation and control of processes and phenomena or a continuous supervision over some protected objects [10]. The monitoring of waste should therefore involve the observation and controls of all the processes connected with waste management and also involve the supervising activities over the subjects that produce such wastes or manage them.

In Poland, the first activities aimed at organizing the monitoring of waste were undertaken in the year 1990 by the State Inspection of Environmental Protection within the frames of state monitoring of environment condition [9]. Until the year 2006 the Inspectorates for Environmental Protection were responsible for the monitoring of waste that gathered information about [7]:

- the amount of waste produced with the inclusion of its usage, neutralization, also in terms of neutralization through storage,
- the largest producers of hazardous waste,
- waste disposals including a degree and way of securing them,
- a full turnover of hazardous waste.

An obligation to monitor the activities concerning waste management results from legal acts, among others, the Waste Act of 14 December 2012. At present the data on waste production and management along with a registry of granted permissions are gathered by the Voivodeship Marshal Offices, however, the Inspectorates for Environmental Protection supervise law abiding concerning the environment protection and conduct the research and evaluation of environment condition.

The obligation of conducting monitoring is also incorporated in the EU law related to both waste management and environment protection. One of the most important acts of EU law on environment protection is the Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control). As it concerns an integrated pollution prevention it also includes the regulations directly related to waste management [3].

This Directive says that each installation should be utilized only when it had an integrated permission granted which refers to appropriate requirements regarding waste monitoring and management that are produced by such installation [3].

On the basis of the Directive, there may be 3 main types of monitoring distinguished, connected with the activity of enterprises [8]:

- emission monitoring,
- process monitoring,
- monitoring of influence on the environment.
The monitoring of activities concerning industrial waste management is only a part of the entirety of the system of environment monitoring and is placed in the group of “process monitoring”. The bodies, granting the integrated permissions for the enterprises possessing installations, the functioning of which causes environment pollution, should take into account some factors concerning the conduction of monitoring, e.g. what is the purpose of monitoring conduction, who should conduct monitoring, what should be monitored and in what manner. These factors are presented and described in Tab. 1.2.

### Tab. 1.2 The factors taken into account when issuing the integrated permission

<table>
<thead>
<tr>
<th>Factors</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>„Why” monitor?</td>
<td>The main purpose of monitoring is the compliance assessments as well as the environmental reporting of industrial emission (however, monitoring data obtained for one purpose can serve other purposes). In all cases it is important that the objectives for undertaking the monitoring are clear for all the parties involved.</td>
</tr>
<tr>
<td>„Who” carries out the monitoring?</td>
<td>The responsibility for monitoring is generally divided between the competent authorities (Marshal Office, Voivodeship Environmental Protection Inspectorates) and the operators (companies that conduct the installations). It is highly important that monitoring responsibilities are clearly assigned to all relevant parties (operators, authorities, third party contractors) so that they are all aware of how the work is divided and what their own duties and responsibilities are.</td>
</tr>
<tr>
<td>„What” to monitor?</td>
<td>The parameters to be monitored depend on the production processes, raw materials and chemicals used in the installation.</td>
</tr>
<tr>
<td>„How” to monitor?</td>
<td>A method of monitoring and expressing the emission limit value depends on the objectives set for monitoring of waste management. Different types of units can be applied. In all cases, the units should be clearly stated and they should match the relevant parameter, application and context. Monitoring results are presented as a report. The report includes the summary and the conclusions from the compliance assessment.</td>
</tr>
</tbody>
</table>

Source: Own elaboration based on: [8]

The monitoring of waste ought to constitute the grounds for the elaboration of plans and strategies of waste management, both on the level of community and the whole country as it enables observation of changes in the amount of waste produced, possibilities of its utilization, neutralization or storage, as well as changes in the domination of the individual waste groups [7]. The structure of monitoring is presented in Fig. 1.2.

The objective of monitoring on a domestic level is to gather information from the voivodeship databases for the decision-makers of central level, however, the monitoring on a local level is organized for the needs of the particular objects (e.g. disposal sites) in order to determine their impact on the environment [9].

When conducting the monitoring one should, if only possible, take actions connected with the optimization of the costs of monitoring but always having in mind the objectives of monitoring that are supposed to be achieved. A return on the monitor-
ing conduction may be improved through undertaking such activities as: selecting appropriate quality requirements to comply with, optimization of a number of monitoring parameters and frequency, supplementing the regular monitoring with special research and so on [8].

In general, the subjects taking part in the system of industrial waste monitoring involve both the supervising bodies and the enterprises themselves. In connection with this, those subjects undertake various activities that include among others [1], [2], [14]:

- examining waste properties (monitoring of waste stream),
- submitting evaluation, reports on waste management,
- obtaining/granting integrated permissions,
- submitting total reports on environment condition (including the ones on waste management),
- evaluation of the effectiveness of technical solutions adjusted for a maximal impact reduction of objects on the environment,
- developing the characteristics of particular waste (“basic characteristics” and “compliance tests”) – in order to know whether the particular waste may be stored on a disposal site and where it can be managed,
- verifying the compliance of the ways of industrial objects utilization with the conditions set in the administrative decisions,
- developing the programs and plans of waste management.

The entities that participating in the system of industrial waste monitoring in Poland are presented in Fig. 1.3.

The owners, producers, disposal sites and carriers are obliged to send information on waste management to Marshal Offices. Furthermore, the Marshal Offices submit a total report to the Minister of Environment Protection who also supervises the Chief Inspector of Environmental Protection. The Voivodeship Environmental Protection Inspectorates supervise the subjects dealing with waste management and are obliged to prepare and send the reports on control to the Chief Inspectorate of Environmental Protection.

Unfortunately, the current system of industrial waste monitoring in Poland has some drawbacks. The monitoring of subjects dealing with waste management is not
of continuous character but only a periodical one in a form of submitting a yearly statement on the amount of waste produced by waste producers. There are no tools that could control whether the amounts submitted in the yearly reports are consistent with the real state. The possible distortions may be detected only through a direct control by the Voivodeship Environmental Protection Inspectorates. Moreover, the activities of each enterprise concerning waste management are perceived and evaluated individually, a system of monitoring does not include the relationships among all the subjects engaged in the management process.

**Fig. 1.3** The system of monitoring of industrial waste management in Poland

Source: Own elaboration

### 1.4 IT TOOLS SUPPORTING THE MONITORING OF INDUSTRIAL WASTE MANAGEMENT

Until the monitoring of waste was conducting by Voivodeship Environmental Protection Inspectorates the information about the waste was collecting in the computer database SIGOP (‘Information System of Industrial Waste Management’). The source materials to update this database were polls sent to the largest producers. The system enables collecting data about: producers of hazardous waste, the amount of waste and the installations to managing the waste. At present, this database is no longer updated, and the data about producers and waste management are collected in Central System of Waste (CSO). This system is replenished by Marshal Offices and closely cooperates with sixteen Voivodeship Systems of Waste (WSO). The base of WSO includes information about [2]:

- the amount and the types of produced waste,
- the ways of managing of different types of waste (with the category of recovery or treatment),
- management of waste oils (specifying of amount of recycled or disposal waste oils and the number of approval decisions and registers in the field of waste oil management),
• municipal sewage sludge management (specifying the composition and properties of municipal sewage sludge and the places of their application),
• register of issued decisions in the field of producing and managing of waste (with the register of waste owners which are exempted from obligation to obtain a business license for the collection, transport, recovery or disposal of waste),
• waste management plans, (taking into account the scope of the plans and the timing of subsequent stages of drawing up the plans),
• installations used for recovery or disposal of waste (in separating the landfill and installations for thermal treatment of waste).

The data included in the WSO are obtained on the basis of the yearly compiled list of waste produced and information obtained from prefects. Unfortunately, not all yearly compiled lists of produced waste go to the Marshal Offices. Most often, it is the effect of the ignorance of environmental law, low environmental awareness and resulting from it the aversion to the need to fill the next document (and – in practise – the lack of sanctions for non-compliance) [4]. WSO and CSO are available electronically via the Internet on the basis of the access password. However, the free access to database has only some authorities [2]:
• Minister for the Environment,
• Minister for the Economy,
• Chief Inspector for Environmental Protection,
• board of the National Fund for Environmental Protection and Water Management,
• board of the Voivodeship Fund for Environmental Protection and Water Management,
• General Director of Environmental Protection,
• Regional Director of Environmental Protection,
• Prefects,
• Mayor or President of the City,
• Voivodeship Environmental Protection Inspector,
• public statistics service.

The employees of particular country or municipal offices receive the access only to some parts of database that concern the waste management in their area [11].

The unquestionable advantage of this system is comprehensive collection of data, that give the possibility of grouping many valuable information in one place. However, this system seems to be underdeveloped and the entered data unreliable. Database require implement many amendments. The quantity of produced waste and exploited waste is not balanced, that makes it impossible to draw any conclusions about waste management in a given area [1]. Therefore it seems to be necessary to carrying out further research for development the systems supporting the monitoring and control of activities in the field of waste management, primarily in the context of verification of the entered information. The research should be carrying out with the future users of these systems – in order to be easy to use and functional.
CONCLUSIONS

Production of industrial waste is still a significant problem. Despite undertaking many activities aimed at waste management, there is some amount of wastes stored at disposal sites. The reason is a lack of one, complex waste management system, common for all wastes. Each enterprise has its own individual system that does not always include the objectives set in the voivodeship and domestic plans of waste management due to the financial aspects. It also constitutes a problem for the bodies supervising waste management. Some enterprises do not comply with all the reporting requirements what is caused by a lack of knowledge in terms of environmental protection law, low level of ecological consciousness of the society and small (sometimes even none) sanctions for not respecting the obligations. Therefore, a very important issue became the monitoring and control of this area, both on a domestic and regional level. However, the system of industrial waste monitoring functioning these days has some gaps. First of all, the monitoring of activities of the subjects dealing with waste management is not of continuous character but of periodical one and is only based on yearly statements on the amounts of waste produced and information from prefects.

Moreover, the IT tools supporting the work of supervising bodies also require introducing the improvements, mainly in terms of verification of the data entered. The databases should be extended with additional modules that would gather information concerning the relationships among all the subjects involved in the waste management process.

REFERENCES


MONITORING OF ACTIVITIES IN THE FIELD OF INDUSTRIAL WASTE MANAGEMENT

Abstract: The main purpose of this paper is the attempt to assess the currently existing system of monitoring of activities in the field of industrial waste management. The article characterized the state of industrial waste management in Poland in recent years and listed the main groups of waste and main areas of their application. In the paper there is the role of waste monitoring and the description of tasks of different entities in the field of control and supervision of waste management. Moreover, the paper shows the structure of waste monitoring and describes the system of waste monitoring in Poland, and presents the IT systems that supporting the work of supervisory authorities as well.

Key words: waste management, waste monitoring, industrial waste

MONITOROWANIE DZIAŁAŃ W ZAKRESIE GOSPODARKI ODPADAMI PRZEMYSŁOWYMI

Streszczenie: Głównym celem pracy była próba oceny obecnie funkcjonującego systemu monitorowania działań w zakresie gospodarki odpadami przemysłowymi. W artykule scharakteryzowano stan gospodarki odpadami przemysłowymi w Polsce w ostatnich latach, wymienione zostały główne grupy odpadów oraz główne kierunki ich zagospodarowania. Opisano rolę monitoringu odpadów oraz scharakteryzowano zadania różnych podmiotów w zakresie kontroli i nadzoru gospodarki odpadami. Ponadto w pracy zaprezentowana została struktura monitoringu odpadów, opisany został system monitorowania odpadów w Polsce, a także przedstawione zostały systemy informatyczne, które wspomagają pracę organów nadzorczych.

Słowa kluczowe: gospodarka odpadami, monitoring odpadów, odpady przemysłowe

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2

VALUTAZIONE DELLE NON CONFORMITÀ NELL'ESEMPIO DI UN'AZIENDA ITALIANA

2.1 INTRODUZIONE

L’introduzione di sistemi di gestione della qualità certificati, conformi ai requisiti della norma ISO 9001 costringe gli imprenditori ad applicare le procedure appropriate [1], [2], [3], [5], [10], [11]. Allo stesso tempo, gli impianti di produzione, migliorando le proprie attività di gestione della qualità, dovrebbero eliminare le debolezze del processo, per esempio impedendo cause di non conformità [1], [2], [7], [11]. Il sistema delle azioni intraprese dalle aziende dovrebbe includere i fattori economici, ma anche tecnici e umani [3], [7], [10], [11]. Inoltre, ogni attività aziendale, in particolare quella volta alla fornitura del prodotto finito, dovrebbe essere conforme ai requisiti posti dal cliente, soddisfacendo così le sue esigenze.

In caso di rilevazione di non conformità, si dovrebbe fare un’analisi approfondita dei dati disponibili, determinare la causa della non conformità, attuare azioni correttive, ma soprattutto, applicare misure preventive per evitare il ripetersi della stessa mancanza di conformità. Questa operazione, di norma viene effettuata analizzando e migliorando le procedure per la specifica non conformità [1], [2], [6], [8], [10]. Tuttavia, le mancanze di conformità, che si verificano nei processi produttivi, non di rado vengono attribuite dagli imprenditori alle precise postazioni in cui sono state individuate, e quindi, anche alle persone che lavorano in queste postazioni. Azioni di miglioramento, dovrebbero invece tener conto delle cause originali delle mancanze di conformità, che spesso non sono collocate in modo convergente con la posizione nella quale è stata verificata la non conformità, anzi alle volte le ragioni delle cause vanno al di là della specifica procedura [10].

2.2 MISURAZIONI E ANALISI DEI DATI

Le norme della serie ISO 9000 impongono alle aziende numerosi requisiti in termini di monitoraggio della qualità dei processi. Nel caso delle imprese industriali sono particolarmente importanti le questioni riguardanti i processi produttivi e le non conformità che si verificano nel loro caso. L’uso di diversi metodi di gestione della qualità permette di analizzare le cause di queste non conformità e consente la loro valutazione. In questa pubblicazione, questo tipo di analisi è presentata sull’esempio di una azienda produttiva italiana. A causa del mancato consenso dell’azienda sull’uso del suo nome, nella pubblicazione viene conseguentemente utilizzato il termine „azienda X".
Secondo i requisiti imposti dalla norma di qualità ISO 9001 sulle organizzazioni che applicano la gestione della qualità, l’azienda italiana X, impegnata nella produzione di stampi in metallo duro e attrezzi in acciaio principalmente per le industrie produttrici di bulloni e viti, ha creato una procedura per la gestione dei controlli interni. Lo scopo di questa procedura è quello di individuare le attività operative in materia di pianificazione e di attuare i controlli interni [4], [6], [9], [10]. Questa procedura si applica a tutti i processi dell’azienda X. In questa procedura, audit è il termine usato come sinonimo di controllo [3], [9], [10]. I controlli nell’azienda X sono eseguiti con una pianificazione a lungo termine [3], in conformità con il piano di audit annuale [4], [9]. Una frequenza minima di controllo annuale è programmata per ogni processo appartenente al sistema di qualità. L’aumento della frequenza di ogni singolo processo deve essere determinato sulla base dei seguenti elementi [9]:

- rilevazione di non conformità a seguito di controlli svolti;
- reclami;
- cambiamenti significativi nell’organizzazione, nella sua struttura e/o nei processi;
- la particolare importanza del processo.

Se necessario, gli interventi urgenti possono sostituire quelli programmati annualmente. Al fine di migliorare l’efficacia di questo sistema di controllo, la persona responsabile del sistema qualità, esegue annuali verifiche dei piani di audit analizzando i risultati complessivi conseguiti [9].

![Diagramma](image)

**Fig. 2.1 Ore di lavoro perse a causa delle non conformità rilevate**

Fonte: Elaborazione propria sulla base [4]

Nell’azienda X, i controlli sui dati relativi alle non conformità dei prodotti realizzati, sono effettuati semestralmente. Questi dati sono registrati nei rapporti di non conformità, e conteggiati due volte l’anno - dopo il 31 maggio, per il periodo dal 1 gennaio al 31 maggio e dopo il 31 dicembre, per il periodo dal 1 giugno al 31 dicembre. Sintesi
dei risultati degli anni 2003-2014 sono presentate nella Tab. 2.1.

I caratteri in grassetto nella tabella rappresentano la crescita registrata di non conformità in un determinato periodo in rapporto al periodo precedente. Con i dati di cui sopra è stato creato un grafico (Fig. 2.1), che mostra le non conformità registrate nel processo di produzione dei prodotti, rappresentate dal punto di vista delle ore perse.

### Tab. 2.1 Rapporto di sintesi delle non conformità interne

<table>
<thead>
<tr>
<th>DA</th>
<th>A</th>
<th>Ore perse</th>
<th>Quantità</th>
<th>Incremento</th>
</tr>
</thead>
<tbody>
<tr>
<td>01/01/03</td>
<td>31/05/03</td>
<td>123</td>
<td>208</td>
<td></td>
</tr>
<tr>
<td>01/06/03</td>
<td>31/12/03</td>
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<tr>
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<tr>
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<td>31/12/13</td>
<td>96</td>
<td>221</td>
<td>-53%</td>
</tr>
<tr>
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<td>472</td>
<td>550</td>
<td>392%</td>
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</table>

Fonte: Elaborazione propria sulla base: [4]

Analizzando il grafico si può concludere, che le non conformità registrate nel processo di produzione dell’azienda X non presentano variazioni periodiche e quindi non è presente in questo caso un trend. Ciò significa, che le non conformità generate durante questo periodo, ossia dal 31.05.2003 al 31.12.2014, non mostrano una tendenza crescente o decrescente. Tuttavia, è possibile indicare la quantità media approssimativa di non conformità generate, che, rappresentata in termini di ore di lavoro perse, è di

---

1 I dati vengono raccolti due volte all’anno. Guardandoli con attenzione, si noterà, che i periodi che dovrebbero essere semestri, in realtà, non sono uguali. Questa differenza nella percezione della lunghezza del semestre, e quindi, di conseguenza, nella raccolta dei dati semestrali, è dovuta principalmente alle differenze culturali. In Italia quasi tutte le attività sono chiuse nel mese di agosto per il periodo di vacanza. Questa consuetudine causa la chiusura per un periodo di almeno due settimane anche di quelle attività che vorrebbero rimanere aperte nel mese di agosto in quanto non avrebbero con chi collaborare. Tale situazione vale anche per gli uffici pubblici.
quasi 230 ore ed è segnata sullo stesso grafico. Gli stessi dati hanno anche consentito la rappresentazione grafica della quantità di prodotti che sono stati trovati non conformi con il prodotto desiderato dal cliente (Fig. 2.2).

![Fig. 2.2 Quantità di prodotti registrati come non conformità](image)

Fonte: Elaborazione propria sulla base [4]

Nel grafico è stato anche selezionato il trend lineare, che tende a diminuire. Come si può vedere, le mancate conformità del prodotto, nel corso di questi ultimi anni, sono state registrate più volte.

Tali non conformità hanno significativamente aumentato i costi di produzione dell’azienda X. Nei costi di produzione della società devono essere incluse anche le ore di lavoro perse dai dipendenti [12]. Nella Tab. 2.2 è rappresentata una sintesi di non conformità rilevate tenendo conto del tempo perduto dagli operatori.

Guardando l’ultimo periodo analizzato, è possibile identificare 77 tipi di non conformità. I dati dettagliati con indicate le ore perse di lavoro e il numero di unità non conformi, sono presentati nella Tab. 2.3.

I dati presentati sono stati poi ordinati attraverso l’applicazione del metodo ABC (Tab. 2.4). Il criterio secondo il quale è stata creata la gerarchia dei dati, era la quantità di ore perse, che è una componente del costo del processo di produzione nell’azienda X. I risultati sono presentati nella Tab. 2.4, in cui le non conformità nel livello B e C sono indicate solo coi valori collettivi.

È stato creato il diagramma Pareto-Lorenz, creato sulla base di tutte le mancanze di conformità registrate nel presentato periodo e ordinate secondo il metodo ABC (Fig. 2.3). Dalla tabella (Tab. 2.4) e dal diagramma (Fig. 2.3) presentati precedentemente nella pubblicazione, si vede che, su settantasette non conformità solo sedici hanno un impatto significativo sul grande aumento del numero di ore perse dagli operatori. Delle restanti non conformità, venti hanno un influenza di media rilevanza sulla quantità di ore perse, e la stragrande maggioranza, ben quarantuno, ne ha un impatto trascurabile. Il numero di ore di lavoro perse dagli operatori derivante dalle non conformità in più del 85% del totale di ore perse è stato causato da sedici fattori.
Tab. 2.2 Accostamento dei dati di non conformità tenendo conto del tempo perso da parte degli operatori, per il periodo dal 01.06.2014 al 31.12.2014

<table>
<thead>
<tr>
<th>Operatore</th>
<th>Numero Non Conformità</th>
<th>Quantità</th>
<th>Quantità non conforme per tipo</th>
<th>Quantità dei pezzi</th>
<th>Quantità di non conformità per tipo</th>
<th>Quantità di non conformità</th>
<th>Quantità dei pezzi</th>
<th>Quantità di non conformità per tipo</th>
<th>Quantità dei pezzi</th>
<th>Quantità di non conformità per tipo</th>
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</thead>
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<td>4</td>
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<td>4</td>
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Fonte: Elaborazione propria sulla base: [4]

Tab. 2.3 Tipologia di non conformità registrate nel periodo dal 01.06.2014 al 31.12.2014

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<th>Quantità di non conformità per tipo</th>
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<th>Quantità di non conformità per tipo</th>
<th>Quantità dei pezzi</th>
<th>Quantità di non conformità per tipo</th>
<th>Quantità dei pezzi</th>
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Fonte: Elaborazione propria sulla base: [4]
Tab. 2.4 La tipologia di non conformità registrate dal 01.06.2014 al 31.12.2014 – i dati strutturati secondo il metodo ABC

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Fonte: Elaborazione propria sulla base: [4]

Fig. 2.3 La quantità di ore perse nel periodo 01.06.2014 – 31.12.2014

Fonte: Elaborazione propria sulla base: [4]
Sulla base dei risultati ottenuti precedentemente è stato creato il diagramma di Ishikawa, che illustra una serie di fattori che influenzano il normale corso del processo di produzione, e che pertanto possono generare anche tutte le non conformità summenzionate (Fig. 2.4).

**Fig. 2.4 Diagramma di Ishikawa raffigurante gruppi di fattori – cause che possono influenzare il processo di produzione della società X**

Fonte: Elaborazione propria

Delle sedici non conformità specificate, che causano oltre l’85% del valore complessivo delle ore perse di lavoro dagli operatori durante il processo di produzione, sono state selezionate le prime cinque, che generano quasi il 45% delle ore perse sul totale delle mancanze di conformità. Le non conformità sono riportate in Tab. 2.5.

**Tab. 2.5 Le cinque principali non conformità che si verificano nel processo di produzione dell’azienda X**

<table>
<thead>
<tr>
<th>Tipo di non conformità</th>
<th>Nome di non conformità</th>
<th>Ore perse [h]</th>
<th>Cumulativo di ore perse [h]</th>
<th>Partecipazione % in quantità di ore perse</th>
<th>Cumulativo della partecipazione % in quantità di ore perse</th>
</tr>
</thead>
<tbody>
<tr>
<td>N1</td>
<td>Foro troppo largo</td>
<td>101,05</td>
<td>101,05</td>
<td>13,19</td>
<td>13,19</td>
</tr>
<tr>
<td>N3</td>
<td>Sagoma larga</td>
<td>91,35</td>
<td>192,40</td>
<td>11,93</td>
<td>25,12</td>
</tr>
<tr>
<td>N6</td>
<td>Tornitura minorata</td>
<td>56,20</td>
<td>248,60</td>
<td>7,34</td>
<td>32,46</td>
</tr>
<tr>
<td>N5</td>
<td>Testimone foro</td>
<td>51,80</td>
<td>300,40</td>
<td>6,76</td>
<td>39,22</td>
</tr>
<tr>
<td>N7</td>
<td>Fori fuori centro</td>
<td>41,25</td>
<td>341,65</td>
<td>5,39</td>
<td>44,60</td>
</tr>
</tbody>
</table>

Fonte: Elaborazione propria sulla base: [4]

È stato quindi creato uno strumento per valutare gli elementi presentati nel diagramma di Ishikawa (Fig. 2.4). Questo strumento è stato costituito per fornire i pesi, sotto forma di punti, per ogni categoria di cause, ma per ciascun fattore non più di cinque punti, che possono essere riportati integralmente nella categoria sul primo livello o divisi in sottocategorie nei successivi due livelli. Questa azione è stata eseguita separatamente per ciascuna assenza di conformità. In questo modo, ognuno dei fattori
Descritti nel diagramma di Ishikawa, al quale è stato dato un valore, è coerente con le cause più probabili e che più spesso provocano proprio queste non conformità. Questa operazione è stata illustrata nelle Tab. 2.6 – Tab. 2.10.

**Tab. 2.6 Valutazione dei fattori - cause della non conformità I**

<table>
<thead>
<tr>
<th>NON CONFORMITÀ</th>
<th>OPERATORE</th>
<th>TOT. PUNTI LIV. 1-2</th>
<th>TOT. PUNTI LIV. 2-3</th>
<th>TOTALE DEI PUNTI</th>
<th>VALORE [%]</th>
<th>CUMULATIVO DEL VALORE [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mancanza di qualifiche</td>
<td>Mancanza di organizzazione del proprio lavoro</td>
<td>~ 0</td>
<td>~ 0</td>
<td>~ 0</td>
<td>5</td>
<td>41,67</td>
</tr>
<tr>
<td>Mancanza di competenze</td>
<td>~ Turni di lavoro</td>
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<td>~ 0</td>
<td>~ 0</td>
<td>5</td>
<td>41,67</td>
</tr>
<tr>
<td></td>
<td>Mancanza di conoscenza dei costi</td>
<td>~ 0</td>
<td>~ 0</td>
<td>~ 0</td>
<td>5</td>
<td>41,67</td>
</tr>
<tr>
<td></td>
<td>Distrazione</td>
<td>~ 0</td>
<td>~ 0</td>
<td>~ 0</td>
<td>5</td>
<td>41,67</td>
</tr>
<tr>
<td></td>
<td>Cattiva condizione tecnica</td>
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<td>~ 0</td>
<td>~ 0</td>
<td>5</td>
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</tr>
<tr>
<td></td>
<td>Avaria</td>
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<td>~ 0</td>
<td>~ 0</td>
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<td>41,67</td>
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<td>Sbagliata Impostazione della macchina</td>
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<td>~ 0</td>
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<td>~ 0</td>
<td>~ 0</td>
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<td>41,67</td>
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<td></td>
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<td>~ 0</td>
<td>~ 0</td>
<td>5</td>
<td>41,67</td>
</tr>
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<td></td>
<td>Ritardo nella consegna del materiale sulla postazione</td>
<td>~ 0</td>
<td>~ 0</td>
<td>~ 0</td>
<td>5</td>
<td>41,67</td>
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<td></td>
<td>FLUSSO DI INFORMAZIONI</td>
<td>~ 0</td>
<td>~ 0</td>
<td>~ 0</td>
<td>5</td>
<td>41,67</td>
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<tr>
<td></td>
<td>Errori nell’informazione</td>
<td>~ 0</td>
<td>~ 0</td>
<td>~ 0</td>
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<td>~ 0</td>
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<td>Errori nell’organizzazione e pianificazione del lavoro</td>
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<td>41,67</td>
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<td>Mancanza di collaborazione</td>
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<td>41,67</td>
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<td>41,67</td>
</tr>
</tbody>
</table>

Fonte: Elaborazione propria
**Tab. 2.7 Valutazione dei fattori - cause della non conformità II**

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<tr>
<th>NON CONFORMITÀ</th>
<th>CATEGORIA</th>
<th>OPERATORE</th>
<th>VALORE [%]</th>
<th>COMUNICATIVO DEL VALORE [%]</th>
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</thead>
<tbody>
<tr>
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<td>~ ~ 5</td>
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<td>~ 0</td>
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<td>~ ~ 5</td>
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<td>Scarra qualità</td>
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<tr>
<td>FLUSSO DI INFORMAZIONI</td>
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<td>100,00</td>
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<td>Inadequata gestione del tempo</td>
<td>Mancanza del sistema monitorizzazione</td>
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<td>~ ~ 2</td>
<td></td>
</tr>
<tr>
<td>Fonte: Elaborazione propria</td>
<td></td>
<td></td>
<td></td>
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</table>

**Tab. 2.8 Valutazione dei fattori - cause della non conformità III**

<table>
<thead>
<tr>
<th>NON CONFORMITÀ</th>
<th>CATEGORIA</th>
<th>OPERATORE</th>
<th>VALORE [%]</th>
<th>COMUNICATIVO DEL VALORE [%]</th>
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<td>~ ~ 5</td>
</tr>
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<td>Mancanza di qualità</td>
<td>Malese</td>
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<tr>
<td>Mancanza di qualità</td>
<td>Mancanza di informazioni</td>
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<td>~ 0</td>
<td>~ 0</td>
</tr>
<tr>
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<td>Mancanza di disciplina</td>
<td>~ ~ 2</td>
<td>31,25</td>
<td>~ ~ 2</td>
</tr>
<tr>
<td>MACCHINA</td>
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<td>6,25</td>
<td>37,50</td>
<td></td>
</tr>
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<td>Cattiva condizione tecnica</td>
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<td>0</td>
</tr>
<tr>
<td>MATERIALE</td>
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<td>6,25</td>
<td>43,75</td>
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<td>Scarra qualità</td>
<td>Consegnato del materiale sbagliato sulla postazione</td>
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<td>0</td>
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<tr>
<td>FLUSSO DI INFORMAZIONI</td>
<td>~ ~ 5</td>
<td>31,25</td>
<td>75,00</td>
<td></td>
</tr>
<tr>
<td>Errori nell’informazione</td>
<td>Ritardo nel flusso di informazioni</td>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>GESTIONE</td>
<td>~ ~ 4</td>
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<td>100,00</td>
<td></td>
</tr>
<tr>
<td>Inadequata gestione del tempo</td>
<td>Mancanza del sistema monitorizzazione</td>
<td>~ ~ 2</td>
<td>~ ~ 2</td>
<td></td>
</tr>
<tr>
<td>Fonte: Elaborazione propria</td>
<td></td>
<td></td>
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### Tabella 2.10 Valutazione dei fattori - cause della non conformità IV

<table>
<thead>
<tr>
<th>CATEGORIA</th>
<th>OPERATORE</th>
<th>MACCHINA</th>
<th>MATERIALE</th>
<th>FLUSSO DI INFORMAZIONI</th>
<th>GESTIONE</th>
<th>TOTALE</th>
</tr>
</thead>
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<tr>
<td>NON CONFORMITÀ</td>
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</tr>
<tr>
<td>[%]</td>
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<td>[%]</td>
<td>[%]</td>
<td>[%]</td>
<td>[%]</td>
<td>[%]</td>
</tr>
<tr>
<td><strong>V</strong></td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>II</strong></td>
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<td>0</td>
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<td>0</td>
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<td>0</td>
</tr>
<tr>
<td><strong>TOTALE</strong></td>
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<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Fonte: Elaborazione propria
Successivamente è stata creata la tabella di riepilogo per tutte e cinque le non conformità, che sintetizza i risultati ottenuti dalle azioni precedenti (Tab. 2.11). Per ogni categoria di cause della mancanza di conformità, la tabella mostra in sequenza il numero di punti registrati nelle non conformità, la loro percentuale di ciascuna categoria in non conformità e la quota accumulata dalle categorie di cause nelle non conformità.

### Tab. 2.11 Valutazione dei fattori – sintesi dei risultati

<table>
<thead>
<tr>
<th>Il nome della categoria</th>
<th>Quant. dei punti per la nc.</th>
<th>Quantità totale di punti</th>
<th>Quota in non conformità [%]</th>
<th>Cumulativo di quote in non conformità [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>II</td>
<td>III</td>
<td>IV</td>
</tr>
<tr>
<td>Operatore</td>
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<td>5</td>
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<td>5</td>
</tr>
<tr>
<td>Macchina</td>
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<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Materiale</td>
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<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Flusso di informazioni</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>2</td>
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<td>Gestione</td>
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<td>5</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td><strong>Totale</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fonte: Elaborazione propria

Così sarà possibile ora presentare i risultati sommari per ciascuna categoria di cause di queste cinque maggiori non conformità (Tab. 2.12).

### Tab. 2.12 Quota di singole categorie di cause nelle cinque non conformità

<table>
<thead>
<tr>
<th>Il nome della categoria</th>
<th>Quantità totale di punti</th>
<th>Quota di categorie in cinque non conformità [%]</th>
<th>Cumulativo delle quote di categorie in cinque non conformità [%]</th>
</tr>
</thead>
<tbody>
<tr>
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<td>25</td>
<td>35,71</td>
<td>35,71</td>
</tr>
<tr>
<td>Gestione</td>
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<td>64,29</td>
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<td>Flusso di informazioni</td>
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<td>88,57</td>
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<tr>
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<td>10,00</td>
<td>98,57</td>
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<tr>
<td>Materiale</td>
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<td><strong>Totale</strong></td>
<td><strong>70</strong></td>
<td><strong>100,00</strong></td>
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</tbody>
</table>

Fonte: Elaborazione propria

**CONCLUSIONI**

Nella precedente parte della pubblicazione sono state individuate diverse categorie di fattori-cause della mancanza di conformità e la loro quota di presenza nelle cinque principali non conformità che si verificano nell'azienda. Il risultato del test sulla presenza di queste cause di non conformità, può essere illustrato dal grafico Pareto-Lorenz (Fig. 2.5).

Sullo schema, che illustra i calcoli precedentemente fatti (Tab. 2.12), si può notare, che il più serio gruppo di ragioni che causano frequente comparsa di non conformità del
prodotto durante il processo di produzione nell’azienda X, sono i fattori attribuiti ad una categoria di cause denominata "operatore". Questa categoria per più del 35% è il motivo della non conformità. Al fine di ridurre gli errori causati per colpa degli operatori, i manager dovrebbero esaminare se questi sono contenuti del lavoro che svolgono, e quindi il livello della loro soddisfazione e motivazione. In caso contrario, gli operatori inevitabilmente commetteranno errori costosi per l’impresa per motivi futili. Anche utilizzando le migliori attrezzature e materiali di qualità, non è possibile produrre in modo efficace qualsiasi cosa, se le persone che comandano le macchine atte al trattamento dei materiali, non sono adeguatamente motivati.

![Diagramma di Pareto-Lorenz che raffigura cumulativo delle categorie di cause nelle cique non conformità](image)

Fonte: Elaborazione propria

La colpa nelle non conformità emergenti non può essere attribuita esclusivamente agli operatori che lavorano sulla linea di produzione, perché gli altri due gruppi di motivi sembrano incidere anche loro in modo significativo. Queste cause sono costituite dalle categorie "gestione" e "flusso di informazioni". La prima di queste è dovuta principalmente alla mancanza di gestione aziendale tale che gli elementi che la costituiscono, cioè le persone, siano motivate e capaci di collaborare tra di loro in modo efficace. È inoltre necessario introdurre un sistema di motivazione ed un eventuale pacchetto premio, non necessariamente materiale, distinguendo quelle persone che sono capaci di fare il loro lavoro in maniera impeccabile.

Anche un’altra delle cause - "flusso di informazioni", dipende in gran parte dalla gestione efficace della società. Al fine di eliminare il più possibile le non conformità derivanti da questa causa, è opportuno analizzare l’ordine della commessa e le informazioni in esso contenute, perché le lacune o la troppo poca precisione nella definizione di ciò che ci si aspetta dall’operatore sul luogo di lavoro, genera alte perdite per l’azienda X. Inoltre potrebbe prevenire possibili e alquanto sgradevoli cambiamenti del personale all’interno dell’organizzazione.
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VALUTAZIONE DELLE NON CONFORMITÀ NELL’ESEMPIO DI UN’AZIENDA ITALIANA

Sommario: In questa pubblicazione sono presentate e analizionate le difficoltà che devono fronteggiare le imprese nel differenziare i processi e le procedure che le costituiscono, dalle persone che operano queste procedure. Si presenta come uno strumento per valutare categorie campione che formano l’insorgenza di non conformità nel processo produttivo dell’azienda italiana.

Parole chiave: gestione della qualità, strumento di valutazione, non conformità nel processo di produzione, categorie delle cause di non conformità

VALUATION OF NON-COMPLIANCE ON THE EXAMPLE OF THE CHOSEN ITALIAN COMPANY

Abstract: In this publication we presented and analyzed the difficulties faced by businesses in differentiating processes and constituent procedures from persons concerned. It presented as a tool for evaluating sample categories that makeup the occurrence of inconsistencies in the manufacturing process of the Italian company.

Key words: quality management, evaluation tool, inconsistencies in the manufacturing process, the categories of the reasons for non-compliance

WARTOŚCIOWANIE NIEZGODNOŚCI NA PRZYKŁADZIE WYBRANEGO PRZEDSIĘBIORSTWA WŁOSKIEGO

Streszczenie: W publikacji zaprezentowano i przeanalizowano trudności, z jakimi borykają się przedsiębiorcy w odróżnianiu procesów i składających się na nie procedur od osób, których one dotyczą. Przedstawiono także narzędzie służące wartościowaniu przykładowych kategorii przyczyn, jakie składają się na występowanie niezgodności w procesie produkcyjnym wybranego przedsiębiorstwa włoskiego.

Słowa kluczowe: zarządzanie jakością, narzędzie wartościowania, niezgodności w procesie produkcyjnym, kategorie przyczyn niezgodności

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3

DECISION SUPPORT SYSTEMS IN WASTE MANAGEMENT – A REVIEW OF SELECTED TOOLS

3.1 INTRODUCTION

The necessity of decision making in the field of uncertainty, forms an integral part of traders, managers or analysts workers. Seemingly, this is an intuitive process that applies to every human being, but in a professional resource management requires appropriate procedures and preparation. Tracing the definition of W.T. Bielecki [6] decision making is preceded by the identification of the problem, collection of the relevant information, expert knowledge gathering and finally the elaboration of solutions which under evaluation and selection will allow to make the best choices. Business practice has caused computerization of these activities, creating the foundations of decision support systems for all sectors of enterprises’ activity.

Waste Management due to its multifaceted nature, also went through a number of support systems which will allow to effective implementation of the decision-making processes with varying complexity. A wide range of information and data, including the logistical, technological, environmental, social and legal issues it is possible to process using multi-criteria analysis and specialist support systems.

3.2 THE ESSENCE OF DECISION SUPPORT SYSTEMS

Decision support systems have been known for decades, and more specifically from the time when the information technology development has enabled automation of the selected decision-making areas [6]. In connection with these issues, DSS (Decision Support) were defined as information solutions that support business and organizational decision-making activities, enabling setting the optimal solution.

Wide range of applications and benefits of DDS, are resulted in the rapid development of all kinds of tools which denominator is defined by S. Alter requirements, that also constitute the essence of support systems. These include [3]:

- the DDS are designed for support the decision-making process,
- the DDS should support, not automate decision-making,
- the DDS should be flexible enough to smoothly adapt to the constantly changing requirements by decision makers.

During the design process of decision support tools is necessary to prepare detailed conditions including an analysis of its application. Systems should be mostly adequa-
te, which means compatibility of the operational needs with contained data and if-then rules. DSS is required also availability, which is associated with the correct process of communication and unambiguous interpretation of the results.

Unequivocal purpose of application DDS has a graphical representation of its structure (Fig. 3.1), which in the most transparent way to introduce the main elements of its architecture, and to verify which information systems are a decision support system.

According to the graphical representation of DDS, a composition of separate elements is affecting the advisability of the system. The basic division of structure covering the core of the system highlights the DDS focused on data and DDS focused on decision support models. Depending on demands, the classification can be extended to DDS focused on communication, documents or knowledge – as a purposely dominant part of system architecture.

Each system consists of a database (DB), which collects, provides and stores relevant data. Therefore, DB is selected information units that have been extracted from a comprehensive set of data and are a main power source of DDS [3]. Analysis, forecasts, current transactions – these are the actions faced by all users of information systems. Well ordered and thematically selected data source allows you to quickly and efficiently process with the extensive database that is stored on storage media and allows satisfying the information needs at any time.

The user interface of DDS is considered as a web page or text, image or software part responsible for interaction with the user. Due to the diversity of DDS, the issue of the designed interfaces is widely considered with the functional and operational requirements. Creating an interface in accordance with the C.M. Olszak [6] recommendations, in addition to an accurate analysis of the tasks and systems objectives should be took into account the implementation of lexical and semantic level. The results of these analyzes are the description of the communication language with the decision-maker, a choice of interface standard, and the environment of its implementation [3]. Due to the high level of details in interface design and its effects impact on the system functionality, it is proposed to prototype which allows evaluating preliminary designs.

In order to reduce costs and eliminate the risk of decision-making process errors, there are used a various methods for simulating potential solutions. All processes and phenomena occurring in reality can be described using the interrelationships between components, which create a special collection and aim to achieve a particular purpose.
This reflection of reality by a set is called a model, on which DDS examine and predict options of analyzed alternatives.

Modeling is a separate and complex chapter in the issues of DDS. Versatility of the system application, determines the need of models elaboration with an adequate level of detail. In a study of phenomena and processes are often used advanced mathematical models that clearly identify the most important factors. The logical decomposition and selection of the most important parameters allow to adequate processing of data and execute analyzes that can be the basis of optimization methods.

In the literature can also be found the application of conceptual models, object-oriented models, models of multi-criteria analysis or specialist models including i.a. integrated waste management systems. Extensive use of DDS and the possibility of setting up models, have been formed a new trend in the application of artificial intelligence in the process of decision-making. Their use is most common in resolving the complex decision-making processes which require pattern recognition and classification, learning or effective risk management.

Economic development encourages the development of specialized information systems, including decision support systems. Their application can be found in many industries and sectors, where companies implement their processes under conditions of uncertainty and risk. Due to market demands, DDS is characterized by complex and hybrid structure, which includes the use of i.a. spatial information systems.

Simulations and interpretations carried out on a visual representation of solutions allow to a better understanding of the effects and take a final decision. The use of this type of hybrid systems, in particular, is known in environmental management and waste management. DDS is based on complex models of waste management systems and is often used by public and private entities that process the collected data for analysis, forecasting and simulation.

3.3 SUPPORT SYSTEMS IN THE WASTE MANAGEMENT

The use of decision support systems in waste management have been intensified along with the need for analysis of additional issues, including costs, spatial planning, legal requirements, environmental protection and technologies used.

The first attempt to use the informatics tools within Waste Management Systems Data Management was included basic data management. Recording and reporting – are the basic activities related to the management of waste flows from the manufacturers to waste processing entities. Standard data sheets have enabled to implement these basic requirements, but have limited significantly more complex actions. Along with the need of process simulation, forecasting and reporting the results of alternative solutions – has been being grown a need to develop informatics tools using spreadsheets, mathematical optimization and simulation models, including Geographic Information Systems [5].

The increasing interest in spatial data analysis is resulted in widening of the decision support systems properties by GIS (ang. Geographic Information System) with the result of developing technology SDSS (ang. Spatial Decision Support System). The dyna-
mic development of GIS-based software currently supports local governments in the spatial planning management, water, sewage and waste management, enabling to build spatial information infrastructure at different administrative levels [5]. In this perspective, GIS is a valuable component of DDS during the flows planning and determining location of waste recovery facilities and waste disposal. Multi-criteria analysis related to this issue enriched through geographical analysis, allow to specify the best solution for complex decision-making processes.

Tab. 3.1 shows some examples of decision support systems in waste management designed to meet specific targets like determining the location of landfills and assessment of technology collection or waste treatment and its disposal. You may have noticed widely used of all kinds of methods to support decision-making in waste management. In addition to using approaches like LCA, AHP or spreadsheets, is observed increasing interest in the application of spatial information – GIS, which allows the presentation of the position of important objects related to waste management.

The literature describes many of the systems used for locating landfills. Their detailed analysis based on multi-criteria decision-making process also using geographic information systems, is enable to selection the best solution. In the current situation, according to new regulations and requirements of the EU, storage is the ultimate form of recycling, which should be kept to a minimum, and building a new landfills should be eliminated from waste management plans. Law enforcement and rational waste management require the elaboration of integrated tools that could meet the growing expectations.

The current state of waste management in Poland is interested in the possibility of energy recovery from waste that could support the enforcement of EU requirements, including reducing waste deposited in landfills, and thus affecting their increasing level of recovery. The realization of these assumptions requires detailed logistics and technology analysis in the context of local waste management systems, where it would be possible to use waste energy. One of DDS examples implemented for this purpose is W2E Software [11], which supports the best choice in selecting energy recovery technology from sewage sludge. Other systems briefly treat these issues as one of the waste processing capabilities, without detailed analysis of the possibility of waste incineration.

Specialized use of DDS to separate the waste management processes is increasingly appreciated by the users from public level of administration as well as private entrepreneurs and investors. In the context of the waste streams management, these kinds of tools undoubtedly etched into the framework of the waste management system as an integral part of planning, monitoring, simulation and evaluation.
### Tab. 3.1 Examples of decision support systems in waste management

<table>
<thead>
<tr>
<th>No.</th>
<th>Name of the system</th>
<th>Country of origin/Authors</th>
<th>Approaches to support decision making process</th>
<th>Application</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Municipal Solid Waste Management System Planning [DSS]</td>
<td>Canada, Winnipeg</td>
<td>Knowledge base, Spreadsheet, Optimization and simulation models</td>
<td>Forecasting the quantity and quality of generated municipal waste, technology collection assessment, treatment and disposal of waste, estimating the cost of planned solutions, forecasting volumes and time of investment associated with waste management</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>Spatial Decision Support System [SDSS]</td>
<td>Greece</td>
<td>AHP, GIS</td>
<td>Determining the location of a landfill on the Lesbos island.</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>Spatial Decision Support System [SDSS]</td>
<td>Thailand</td>
<td>AHP, GIS, Fuzzy logic</td>
<td>Determining the initial location of landfills in Thailand.</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>DSS for Landfill Design, Evaluation and Monitoring LDEM-DSS</td>
<td>No data</td>
<td>GIS, Expert system Simulation model</td>
<td>Design, evaluation and monitoring of landfills.</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>SIGOP</td>
<td>Poland, Katowice</td>
<td>Knowledge base,</td>
<td>SIGOP’s database is used during the development of waste management programs for planning the industrial and service waste management, plans for municipalities, counties, provinces and also in ecological assessments of waste in particular to define ways of dealing with waste. On the basis of collected information in the database the standard reports are issued</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>EcoSolver IP-SSK</td>
<td>Switzerland</td>
<td>LCA model, Dynamic model, Simulation model</td>
<td>Separation of plastic waste streams planning with regard to the facilities of recycling, treatment and recovery of mechanical energy for selected regions</td>
<td>13</td>
</tr>
<tr>
<td>7</td>
<td>W2E Software</td>
<td>No data</td>
<td>Mathematical model, Simulation model</td>
<td>Analysis and evaluation of the possibility of disposing of sewage sludge in the process of energy recovery - choosing the best solution</td>
<td>11</td>
</tr>
<tr>
<td>8</td>
<td>ReFlows</td>
<td>Greece</td>
<td>Mathematical model, Simulation model</td>
<td>Simulation of physical and financial flows in various scenarios in waste management system based on maximizing the recovery and recycling of municipal solid waste.</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Spatial Decision Support System [SDSS]</td>
<td>Chang, 2008</td>
<td>GIS, Fuzzy logic, multi-criteria decision-making methods</td>
<td>Landfills location, taking into account factors: transport, ecological, environmental, economic, social and historical indicators.</td>
<td>7</td>
</tr>
</tbody>
</table>

Source: Own elaboration
3.4 INFORMATION SYSTEMS USED IN THE WASTE MANAGEMENT

Amendments to the Act on maintaining cleanliness and order in municipalities imposed on local governments a duty of development and implementation a waste management system which will effectively realized flows of municipal waste streams from inhabitants to the places of their processing. The new responsibilities of municipalities and related cooperation reorganization of entities responsible for waste transport and utilization have provoked a range of decision problems that require detailed analysis. Application of modern software in waste management is aimed at supporting system’s processes, starting with the register of residents and calculating charges and monitoring the waste flows to the places of their processing.

Tab. 3.2 presents an attempt to fit the different levels of decision-making waste management system to types of information systems executing separate tasks. The essence of this division focuses on the use of structured data sets (databases), as a part of a defined system’s needs. The lowest level of decision-making related to current operations includes all applications that use the data for everyday system operation. Their main purpose is to store data and their basic processing at the operational level of waste management. Selected data are the basis of support for the analytical and reporting systems in waste management that usage allows to execute complex actions. The results (both operational and tactical level) are the basis of decision support system’s functions at a strategic level of waste management. It should be noted that only an integrated systems that in theirs structure already have registration-transaction and analytical data, might include the waste management system functioning at the regional level. Currently solutions realize tasks associated with selected elements of the systems, avoiding the complex connections and correlations.

<table>
<thead>
<tr>
<th>Type systems</th>
<th>Decision levels</th>
<th>Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decision support systems</td>
<td>Strategic</td>
<td>Options planning for the waste management systems of different groups, forecasting changes in processes, parameters, manufucturing waste streams, investment decisions</td>
</tr>
<tr>
<td>Analytical and reporting systems</td>
<td>Taktical</td>
<td>identification data structures describing the elements of the system and process, data, process and environmental hazards classification study the correlation between the different parts and processes, component process analysis (eg migration of pollutants from waste treatment facilities), process modeling, elementary objects</td>
</tr>
<tr>
<td>Transactional and registration systems</td>
<td>Operating</td>
<td>management and control of processes, systems and subsystems including calculating the costs of waste management, recording the mass of generated waste different groups, financial operations</td>
</tr>
</tbody>
</table>

Source: Own elaboration based on: [3], [5]

Municipal waste management system, which one in pursuance of the new rules is organized and coordinated by municipalities, requires detailed records of data processing and analysis. According to these requirements and the need to elaborate tools to help residents’ service as part of the system, the market formed dedicated software for
municipalities, as well as waste management sector companies. Examples of such solutions are shown in Tab. 3.3.

Offered applications are characterized by standards that apply information systems in modules that let to waste recording, preparing of aggregated data or process monitoring and reporting. Qualified tools for systems support require distinguishing the clear specialization structure and functions of the operating system in decision-making processes. It is important to separate the models which allow ensuring the solution of complex decision problems in the context of i.a. forecasts or simulations. The management system „odpadywgminie.com” and Ulysses ODPADY, to the greatest degree, compared to other tools provides additional functions associated with process modeling.

<table>
<thead>
<tr>
<th>No.</th>
<th>Software name</th>
<th>Authors</th>
<th>Recipient</th>
<th>The module of declarations and financial settlements</th>
<th>The module of logistic</th>
<th>The module of reporting</th>
<th>Analysis and process monitoring module</th>
<th>Modeling/Forecasting Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Management system „odpadywgminie.com”</td>
<td>Profeko Sp z o.o.</td>
<td>Municipalities</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes */ 12</td>
</tr>
<tr>
<td>2</td>
<td>ecoSANIT</td>
<td>Logic Synergy</td>
<td>Municipalities</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No 9</td>
</tr>
<tr>
<td>3</td>
<td>Ulisses ODPADY</td>
<td>ULISSES</td>
<td>Municipalities</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes/** 15</td>
</tr>
<tr>
<td>4</td>
<td>Waste records 2015</td>
<td>darsoft.pl</td>
<td>Industrial companies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No 4</td>
</tr>
<tr>
<td>5</td>
<td>Waste Management Informatic System (SIGO)</td>
<td>Solvena Management Systems Sp. z o.o.</td>
<td>Companies engaging in complex municipal and industrial waste management.</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No 14</td>
</tr>
<tr>
<td>6</td>
<td>Municipal waste monitoring system</td>
<td>Solvena Management Systems Sp. z o.o.</td>
<td>Municipalities</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No 14</td>
</tr>
</tbody>
</table>

/* Creation of a „knowledge base” of waste management, simulation model of the costs and logistics of waste management in the municipality, creation of budgetary forecasts for the entire waste management system.
/** Forecasting local government incomings from waste management,
Source: Own elaboration

The proposed on the market tools, in particular are based on the database processing operation level, and above all, on waste quantity and morphology recording, and number of entities of their processing. The generated reports and reports for basic operation of the system, rarely planning and modeling new solutions. The exception is the management system called „odpadywgminie.com”, which supports waste management and prognostic simulation models of logistics processes and economic analyzes. The results of these additional features undoubtedly constitute value-added analysis and make it possible to try to improve the system and achieve better results with the waste recovery and recycling.
CONCLUSION

Review of the literature and available on the market applications to support waste management system, strengthens the conviction about the benefits of the decision support systems used in practice. Unquestionable advantages associated with the implementation of systems that translate into efficiency implemented actions include eg.:

- multicriterial – decisions can be examined from the point of view of any number of criteria;
- flexibility – the ability to input any number of decision variables, parameters, constraints, goals. DDS flexible structure makes it prepared to changing user needs;
- the possibility of hybrid approach – combining the use of several methods to solve the decision-making problem (np. SDSS);
- interdisciplinary approach – decision-making problems can be solved from the point of view of a variety of criteria such as technological, logistic, economic, social;
- low cost of ownership – the ability to acquire knowledge and to identify the best solution at the lowest cost;
- integration – the ability to quickly analyze and processing different (distributed) databases.

The presented examples in this article information system enable to support processes in various areas of waste management and realizing its targets. The weakness of the designed and implemented software solutions is the lack of a comprehensive approach. Each additional module to support separate areas could improve the efficiency of the decision-making processes at every level of waste management. Their extended properties can significantly contribute to a comprehensive approach within the different groups of waste flows, identifying the most ecologically and economically beneficial possibilities of their development. In addition, the compatibility of information systems at local and regional level avoids errors at registration. Therefore it is recommended a thorough analysis taking into account the needs of application DDS, for example:

- analysis of the current state of waste management problems and modeling purposes;
- choice of methods and tools for solving defined decision-making problems;
- determination of evaluation criteria, variables and parameters along with their preferred values;
- verify the ability to integrate existing resources of data and knowledge base with the designed system.

Despite the widespread use of DSS there are still many areas of waste management to implement such solutions. Unlimited possibilities that provide information technology enable the development of models using multi-criteria decision-making methods of analysis and evaluation. Waste management is one of those areas that the management and planning need to take into account the many complex aspects of both quantita-
tive and qualitative that is why all the applications are enabled to faster and more efficient work.

To conclude, designing the support systems for waste management requires a flexible approach that takes into account the problems of generation, transportation and various kinds of waste processing technology. Used for the structure of DDS models and databases should form an integrated waste management system, taking into account the legal, social, environmental and economic aspects.

REFERENCES
DECISION SUPPORT SYSTEMS IN WASTE MANAGEMENT
– A REVIEW OF SELECTED TOOLS

Abstract: The article presents review of information solutions in waste management with special regard to decision support systems (DSS). There was indicated basic components of system's architecture and their influence on waste management assignments. Analysis of designed and implemented software solutions has enabled the ordering of various types of information systems for decision-making levels of regional and municipal waste management systems.

Key words: decision support system, waste management system

SYSTEMY WSPOMAGAŃIA DECYZJI W GOSPODARCE ODPADAMI
– PRZEGLĄD WYBRANYCH NARZĘDZI

Streszczenie: W artykule przedstawiono przegląd rozwiązań informatycznych w gospodarce odpadami ze szczególnym uwzględnieniem systemów wspomagania decyzji (SWD). Wskazano zasadnicze komponenty architektury systemów oraz ich wpływ na realizację zadań z zakresu gospodarki odpadami. Analiza projektowanych i wdrażanych rozwiązań aplikacyjnych umożliwiła przyporządkowanie poszczególnych typów systemów informatycznych do poziomów decyzyjnych regionalnych i gminnych systemów gospodarki odpadami.

Słowa kluczowe: system wspomagania decyzji, system gospodarki odpadami

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4

ANALYSIS OF THE CAUSES THE QUANTITATIVE CHANGES AND TRENDS IN CONFERRED ISO 9001 CERTIFICATES IN POLAND.
RESEARCH BASED ON THE DATA FROM AUDITS

4.1 INTRODUCTION

Since ISO 9001 Standards appeared, they were used as guidelines for continuous operation improvement of enterprises. However, they were applied gradually not only in production enterprises but also in the case of services. It causes next changes, which appeared not only in construction but first of all, in substantial content of standards. The first revolutionary change in content was the release of ISO 9001:2000 Standard. The basis of these changes constituted the adaptation to current trends and conditions at the market. The next amendments to the content were not so decisive any more. Changes related only to minuteness of detail of separate issues, or changes in definitions. The release of the standard including next changes is planned at the end of 2015. This time the planned changes will be considerably wider than the earlier amendments. Not only the content will undergo the change, but also arrangement as well as the scope that standard shall include.

However, do amendments may influence the increase or decrease of enterprises quantity that subject to certifications? It is worth to think over if enterprises take the trouble to introduce changes connected with the certification, by implementing or supporting it, due to internal need of the improvement? Are there considerably more factors that determine the wish to possess as documentary form the fulfilling the specified requirements?

4.2 PURPOSE AND CHARACTERISTICS OF RESEARCH

The aim of the paper is to present how Polish enterprises assume an attitude towards the trends of certifications that appear at the market. Are the changes at the world market associated with fashion or issue of new release of the standard have the influence on the quantity of certificates granted in the country, and if so, to what extent?

In the research, data were collected pertaining to 2014, over a group above 300 chosen enterprises, without taking into account the factor of the location that is the provinces or localization in more industrialized region of the country.
The criteria of the division were as follows:

- the sort of enterprise activity – division into 12 general sectors that were divided to smaller groups;
- the size of the enterprise – in terms of quantity of current full time employments, with division into micro, small, medium, large and very large enterprises;
- duration of system possession – i.e. the period of possession by means of documented method the ISO 9001 certificate, with division into periods below one year, between 1 and 3 years, from 3 up to 6 years, from 6 up to 9 years, and duration longer than 9 years;
- the kind of conducted audit – that is certifying audit, recertifying one as well as the first and second supervision audits.

Based on conducted research, the below mentioned relationships were analysed: size, sort of activity of given enterprise (trade), as well as duration of possession by an enterprise the certificate pertaining to ISO 9001 Standard as well as the type of recently conducted audit.

4.3 STRUCTURE OF ENTERPRISES IN POLAND

As mentioned earlier, enterprises were divided into 12 sectors. Each of them possesses definite kind or kinds of activities that enterprise is composed of. Tab. 4.1 presents division of enterprises that were included in the research together with the division into separate sectors.

During the research there were check companies form almost every business sector. In results we received interesting comparison between branches. The biggest group of the companies that were checked during the research constitute establishment related with almost any kind of industry business.

Comparing results from research to number of certifications in Poland industry, we receive similar results than when we check only new data. In 2012 trade with the biggest number of new certifications were “Basic metal products”, and that was 9.36% of all certificates (Fig. 4.3). Now, after 2 years, that is still the leader. In new research for over 300 companies, there are 66 from sector Metal processing and manufacturing of metal products”.

As regards the division into trades of enterprises under research – the processing industry predominates. Processing industry includes 48% of entities under research (Fig. 4.1). However, this is the sector that contains the largest differentiation due to sort of activities that enterprise is composed of; thus the high result. It is worth to notice that they are trades that as the first ones began to implement the ISO 9001 Standard. That’s why we may assume that it operates there for the longest time; just these branches have the largest experience working with ISO 9001 and their knowledge is maximally developed. These are also common firms that may precisely specify, according to their opinion, what advantages and what disadvantages has possessing the standards, just due to experiences connected with them.
Tab. 4.1 The quantity of enterprises was described using more detailed division – i.e. into branches in separate sectors

<table>
<thead>
<tr>
<th>The division of enterprises in industries, in various sectors</th>
<th>Number of companies</th>
<th>The division of enterprises in industries, in various sectors</th>
<th>Number of companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Sector 1: Agriculture, fisheries, hotel and restaurants</td>
<td></td>
<td>Agriculture and forestry, fisheries and fish farming</td>
<td>3</td>
</tr>
<tr>
<td>Agriculture and forestry, fisheries and fish farming</td>
<td></td>
<td>Hospitality, Restaurants and Catering</td>
<td>1</td>
</tr>
<tr>
<td><strong>Business Sector 2: Processing industry</strong></td>
<td></td>
<td>Metal processing and manufacturing of metal products</td>
<td>66</td>
</tr>
<tr>
<td>Metal processing and manufacturing of metal products</td>
<td></td>
<td>Glass industry, ceramics, stones and minerals processing</td>
<td>5</td>
</tr>
<tr>
<td>Manufacture of rubber and plastic</td>
<td>27</td>
<td>Textiles &amp; Clothing</td>
<td>4</td>
</tr>
<tr>
<td>Mechanical engineering</td>
<td>21</td>
<td>Timber industry</td>
<td>2</td>
</tr>
<tr>
<td>Manufacture of office machinery, equipment and data processing equipment, electrical engineering, precision mechanics, optics</td>
<td>16</td>
<td>Production of cement, lime, plaster, articles of concrete, lime and plaster</td>
<td>3</td>
</tr>
<tr>
<td>Chemical industry</td>
<td>6</td>
<td>Publishing industry</td>
<td>0</td>
</tr>
<tr>
<td>Paper industry</td>
<td>6</td>
<td>Shipbuilding</td>
<td>0</td>
</tr>
<tr>
<td>Printing industry</td>
<td>6</td>
<td>Coking plants and oil industry</td>
<td>0</td>
</tr>
<tr>
<td>Service and repair of automobiles and related products used</td>
<td>5</td>
<td>Manufacturing nec (furniture, toys, musical instruments)</td>
<td>0</td>
</tr>
<tr>
<td>Manufacture of basic metals</td>
<td>5</td>
<td>Leather industry</td>
<td>0</td>
</tr>
<tr>
<td>Construction of other vehicles (vehicles, rail vehicles, motorcycles, bicycles)</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Business Sector 3: The construction sector</strong></td>
<td></td>
<td>Architecture</td>
<td>23</td>
</tr>
<tr>
<td><strong>Business Sector 4: Supply and waste disposal, recovery, recycling</strong></td>
<td>42</td>
<td>Recycling</td>
<td>2</td>
</tr>
<tr>
<td>Trade, wholesale and retail</td>
<td>42</td>
<td>Recycling</td>
<td>2</td>
</tr>
<tr>
<td>Provision of services for businesses</td>
<td>17</td>
<td>waste management</td>
<td>2</td>
</tr>
<tr>
<td>Research and scientific experimentation and engineering</td>
<td>16</td>
<td>Transmission of information and telecommunications</td>
<td>2</td>
</tr>
<tr>
<td>Transport and Storage</td>
<td>9</td>
<td>Electroenergetics</td>
<td>1</td>
</tr>
<tr>
<td>Administration building, developing, renting of machinery and household appliances, credit institutions and insurance, financial services, banking-in, leasing, loans, insurance</td>
<td>6</td>
<td>The provision of other public and personal services</td>
<td>1</td>
</tr>
<tr>
<td>Data processing, computer service, software delivery</td>
<td>5</td>
<td>Public management</td>
<td>0</td>
</tr>
<tr>
<td>Waterworks, heating</td>
<td>3</td>
<td>Gas industry</td>
<td>0</td>
</tr>
<tr>
<td><strong>Business Sector 6: Social services</strong></td>
<td></td>
<td><strong>Business Sector 7: Food products and tobacco industry</strong></td>
<td></td>
</tr>
<tr>
<td>Education, social services without accommodation</td>
<td>7</td>
<td>Food, Beverages and Tobacco</td>
<td>10</td>
</tr>
<tr>
<td><strong>Business Sector 8: Production and processing of nuclear fuels</strong></td>
<td></td>
<td><strong>Business Sector 9: Production of pharmaceuticals</strong></td>
<td></td>
</tr>
<tr>
<td>Production and processing, special nuclear material and fuel</td>
<td>0</td>
<td>Industry pharmaceutical products</td>
<td>2</td>
</tr>
<tr>
<td><strong>Business Sector 10: Aviation</strong></td>
<td></td>
<td><strong>Business Sector 12: Medical Devices</strong></td>
<td></td>
</tr>
<tr>
<td>Aviation</td>
<td>0</td>
<td>Production of medical devices</td>
<td>19</td>
</tr>
<tr>
<td><strong>Business Sector 11: Medical and Veterinary Services</strong></td>
<td></td>
<td>Social welfare</td>
<td>0</td>
</tr>
<tr>
<td>Therapeutics</td>
<td>15</td>
<td>Social welfare</td>
<td>0</td>
</tr>
<tr>
<td>Veterinary</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Own elaboration
Analysing the structure considering the size of enterprises (Fig. 4.2) the largest interest in possession or maintenance the certification appears in the group of small and medium enterprises. Just these enterprises constitute the most numerous group in Poland; according to Main Statistic Office (GUS) data, in 2013, among over 80 thousand of enterprises in Poland, 78% employ below 50 employees. The next group is medium entities group employing from 50 up to 249 persons – this makes up 18.1% of all registered enterprises in the country. Comparing results for Poland and UE firms (Fig. 4.4), the largest gross value added (GVA) is generated by companies that employ above 249 persons, firms employing lesser amount of employees constitute over 50% generated value. According to PARP data, within recent years, participation of small and medium size enterprises successively increases in creating the national gross product. In 2004-2009, the growth from 21.9% up to 23.9% followed for large enterprises as well as from 8.9% up to 10.1% in case of medium enterprises.

![Fig. 4.1 The division of enterprises in the sector, due to kind of business](Source: Own elaboration)

![Fig. 4.2 The division of enterprises according to number of its employees](Source: Own elaboration)
Fig. 4.3 Number of certifications ISO 9001 in Poland, by industry (in 2012 year)

Source: Own elaboration based on: [2], [3]
In case of such enterprises, possessing the certificate of specified scope allows being competitive, especially when more than one enterprise exists of similar profile of activity or prices in given area. At present, markdown stopped to be the best opportunity to encourage for co-operation. Regardless, whether this pertains to raw material deliveries, products or services. At present, the price is not any more the only criterion taken into consideration while linking co-operation. Frequently, the certification becomes the requirement or one of the terms of co-operation within given scope. This is a form of guarantee for other entities that given enterprise fulfils appropriate requirements.

![Fig. 4.4 The structure of generating of gross value added in the business sector by size of enterprises in Poland (left) and the UE (right) in 2009](source: [1])

Taking into consideration fluctuations in trends of certifications, certain dependences appear between trends in certification in the world and in Poland and the results of conducted research. In 1999-2012, slight loss of balance pertaining to increase of number of granted certificates appeared twice at certification market in Poland (Fig. 4.5).

![Fig. 4.5 Number of certificates ISO 9001 in Poland in years 1993 to 2012](source: [3])

This is equivalent with results of research conducted at present. Comparison of certificate possession duration in enterprises presented in Fig. 6 defines that enterprises having implemented and applied certificate within the period of time from 1 to 3 years constitute the largest group of enterprises. Imposing these data onto information on changes in quantity of granted certificates in Poland within the recent years, certain convergence appears.
The largest group of enterprises taking into consideration the time of possession of the system agrees with the data on the growth of quantity of certificates in our country. The second group as regards the size, are enterprises that possess the certificate 9 or more years. According to graph in Fig. 4.6, these enterprises are included within the range of enterprises that achieved the first certification before 2006, that is in the period of time in which permanent growth of the number of certification was observed. Thus the fact may be confirmed that a lot of enterprises that obtained the certification in the past still maintain it.

**Fig. 4.6 The division of companies given the time of having ISO 9001 certification**

Source: Own elaboration

Duration of certificate possession corresponds with types of research conducted. According to research conducted the largest participation in conducted research had supervision audits (Fig. 4.7). One may conclude that majority of enterprises under research are enterprises possessing implemented and operating, at least since several years, system of the quality management. Entities that recertificate constitute also a large group. The number of enterprises that just implement the certificates is the least numerous group. At present this is 8% among enterprises subject to research. This fact may present not very strong wish to possess the certificate among new or existing enterprises.

**Fig. 4.7 Number of audits carried out, divided by type**

Source: Own elaboration
This is also connected with the fact that large enterprises or smaller ones, but of stable position at the market often already possess certificates. Small enterprises or these ones that just begin the activity, due to changes at the market, may postpone the certification because of costs connected with it.

This fact is also the determinant of economic level. Referring to previous research connected with trends in certification we may assume that Poland reached higher economic level as well as certain degree of certificates saturation pertaining to ISO 9001; thus there are more audits conducted in order to maintain existing system than to start its possession.

CONCLUSION

At present, this is frequently to mention about the trend to reduce the number of granted certificates. This is noticeable in the world, but this fact should not be considered as a completely and unambiguously negative factor. Reduction of quantity of completely new certifications can also be the determinant of maturity of given country. Because this is still often required to specify fulfilment of certain criteria, both in the international trade as and national one, we cannot approach to its development in the completely unambiguous way.

Changes that proceed in enterprises structure in our country are quite standard if they are analysed taking into consideration the trends that may affect them. The market of certification has been filled to certain degree. However, new release of ISO 9001:2015 Standard issued this year, could change this approach. Until now, every new update constituted the point in which we could clearly see the growth in interest for certification. Revolutionary form and the change of customer group could produce a large interest, but now, not only in production branches but mainly in services.

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ANALYSIS OF THE CAUSES THE QUANTITATIVE CHANGES AND TRENDS IN CONFERRED ISO 9001 CERTIFICATES IN POLAND.
RESEARCH BASED ON THE DATA FROM AUDITS

Abstract: The article presents the results of research conducted on the basis of data from audits. Comparison of the results of this research, with information related to trends and volatility in the certification, allowed the presentation appearing depending between them. It was also touched on the information about new edition of ISO 9001: 2015, how many an what kind of changes it may cause in the quantities of new and maintained certificates among enterprises. In summary of that article, has been presented the possible influence of factors determining changes but not only the quantity but also the business structure undergoing certification companies.

Key words: certification, ISO 9001, quality management systems

ANALIZA PRZyczYN ZMIA=N ILOŚCIOWYCH ORAZ TRENĐÓW NADAWANYCH CERTYFIKATÓW ISO 9001 W POLSCE.
BADANIE W OparciU o DANE POAUDYTOWE

Streszczenie: W artykule przedstawione zostały wyniki badań przeprowadzonych w oparciu o dane poaudytowe. Zestawienie wyników tych badań z informacjami związanymi z trendami oraz zmiennością na rynku certyfikacji, pozwoliło na przedstawienie pojawiających się między nimi zależności. Poruszony został także temat wprowadzanego nowego wydania normy ISO 9001:2015, z punktu widzenia zmian w ilościach nowych oraz utrzymanych certyfikatów wśród przedsiębiorstw. W podsumowaniu opracowania zostały także możliwe wpływy czynników warunkujących zmiany w nie tylko ilości nadawanych certyfikatów ale także strukturze przedsiębiorstw poddających się certyfikacji.

Słowa kluczowe: certyfikacja, ISO 9001, systemy zarządzania jakością

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5

BENEFITS OF MCHP XRGI USE IN THE BREWING INDUSTRY

5.1 INTRODUCTION

Energy management determines capabilities of development of enterprises to a great extent. It differs depending on the profile of activity, access to various energy carriers and the enterprises’ energy policy. Electricity and heat are basic kinds of energy used in production facilities. Their generation is mainly based on processing chemical energy of fuel in thermal processes. Introduction and wide-scale use of solutions reducing operational costs as well as emissions of pollutants into the natural environment is therefore important [1].

Cogeneration, or combined heat and power (CHP) is conversion of energy carriers into heat, cooling, electricity or mechanical energy in a system or group of machines. It can be conducted on big scale in thermal power plants, as well as on a much smaller scale with micro co-generators. According to the Polish Energy Act, micro co-generation is production in one device of up to 40 kW of electric power and up to 70 kW of thermal energy. MCHP – Micro Co-Generation of Heat and Power – is the abbreviation commonly used for micro co-generators. Of distinction among the known micro co-generation technologies is the MCHP XRGI (XRGI as exergy), which provides higher efficiency than traditional MCHP systems. The complex solution in question, the MCHP XRGI system, consists of an electricity generator powered by a gas engine, and an integrated intelligent heat distributor [5].

Among the various industrial branches of modern economy, food industry is one, where heat and electricity form a major part of production costs. Brewing is in turn one type of food production, which requires relatively considerable input of electricity and heat. The side-effect of electricity generation are emissions of CO₂, CO, NOₓ, SO₂ and other gases originating from both the local energy sources at the brewery (most commonly a gas fueled boiler) as well as from its sources of power (power plants) [6]. This paper shows the applicability of the micro-cogeneration in breweries of different production volumes.

5.2 THE BREWING PROCESS

Operations of the brewery are typically consisting of seven steps: mashing, lautering, boiling, fermenting, conditioning, filtering, and filling. The brewing process consist of three major processing stages, namely the brewhouse (black), storage & fermentation
(grey), and bottling (white). The processing steps within these stages require energy, in the form of electricity, heat or cooling [2]. Detailed processes vary but essential flows of materials and energy are shown on Fig. 5.1.

![Fig. 5.1 Characteristics of the brewery operations](image)

Source: [2]

5.3 ENERGY USE IN A BREWERY

Brewing is an energy-intensive process, and the objective for almost every brewing company is the development of a sustainable process with efficient energy consumption to obtain savings in fuel and energy costs. The major consumers of heat in brewery are mashing, wort boiling, bottle washing, clearing in process (CIP), space heating, beer pasteurization and packing. Electricity is used mainly in beer packing, wort cooling, air compressing, boiler cooling, and various devices such as pumps, fans and lighting.

The European Commission (EC) published best available techniques reference (BREF) documents. BREF documents can be considered as guidelines for reduction of energy consumption and sustainable production technologies in European industry in general [3]. References for brewing are shown in Tab. 5.1 and Tab. 5.2.

In general, heat consumption in Polish breweries varies from 27 up to 54 kWh/hl, while electricity consumption varies from 8 to 12 kWh/hl of beer produced.

<table>
<thead>
<tr>
<th>Tab. 5.1 Benchmarks for European Breweries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter</td>
</tr>
<tr>
<td>-------------------------------------------</td>
</tr>
<tr>
<td>Fresh water consumption</td>
</tr>
<tr>
<td>Thermal energy consumption</td>
</tr>
<tr>
<td>Electricity consumption</td>
</tr>
<tr>
<td>Kieselguhr consumption</td>
</tr>
</tbody>
</table>

Source: Own elaboration
The processing steps of wort boiling and bottle washing require more than half of the thermal energy needed in breweries. Electricity is used for refrigerating purposes in storage and fermentation. Fig. 5.2 and Fig. 5.3 illustrate the energy demand, both electric and thermal, in breweries.

There exists a large energy demand from low-temperature heat-consuming processes, such as bottle washing (90°C) and filtration. Two main criteria positively affect the efficiency of CHP facilities in breweries: a larger number of low temperature processes, and a constant heat and/or cooling demand. Combined heat and power (CHP) or cogeneration has significant potential in the brewery industry, enabling it to reduce operational costs and carbon emissions. Converting the heat into cooling via absorption chillers is called combined cooling heat and power (CCHP) or trigeneration, and can be deployed to support the cooling requirements of the brewery. Benefits of CHP for the brewery industry are not only energy cost savings, but also environment protection, flexibility of power supply, simplified maintenance and, in addition, CHP is scalable according to demands.

### 5.4 SELECTION OF MICRO-COGENERATION UNIT

According to Brewers Association, breweries can be classified, taking into consideration their output in hectoliters, in the following manner:
- macro/large brewery – over 7.000.000 hl,
- craft brewery – less than 7.000.000 hl,
- micro brewery – less than 17.600 hl.
There is no officially-defined level of beer for a brewery to be classified as a Nano brewery, but it is accepted across the beer industry that a Nano brewery is defined based on the size of its brewery system. A Nano brewery produces beer with a 4.7 hl (4 barrel) brewing system or less [1].

In recent years, regional and local (craft) breweries are gaining more and more popularity. This trend is a direct response to consumers affected by poor quality of beer produced by the large national and multi-national brewer groups. And while the craft breweries' share of overall beer market in Poland is still very small (about 6-7%), the perspective of its development is very optimistic.

On specialized fora, more and more people declare, that they do not drink any beer made by the largest brewing groups. Regional and local breweries are gradually increasing their recognition and popularity in the eyes of consumers.

In March 2015, the first edition of craft beerweek took place in Krakow, with 15 Polish craft breweries serving the best Polish craft beers. Typical beer festivals in our country are a more frequent phenomenon. There is also an increasing availability of craft beers. Beer revolution has become so dynamic, that even the most steadfast birofile are not being able to try all of its new produce. E.g. only in 2014 more than half a thousand beer ‘premieres’ took place [4]. Typical craft brewery in Poland has an output varying from 20000 hl up to 1.4000.000 hl. Therefore, this group of breweries can, together with micro breweries, become the target for introduction of micro-cogeneration systems MCHP XRGI.

5.5 METHODOLOGY OF SAVINGS ESTIMATION

MCHP XRGI technology is characterized by large savings in operational costs resulting from:

- low price of kWh generated by natural gas,
- exceptionally high efficiency of micro-cogeneration unit.

<table>
<thead>
<tr>
<th>Tab. 5.3 Comparison of traditional system (purchasing electricity from the grid and using a gas boiler) and cogeneration unit (using a MCHP XRGI 20 unit)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Traditional system</strong></td>
</tr>
<tr>
<td>Energy [kWh]</td>
</tr>
<tr>
<td>Electricity purchase</td>
</tr>
<tr>
<td>Thermal energy generation</td>
</tr>
<tr>
<td>Total:</td>
</tr>
<tr>
<td><strong>Cogeneration unit MCHP</strong></td>
</tr>
<tr>
<td>Energy [kWh]</td>
</tr>
<tr>
<td>Electricity generation</td>
</tr>
<tr>
<td>Thermal energy generation</td>
</tr>
<tr>
<td>Profits from yellow certificates</td>
</tr>
<tr>
<td>Total:</td>
</tr>
</tbody>
</table>

Source: [5]
On the basis of the above-calculated savings per hour of operation it can be seen that to supply a certain amount of electricity and heat to the processes can be ~47% cheaper when the microcogeneration system is applied (Tab. 5.3).

Knowing demands for selected processes as shown in Tab. 5.5 and Tab. 5.6, and comparing them with cogeneration unit output (Tab. 5.4) we are able to choose appropriate cogeneration unit or units. For example, considering continuous processes of brewing and cooling:

- for a micro-brewery (output 17,600 hl/year) XRGI9 unit is suitable,
- for a small regional brewery (output 20,000hl/year) XRGI15 unit is suitable,
- for a medium regional brewery (output of 350,000 hl/year) we can use 4 or 5 XRGI20 units.

**Tab. 5.4 Co-generators output per year (8760 hours of operation)**

<table>
<thead>
<tr>
<th>Type of MCHP XRG1 unit</th>
<th>XRGI 6</th>
<th>XRGI 9</th>
<th>XRGI 15</th>
<th>XRGI 20</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Electricity Generation [kWhe]</strong></td>
<td>21,900</td>
<td>35,040</td>
<td>52,560</td>
<td>87,600</td>
</tr>
<tr>
<td>52,560</td>
<td>78,840</td>
<td>133,152</td>
<td>175,200</td>
<td></td>
</tr>
<tr>
<td><strong>Thermal energy generation [kWhth]</strong></td>
<td>74,460</td>
<td>122,640</td>
<td>148,920</td>
<td>219,000</td>
</tr>
<tr>
<td>118,260</td>
<td>175,200</td>
<td>262,800</td>
<td>350,400</td>
<td></td>
</tr>
</tbody>
</table>

Source: [5]

**Tab. 5.5 Electricity and thermal energy consumption per hl of beer for a Polish (micro) brewery and for its selected processes**

<table>
<thead>
<tr>
<th>Per hl of beer</th>
<th>Per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity consumption for brewery [kWhe]</td>
<td>8.5-12</td>
</tr>
<tr>
<td>Thermal energy consumption for brewery [kWhth]</td>
<td>27-54</td>
</tr>
<tr>
<td>Electricity consumption for brewing and cooling [kWhe]</td>
<td>79,300-111,900</td>
</tr>
<tr>
<td>Thermal energy consumption for brewing [kWhth]</td>
<td>180,500-361,000</td>
</tr>
</tbody>
</table>

Source: Own elaboration

**Tab. 5.6 Electricity and thermal energy consumption per hl of beer for a Polish craft brewery and for its selected processes**

<table>
<thead>
<tr>
<th>Brewery output [hl/year]</th>
<th>20.000</th>
<th>350.000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity consumption for brewery [kWhe/year]</td>
<td>170.000-240.000</td>
<td>2.975.000-4.200.000</td>
</tr>
<tr>
<td>Thermal energy consumption for brewery [kWhth/year]</td>
<td>540.000-1.080.000</td>
<td>9.450.000-18.900.000</td>
</tr>
<tr>
<td>Electricity consumption for brewing and cooling [kWhe/year]</td>
<td>90.100-127.200</td>
<td>1.576.750-2.226.000</td>
</tr>
<tr>
<td>Thermal energy consumption for brewing [kWhth/year]</td>
<td>205.200-510.400</td>
<td>3.591.000-7.182.000</td>
</tr>
</tbody>
</table>

Source: Own elaboration

**CONCLUSIONS**

With the above calculations made, it appears that cogeneration should be one of the essential elements of reduction of energy consumption in the brewing industry. For large-scale brewers, due to scope of their energy demand, the best solution...
is a classic form of combined heat and power generation CHP, or combined cooling heat and power (CCHP) generation. For regional breweries and microbreweries a good solution is to use micro-cogeneration CHP XRG1.

Properly selected micro-cogeneration system can in 100% meet brewery demands for electric energy for the process of brewing and cooling beer, and in 30% for the heat needed for brewing. Of course, there is the possibility of increasing the power of selected co-generators in order to provide energy not only to the process of brewing and cooling, but also for other processes in the brewery. However, this requires precise electrical and thermal profiles, which are specific to a particular brewery.

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Abstract: This paper presents basic process flows in beer-making and their energy demands. Prospect of introduction of a different types of cogeneration according to yearly output of breweries is analyzed. Capability of improvement of energy management in micro, small regional and medium size regional breweries through the use of gas micro-cogeneration MCHP XRGI is presented. Comparison of cost of operation is shown for both traditional and proposed system.

Key words: heat, electricity, micro co-generation, natural environment, brewing industry energy management, MCHP XRGI

KORZYŚCI Z ZASTOSOWANIA MCHP XRGI W BROWARNICTWIE

Streszczenie: W artykule przedstawiono zasadnicze procesy technologiczne występujące w browarach oraz ich potrzeby energetyczne. Przeanalizowano możliwości wprowadzenia różnych rodzajów kogeneracji w zależności od wielkości rocznej produkcji browarów. Zaproponowano możliwości poprawy gospodarowania energią w browarach mikro, oraz małych i średnich browarach regionalnych, poprzez wykorzystanie mikrokogeneracji gazowej MCHP XRGI. Pokazano również porównanie kosztów operacyjnych dla tradycyjnego i proponowanego systemu.

Słowa kluczowe: ciepło, energia elektryczna, mikrokogeneracja, środowisko naturalne, browarstwo, gospodarowanie energią, MCHP XRGI

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6

THE ROLE OF LEADERS IN SHAPING
THE QUALITY IN THE CONTEXT
OF PREPARATION OF SELF-ASSESSMENT FOR
THE POLISH QUALITY AWARD COMPETITION

6.1 INTRODUCTION

According to the Central Statistical Office in 2013 there were 1771 thousands
of non-financial companies operating in Poland [2]. These numbers of entities together
with the environment in which they operate constitute specific stimulators in a bid
to achieve a stable economic and competitive position. This strive for achieving high
competitive and market position motivates the leaders in those entities to lead as well
as take actions towards improvement, with the use of various tools and methods. There
are numerous management tools. One of them is the quality management system ISO
9001 which was implemented and started functioning in Poland in more than 10,000
organizations [4]. This system enables comprehensive orderliness of the processes with-
in the organization as well as a focus on defined objectives.

Management commitment is one of the key elements of the functioning of the
system. The system, as a result of built-in mechanisms, stimulates the leaders to analyse
information which is provided by the system and directs further actions by requiring
direct evidence [3, 5]. Therefore, leadership is one of the most important elements in the
functioning of the organization. It embraces the whole organization. Leaders define the
objectives of the organization, create the vision as well as they develop strategy and
allocate necessary resources in order to realize the objectives within the organization.
Their attitude constitutes a factor which has the greatest influence on the internal custo-
mers at all stages of the activities including the quality management system.

The aim of this article is to present the role of the leaders in contemporary organi-
zations during implementation and shaping of the quality management system,
in setting out the organizational strategies as well as tools for monitoring the quality
management system in enterprises.

6.2 LEADERS AND CORPORATE SOCIAL RESPONSIBILITY

Corporate Social Responsibility is a concept representing the implementation
of sustainable (lasting) development including the economic, environmental and social
aspects” (...) [10]. The implementation of this concept has a significant impact on the management of the organization as well as building of a positive image, both in social and economic environment. Rapid changes in the environment of the entities force leaders to adopt a strong attitude, in favour of the integration of stakeholders around the objectives of the organization. Leaders play different roles in the organization. Interpersonal roles – by representing the organization, the leader is both a leader and a mentor in defining standards and the way of performing work, as well as constituting a contact person between various levels of organization. Informative role is also an important part of a leader’s job – he has to be an observer and seeker of new solutions for the organization as well as a spokesperson among the stakeholders of the organization. Decision-making roles are roles which are fulfilled when making decisions resulting from the initiation and implementation of the changes, resource allocation as well as negotiations [1], [8]. Leader is also responsible for realization of declared actions. In the context of Corporate Social Responsibility the leaders’ tasks are detailed as a result of their commitment to promote Corporate Social Responsibility. It is also indispensable for the leaders to fulfil their role in environmental management, ethics, observance of workers’ rights as well as they are obliged to analyse the trends which have an impact on Corporate Social Responsibility. Moreover, it is a vital interest to include Corporate Social responsibility in strategic planning.

6.3 LEADERSHIP STRATEGY IN TQM - TOTAL QUALITY LEADERSHIP

In order to be able to operate in the market, an organization needs an adequate strategy, which would take into consideration both opportunities and threats. The adoption of the strategy is related to the necessity of a trade-off (with the use of available resources) between two states of the enterprise: stability and variability in actions. This contradiction results from the specific understanding of the issue. Importantly, the strategy of quality in one aspect (concentration of actions in order to achieve defined objectives) will be a guideline for operational activities of the company, whereas in the second one it will focus on the flexibility of the entity in an effort to meet the needs and expectations of internal and external stakeholders. Among the adopted quality strategies, one can distinguish the strategies of: leadership; engagement of employees; customer loyalty; organizational culture; quality improvement programmes; techniques, methods and tools of quality; marketing orientation; mass trainings [6]. Connections between different quality strategies are presented in Fig. 6.1. When analysing the figure below, it can be noticed that the strategy of leadership directly affects the following strategies: organizational culture, engagement of employees and customer loyalty. These strategies in turn have an impact on:

- the strategy of organizational culture on the quality improvement programmes and the strategy of techniques, methods and quality tools;
- the strategy of customer loyalty on the strategy of marketing orientation;
mutual interaction occurs between the strategy of engagement of employees and the strategy of organizational culture as well as between the strategy of engagement of the employees and the strategy of mass trainings.

Fig. 6.1 Relationship between quality strategies

Source: [9], p.162

Leadership is the most important factor affecting the effective and efficient functioning of the organization. The concept of Total Quality Leadership, which means total leadership through quality, is aimed to provide the highest quality for the customer, which is a result of continuous improvement of actions, covering all aspects of the organization [6]. TQL also means the use of quantitative methods in order to maintain and improve both products and services resulting from the reported needs of the customers. Therefore, when implementing TQL it is indispensable to take into account the following elements [11]:

- adequate leadership: stimulation of the engagement of all employees achieved by choosing the right leaders;
- use of quantitative methods: the use of analyses and statistics when making decisions;
- knowledge management: all actions aimed to provide team cooperation as well as achieve mutual learning of the employees;
- continuous improvement: supervising the improvement of all processes with the use of the concept of continuous improvement;
- process orientation: it is necessary to order all processes in the organization and give them right priorities;
- meeting the needs of end users: it is necessary to direct any action on meeting directly the needs of the recipients;
- short- and long-term approach: it is necessary to ensure financial stability in the current period as well as to determine the long-term assumptions.

In pro-quality organization, it is the leader who directly shows how to use the capital, both tangible and human. His involvement in the process of identification of the objectives of the organization has a substantial influence on the environment in which
the company operates. The leader of TQL is a visionary and at the same time innovator who believes in progress and human capital. His task is to determine the limits for independence and responsibility of the workers [6].

6.4 THE ROLE OF LEADERSHIP ACCORDING TO THE CRITERIA OF POLISH QUALITY AWARD

Polish Quality Award criteria are developed on the basis of the philosophy of the „The EFQM Excellence Model – the European Foundation for Quality Management”, which are aimed to promote the concept of TQM in Polish organizations – and thus focus on the achievement of European excellence. One of the criteria assessed in the Polish Quality Award is leadership. It constitutes (in addition to strategy, employees, partnership and resources, products and services) the pillar of organization’s potential. This criterion assesses the engagement of the leaders in shaping the future, by defining clear goals and striving to achieve them. According to the Polish Quality Award the best leaders [7]:

- serve as models, strengthen the culture of workers,
- define and communicate the main and most important directions of development,
- know strategic determinants of business development,
- show competence by making substantive and current decisions based on facts, using their experience and taking any consequences of undertaken actions and decisions,
- are characterized by flexibility, especially in setting new directions for the development of the organization,
- build trust of employees and stakeholders.

When analysing the aforementioned tasks which the TQM imposes on leaders, one can easily notice a broad scope of effects which leaders have on the functioning of a company. They are the driving force of the organization, through making the decisions which determine the directions of development of the organization as well as determine the total activity of the company.

6.5 ANALYSIS OF THE ROLE OF A LEADER IN COPMANIES – RESEARCH RESULTS

In order to analyze the role of leaders in organizations with mature quality management system, a pilot study was conducted. Questionnaire was used as a research tool. The obtained data was supplemented with face to face interviews carried out in a group of representatives from manufacturing companies. The study was conducted on one group of participants taking part in training on preparation of the proposal – self-assessment for the competition of Polish Quality Award. The participants of the training were 3 manufacturing companies and one public organization – health care. The study was conducted on a sample of all manufacturing companies with an exception of healthcare organization. The surveyed companies belonged to the group of small (10-50 employees), big (251-500 employees) and large (over 501 employees) organizations which gives an opportunity to compare practices in the surveyed entities. In this study the pro-
blems regarding the participation of leaders at various stages of creation and control of the quality management system were discussed. Selected issues connected directly with the position of leaders as well as their attitude during realization of selected tasks are described later in this paper.

Implementation of the quality management system – whether the organization has implemented the quality management system with an external consultant – just one of the organizations did not use an external advisor. When making a decision about taking an external advisor the management of the organization took into consideration the opinions of other organizations about a given advisory company, its name and prestige. The fee for the service was also of great importance. Considering the obtained responses, as well as complementing them with interviews, it can be concluded that due to the decisions of the leaders in most organizations, external advisors together with all employees took active part in building the systems. The choice of advisors was based on well-thought-out decisions, allowing determining the requirements for the system, and at the same time determining the degree of branch knowledge of advisory company. The analysis regarding the cash which could be used for the implementation of the quality management system was equally important.

The need to implement the quality management system – to what extent the need to build the quality management system resulted from internal needs and to what extent from external needs – in the study group only one company put the equality sign between the external and internal needs. Other entities pointed at the external need as a dominant one. In the conducted interviews the participants agreed that the predominant external factor, in addition to competitive advantage, is taking care about the company’s image in the eyes of the customers. The quality management system is supposed to make the company credible in the eyes of the customers. Moreover, it should constitute a guarantee of diligence at all stages of realization of a given service. When analysing the obtained information it is clear that leaders pay special attention to the satisfaction of customers. The decision to implement the quality management system stemmed from thoughts on both the customer and market analysis – looking for a competitive advantage. In their activities, leaders also took into consideration an internal need which is undoubtedly the need to systematize all processes within the company, and thereby to enhance the comfort of the employees, to determine the limits of liability.

Selection of certification body – is also within the scope of the duties of the top management of the organization – entities subject to the survey proved that the management took into consideration the name and prestige when choosing a particular certification body. Achieving competitive advantage as a result of implementation of the quality management system is directly connected with obtaining a certificate. It is necessary to take into account the fact that each and every prospective customer will have some knowledge on the certification bodies because they, thanks to their established reputation, can guarantee reliable system audits as well as the accuracy of reports form the conducted audits.
Treatment of the quality management systems in the organization – as a system covering all actions of the organization realized in all organizational units. Building awareness of the employees as well as enforcing the proper functioning of the quality management system is not possible without full commitment of leaders as well as their model behaviour. All actions taken up by the leaders constitute an example for all employees and at the same time, they encourage them to adopt the correct attitude towards the assumptions of the quality management system and, therefore, are reflected in the way it is treated within the organization. In the surveyed companies the system is the management tool. This answer clearly shows high commitment of the leaders in the development and implementation of the system.

The tools used in the organization to examine the effectiveness of the quality management system – the respondents indicated the following tools which were used to examine the effectiveness of the quality management system in the organizations: internal audit, monitoring of processes, management review, measurement of customer satisfaction, self-assessment, measurement of the realization of the qualitative objectives, balanced scorecard, measurement of the employees satisfaction. It is clear, therefore, that in the surveyed companies different tools to measure the effectiveness of the quality management system are used. The commitment of leaders constitutes an essential factor in a process of measurement of the quality management system. They monitor and moderate this process. Committed leaders justify in a reasonable way the necessity for measurement, they allocate adequate resources for this purpose, they choose adequate people who would be responsible for this process as well as they try to properly prepare them for this task.

When analysing the potential of the organization, the companies pointed at leadership, strategy and policy as the most important among the pillars of this group. These are the pillars which are directly created by the top management of the organization. Apparently, among the surveyed companies with mature quality management system the leaders fully fulfil their tasks. Full commitment of the leaders allowed the companies to implement TQM, guarantee resources for realization of clearly defined objectives as well as to convince each of the entities to adopt determined strategy of the company.

CONCLUSIONS

Each of the entities functioning on the market has both the potential as well as resources. Proper use of these two components is a guarantee of the success of the company operating in contemporary surroundings. The pace of changes can often cause a problem in keeping up with the trends or ever increasing competition – that is the reason why adapting a corporate strategy as well as motivating employees are extremely important factors in the organization. These tasks are realized by the leaders of those entities. One cannot fail to recognize social responsibility of organization. Leaders are assessed in terms of ethics, observance of workers’ rights and conditions of their work, analysis of future market trends. A crucial aspect of the function of a leader is the assigned interpersonal, informative and decision-making roles which
shape his position and give him powerful position in the organization. Another important aspect of the leader is to develop an appropriate leadership strategy – it is extremely responsible function from the perspective of the organization. As indicated in this article, the leadership strategy has a direct impact on all adopted strategies. This correlation creates the responsibility of leaders for all areas of operations as well as all processes in the company. On the other hand, an application of Total Quality Leadership imposes on leaders an obligation as well as responsibilities for whole organization with a special emphasis on the awareness of their tasks. TQL incudes guidelines for realization of tasks i.e. indicate the areas which require special attention. The qualities that a leader should possess are equally important. They include: self-awareness, self-regulation, motivation, empathy as well as social skills. The role of leadership is also indicated in the competition of Polish Quality Award – it is one of the pillars of the potential of the organization. However, as it was proved in this paper it has a direct impact on the whole organization.

By analysing the data obtained in the survey as well as in direct interview, it should be noted that leaders are fully oriented on cooperation with organizations. They make a decision to implement the quality management system to the company, taking into consideration both internal and external needs. Leaders have a direct influence on the choice of the external advisor to implement the system as well as the certification body. The conditions for making the right choices were in each case an opinion, name and prestige of the organization, which proves to be a well-thought choice as well as it shows their responsibility for taken actions. From the obtained information it appears that the leaders of companies taking part in the Polish Quality Award competition take care of a conscious propagation of the quality management system in the companies managed by them. It results from the way in which the system is treated – as a system covering all activities in the organization, realized in all organizational units. Another advantage of the leaders in the surveyed companies is a wide use of tools for measuring the effectiveness of the system. As it results from the obtained data leaders use various tools to measure the effectiveness of the system (internal audit, monitoring of the processes, management review, measurement of customer satisfaction, self-assessment, balanced scorecard, measurement of the employees’ satisfaction), measuring not only the processes connected with the customer but also those connected with the whole organization. Respondents also pointed to the importance of leadership, strategy and policy as the most important pillars distinguished in Polish Quality Award competition. It should be noted that both the strategy and adopted policy of the company are created by leaders of the organization.

In the conducted study each of the responses indicates an extremely important role of the leaders in organizations. It is often their attitude towards the organization and its problems which determines the success or failure in achieving the competitive position, economic success or success of the organization.
REFERENCES


THE ROLE OF LEADERS IN SHAPING THE QUALITY 
IN THE CONTEXT OF PREPARATION OF SELF-ASSESSMENT 
FOR THE POLISH QUALITY AWARD COMPETITION

Abstract: This paper tries to identify the role of the leaders in shaping the quality within an organization. It describes the area as well as the range of the influence of leaders in organizations. The relationship between leadership strategy and other strategies adopted in the companies was indicated. Moreover, an attempt was made to determine the influence of the leaders on particular stages of implementation as well as functioning of the quality management system in the enterprise. It also presents the role of leadership according to the Polish Quality Award criteria. An analysis indicating the areas of leaders’ influence was conducted on the basis of a survey and interviews carried out in a group of participants of one of the trainings on the preparation of self-assessment for the Polish Quality Award competition.

Key words: leader, quality management system, Total Quality Leadership, self-assessment, the Polish Quality Award

ROLA LIDERÓW W KSZTAŁTOWANIU JAKOSCI W KONTEKSCIE 
PRZYGOTOWYWANIA SAMOOCENY DO KONKURSU POLSKIEJ NAGRODY JAKOŚCI

Streszczenie: W opracowaniu starano się przedstawić rolę jaką spełniają liderzy w kształtowaniu jakości w organizacji. Zobrazowano obszar wpływu i zasięg oddziaływania liderów w przedsiębiorstwach. Wskazano relacje zachodzące pomiędzy strategią przywództwa a pozostałymi strategiami przyjętymi w organizacjach. Podjęto próbę określenia wpływu liderów na poszczególne etapy wdrażania i funkcjonowania systemu zarządzania jakością w przedsiębiorstwie. Przedstawiono również rolę przywództwa według kryteriów Polskiej Nagrody Jakości. Analizy wskazującej obszary oddziaływania liderów, dokonano na podstawie przeprowadzonych badań ankietowych, uzupełnionych o wywiady na grupie uczestników jednego ze szkoleń z zakresu przygotowywania wniosków samooceny, do udziału w konkursie Polskiej Nagrody Jakości.

Słowa kluczowe: lider, system zarządzania jakością, Total Quality Leadership, samoocena, Polska Nagroda Jakości

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AN ANALYSIS OF DEGRADED POST-MINING AREAS TO BE RE-DEVELOPED – CASE STUDY: SLIME SEPARATORS

7.1 INTRODUCTION

The dynamics of economic transformations in Poland, including mainly the process of transforming the socialist economy into a market one, resulted in a large number of abandoned undeveloped post-mining areas. Many hard coal mining plants could not become profitable, which led to their liquidation. Closed mining plants are often located in town centres or in densely populated districts. They are abandoned or used to a modest extent, and their revitalization would require considerable expenditure. Another problem is related to areas affected by mining activity which are located away from the plant. Such areas could frequently be used in a new way, but: the visual condition is a deterrent preventing any activities, the property status of the areas is not regulated, the areas are largely contaminated and there are facilities difficult to adapt.

Among the visible effects of mining activity the one which comes to the fore is surface degradation, dependent on the technology of mining and geological conditions. Area subsidence, an effect of underground mining activity, frequently leads to the creation of characteristic elements of industrial and post-industrial landscape – overflow lands or inundated areas, which take up the farmland, woodland or settlement area.

Surface degradation also includes using the area for waste landfills formed as a result of fossil extraction and processing, so-called heaps and slime separators, where coal sludge of insufficient calorific value is stored. Post-mining waste landfills have a strong negative impact on the landscape aesthetics, but most importantly they are a source of harmful substances permeating to water and emissions of gaseous and dust contaminations. Particularly dangerous is the phenomenon of self-ignition, which tends to occur in older heaps, where frequently material containing several dozen percent of coal was dumped [1].

In the article an initial analysis of a selected part of the post-mining area in the south-western district of Rybnik has been conducted. Basic problems hindering the development as well as the assets of the area have been presented.
7.2 INFLUENCE OF MINING ACTIVITY ON THE AREA

Mining activity has negative effects, which may continue for many years after stopping the extraction or which may permanently influence the affected area.

Among the visible effects the one which comes to the fore is physical degradation of the surface, dependent on the type of mining technologies, the intensity of mining as well as the geological form of the deposit.

Surface degradation is reflected in area subsidence, horizontal displacements or slopes. Apart from surface deformations, it directly translates into destruction or damage to buildings located in the degraded area. Area subsidence frequently leads to the formation of characteristic elements of industrial and post-industrial landscape – overflow lands and inundated areas which take up farmland, woodland or settlement land. An overflow land is water accumulation in the lowered part of the area. Partial inundations, on the other hand, lead to excessive water accumulation in soil in the subsided area. Negative effects of partial inundations include mainly: soil degradation, losses in crops and stand of trees, destruction of natural plant community.

Surface degradation also includes the use of an area for storing the waste produced as a result of fossil extraction and processing, so-called heaps and slime separators, where coal sludge of low calorific value is dumped. Post-mining waste landfills have a definitely negative influence on landscape aesthetics, but first of all, they are a source of harmful substances permeating into waters and emissions of gaseous and dust contaminations. Particularly dangerous is the phenomenon of self-ignition, which occurs mostly in older heaps with waste containing large amounts of coal.

Degradation is also reflected in a change of hydrographic conditions. Two groups of factors can be distinguished: factors directly influencing a change of water circulation and a group of factors indirectly contributing to a change in hydrographic conditions. Direct factors include: uptakes and discharges of water, discharges of deep mine waters to water courses, transfer of water between drainage bases as well as drainage and intensive, long-lasting extraction of groundwater. Indirect factors include among others: melioration works, regulation of water courses and their beds development, change in land use. The above described physical effects concern areas situated far away from the immediate vicinity of a mining plant, whereas the area related to mine overground infrastructure can be affected by effects of chemical degradation, which is reflected e.g. in the saturation of land with compounds harmful to human health or life.

7.3 INVESTMENT LIMITATIONS

The process of economic transformations in Poland caused among others the liquidation of many mining plants. Located frequently in or near urban centres, they are potentially good investment areas – they have convenient road and rail connections with an urban centre and are equipped with energy infrastructure. In the immediate vicinity of a former mining plant there are sometimes post-mining buildings with interesting, historical forms, which would be perfect headquarters of various subjects and institutions.
Unfortunately, due to many factors, in the investors' opinion, the disadvantages of post-mining areas outnumber their advantages. Major drawbacks include the lack of complete information on the key features of a given area – “unreasonably” divided area, unclear property situation, soil contamination or underground infrastructure or its chaotic remains, which make building works difficult. As a result, the investors' attention is directed to undeveloped areas, which despite being located far from the centres, are free of troublesome “surprises”, legal as well as environmental and building ones. A key to the investor’s interest in redevelopment of a post-mining area is providing its detailed analysis, which accurately describes the area’s past and the effects of mining activity, the current condition of the area as well as possible directions of its new development.

7.4 CHARACTERISTICS OF THE AREA SUBJECTED TO ANALYSIS

The area selected for analysis is the reclaimed terrain of former slime separators of „Rymer” coal mine in Rybnik-Niedobczyce. Slime separators are used for storing waste produced in the coal refining process. The mined rock is contaminated with so-called gangue, which is next removed in the process of coal refinement in order to increase its energy value. Refining takes place in a water medium and the obtained products are subjected to dehydration; only particulates having a diameter of maximum 1mm get into the water. This suspension is called coal sludge. It is most frequently deposited in ground slime separators, in which particulate matter is separated from water by gravity forces. Water is returned to industrial circulation, whereas dehydrated coal sludge, depending on the percentage content of contaminations, is treated as waste or is sold as fuel. Slime separators are located in the immediate vicinity of former „Rymer” coal mine in Rybnik-Niedobczyce. The area of former „Rymer” coal mine is conventionally designated by the following boundaries:

- from the north – the bed of the Nacyna stream,
- from the east – National Road No. 78,
- from the south – boundary of the town of Rybnik and Radlin,
- from the west – Górnośląska Street in Rybnik.

These boundaries close an area of approximately 2.4 km². Mining area is no longer continued in this area and it is removed from the register of mining areas.

Major facilities located in the described area include:

- facilities of the former „Rymer” coal mine
- flotation and maintenance waste landfill „Stożki”,
- reclaimed sludge ponds,
- part of the railway line number 158 with Rybnik Rymer station,
- park at the foot of “Stożki” landfill,
- residential development,
- forest grounds.

Fig. 7.1 presents a map of the discussed area with marked facilities.
7.5 CASE STUDY

Below has been presented a sample evaluation of former sludge separators in terms of their potential to be reused (Tab. 7.1 – Tab. 7.49).

**Tab. 7.1 Proper name or short characteristics of an area**

<table>
<thead>
<tr>
<th>Proper name or short characteristics of an area</th>
<th>Reclaimed slime separators</th>
</tr>
</thead>
</table>

**Tab. 7.2 Code and location**

<table>
<thead>
<tr>
<th>Place:</th>
<th>Commune:</th>
<th>Post-code:</th>
<th>Street, no.:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rybnik</td>
<td>Rybnik</td>
<td>44-200</td>
<td>Akacjowa</td>
</tr>
</tbody>
</table>

**Tab. 7.3 GPS coordinates – extreme points**

<table>
<thead>
<tr>
<th>N 50° 3'48.62&quot;N</th>
<th>E 18°30'41.85&quot;E</th>
<th>S 50° 3'41.22&quot;N</th>
<th>W 18°30'17.94&quot;E</th>
</tr>
</thead>
</table>

**Tab. 7.4 Area size (ha)**

<table>
<thead>
<tr>
<th>Area size (ha)</th>
<th>7 ha</th>
</tr>
</thead>
</table>

**Tab. 7.5 Numbers of record parcels of the post-industrial area**

| 6710/300, 1791/304, 1794/304, 779/304, 1870/304, 1866/304, 785/304, 1586/304, 1587/303, 1589/304, 2651/304, 1792/303, 1795/303, 778/303, 1869/303, 1865/303, 784/303, 1567/303, 1793/300, 1796/300, 2370/300, 1868/300, 1864/300, 783/300, 2371/300, 1867/300, 1863/300, 1588/300, 1591/300, 2652/300 |
### Tab. 7.6 Structure of ownership

<table>
<thead>
<tr>
<th>Form of ownership</th>
<th>Share in proprietorship (in surface area percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treasury</td>
<td>35%</td>
</tr>
<tr>
<td>Local government unit (commune, district or province)</td>
<td>65%</td>
</tr>
<tr>
<td>State or local government legal persons</td>
<td>0%</td>
</tr>
<tr>
<td>Other legal persons</td>
<td>0%</td>
</tr>
<tr>
<td>Natural persons</td>
<td>0%</td>
</tr>
</tbody>
</table>

### Tab. 7.7 Is the legal status of the area regulated?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>No information</th>
</tr>
</thead>
</table>

### Tab. 7.8 Status of reclamation activities (choose one option)

<table>
<thead>
<tr>
<th>Planned (approved for implementation)</th>
<th>Included in plans (intended for implementation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completed</td>
<td>In progress</td>
</tr>
<tr>
<td>None</td>
<td>Other</td>
</tr>
</tbody>
</table>

### Tab. 7.9 Immediate intervention required

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

### Tab. 7.10 Utilities supply (networks in the area)

<table>
<thead>
<tr>
<th>Type</th>
<th>Yes/No</th>
<th>Type</th>
<th>Yes/No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical energy</td>
<td>No</td>
<td>Rain water sewer system</td>
<td>No</td>
</tr>
<tr>
<td>Potable water</td>
<td>No</td>
<td>Gas</td>
<td>No</td>
</tr>
<tr>
<td>Industrial water</td>
<td>No</td>
<td>Central heating</td>
<td>No</td>
</tr>
<tr>
<td>Sanitary sewage system</td>
<td>No</td>
<td>Telecommunications system</td>
<td>No</td>
</tr>
<tr>
<td>Combined sewer system</td>
<td>No</td>
<td>Other (what)</td>
<td>No</td>
</tr>
</tbody>
</table>

### Tab. 7.11 Local road and rail infrastructure

<table>
<thead>
<tr>
<th>Road and rail facilities</th>
<th>No. of road/railway</th>
<th>Distance from the area</th>
</tr>
</thead>
<tbody>
<tr>
<td>The nearest existing local, regional or district road</td>
<td>DK 78</td>
<td>10 m</td>
</tr>
<tr>
<td>The nearest existing regional, district road – planned or</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>under construction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The nearest regional or local railway</td>
<td>Railway no. 158</td>
<td>30 m</td>
</tr>
<tr>
<td>The nearest regional, local railway station</td>
<td>Rybnik Rymer</td>
<td>300 m</td>
</tr>
</tbody>
</table>

### Tab. 7.12 Existence of development

<table>
<thead>
<tr>
<th>Developed</th>
<th>Undeveloped</th>
<th>No information</th>
</tr>
</thead>
</table>

### Tab. 7.13 Local air pollution emission sources

<table>
<thead>
<tr>
<th>Emission source neighbourhood</th>
<th>Yes/No</th>
</tr>
</thead>
<tbody>
<tr>
<td>The area is adjacent to a sewage treatment plant, distance of</td>
<td>No</td>
</tr>
<tr>
<td>less than 500m</td>
<td></td>
</tr>
<tr>
<td>The area is adjacent to point air pollution emission source,</td>
<td>No</td>
</tr>
<tr>
<td>distance of less than 500m</td>
<td></td>
</tr>
<tr>
<td>Sewage treatment plant in the area</td>
<td>No</td>
</tr>
<tr>
<td>Point air pollution emission source in the area</td>
<td>No</td>
</tr>
</tbody>
</table>
Tab. 7.14 General description of buildings
(name, cubature, initial and current form of occupancy, property)

<table>
<thead>
<tr>
<th>Type of property</th>
<th>No development</th>
</tr>
</thead>
</table>

Tab. 7.15 Local transmission lines in the vicinity of the area

<table>
<thead>
<tr>
<th>Type of infrastructure</th>
<th>Distance from the area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sanitary sewage collector</td>
<td>100 m</td>
</tr>
<tr>
<td>Medium-voltage power line</td>
<td>In the area</td>
</tr>
<tr>
<td>Low-voltage power line</td>
<td>50 m</td>
</tr>
<tr>
<td>Medium-pressure gas pipeline</td>
<td>400 m</td>
</tr>
<tr>
<td>Low-pressure gas pipeline</td>
<td>-</td>
</tr>
</tbody>
</table>

Tab. 7.16 Inactive waste landfills

<table>
<thead>
<tr>
<th>Facility</th>
<th>Distance</th>
<th>Remarks on arduousness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inactive municipal landfill site</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Inactive industrial landfill site</td>
<td>1500 m</td>
<td></td>
</tr>
<tr>
<td>Mine waters discharge site</td>
<td>100 m</td>
<td></td>
</tr>
</tbody>
</table>

Tab. 7.17 General internal evaluation of the transport network

<table>
<thead>
<tr>
<th>Type</th>
<th>General description (degree of development, technical condition)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road network and car parks</td>
<td>-</td>
</tr>
<tr>
<td>Rail infrastructure</td>
<td>-</td>
</tr>
<tr>
<td>Other (walking paths, cycle lanes, horse etc.)</td>
<td>-</td>
</tr>
</tbody>
</table>

Tab. 7.18 General types of current area use

<table>
<thead>
<tr>
<th>Production and service of production</th>
<th>Yes/No</th>
<th>Production and service of production</th>
<th>Yes/No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Services</td>
<td>No</td>
<td>Open waters</td>
<td>No</td>
</tr>
<tr>
<td>Housing</td>
<td>No</td>
<td>Agriculture</td>
<td>No</td>
</tr>
<tr>
<td>Communication and transport</td>
<td>No</td>
<td>Unused area</td>
<td>No</td>
</tr>
<tr>
<td>Recreation in the open air</td>
<td>No</td>
<td>Other (specify)</td>
<td>No</td>
</tr>
<tr>
<td>Cultivated green areas or environment protection</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Tab. 7.19 Document specifying the directions of future area development (tick)

| Local area development plan | Yes | Land use and development directions plan | No |

Tab. 7.20 In terms of service (basic function – „B”, complementary function – „x”)

<table>
<thead>
<tr>
<th>Name type of service</th>
<th>B/x/-</th>
<th>Name type of service</th>
<th>B/x/-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service development</td>
<td>B</td>
<td>Waste management</td>
<td>-</td>
</tr>
<tr>
<td>Gas engineering</td>
<td>x</td>
<td>Power engineering</td>
<td>-</td>
</tr>
<tr>
<td>Areas with facilities over 2000m²</td>
<td>x</td>
<td>Telecommunications</td>
<td>-</td>
</tr>
<tr>
<td>District heating</td>
<td>x</td>
<td>Sewage system</td>
<td>-</td>
</tr>
<tr>
<td>Other (specify)</td>
<td>-</td>
<td>Water distribution systems</td>
<td>-</td>
</tr>
</tbody>
</table>
### Tab. 7.21 Activity which contributed to degradation

<table>
<thead>
<tr>
<th>Name activity</th>
<th>Yes/No</th>
<th>Name activity</th>
<th>Yes/No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power engineering</td>
<td>No</td>
<td>Industrial waste dumping</td>
<td>No</td>
</tr>
<tr>
<td>Metal industry</td>
<td>No</td>
<td>Municipal waste management</td>
<td>Yes</td>
</tr>
<tr>
<td>Chemical industry</td>
<td>Yes</td>
<td>Sewage treatment</td>
<td>No</td>
</tr>
<tr>
<td>Coke-making industry</td>
<td>No</td>
<td>Cement factory</td>
<td>Yes</td>
</tr>
<tr>
<td>Ferrous metallurgy</td>
<td>Yes</td>
<td>Transportation activity</td>
<td>Yes</td>
</tr>
<tr>
<td>Non-ferrous metallurgy</td>
<td>No</td>
<td>Underground coal mining</td>
<td>No</td>
</tr>
<tr>
<td>Mechanical industry</td>
<td>No</td>
<td>Open cast mining</td>
<td>No</td>
</tr>
<tr>
<td>Construction industry</td>
<td>No</td>
<td>Underground ore mining</td>
<td>No</td>
</tr>
<tr>
<td>Paper industry</td>
<td>Yes</td>
<td>Aggregate extraction</td>
<td>No</td>
</tr>
<tr>
<td>Textile industry</td>
<td>No</td>
<td>Sand extraction</td>
<td>No</td>
</tr>
<tr>
<td>Wood industry</td>
<td>No</td>
<td>Rock mining</td>
<td>No</td>
</tr>
<tr>
<td>Food processing</td>
<td>No</td>
<td>Peat exploitation</td>
<td>No</td>
</tr>
<tr>
<td>Other activity (specify)</td>
<td>No</td>
<td>Other activity (specify)</td>
<td>No</td>
</tr>
</tbody>
</table>

### Tab. 7.22 Presence of waste in the area

<table>
<thead>
<tr>
<th>Type of waste (classification according to the waste law)</th>
<th>Present</th>
<th>Not present</th>
<th>No information available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazardous</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Municipal</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Other than hazardous</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Neutral</td>
<td></td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

Additional information about the type and amount of waste

### Tab. 7.23 Is the area contaminated?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>No information</th>
</tr>
</thead>
</table>

### Tab. 7.24 What kind of substances cause contamination of the area? Caution! Define one type of predominant substance or more, if it is important.

<table>
<thead>
<tr>
<th>Type of contaminating substance</th>
<th>Yes/No</th>
<th>No information available (but contamination is highly probable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metals</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Organic compounds (other than pesticides)</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Emission of gases</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Pesticides</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Other (specify)</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

### Tab. 7.25 Observed or expected radiological hazard

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>No data available</th>
</tr>
</thead>
</table>

### Tab. 7.26 Is the analysed area a part of mining area?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>
Tab. 7.25 Observed or suspected negative impact of contamination present in the area (observed – „O”, suspected – „S”, unlikely – „U”, no information available – „No”)  

<table>
<thead>
<tr>
<th>Threatened facility</th>
<th>O/S/U/No</th>
<th>Threatened facility</th>
<th>O/S/U/No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human health</td>
<td>U</td>
<td>Buildings</td>
<td>U</td>
</tr>
<tr>
<td>Potable water resources</td>
<td>U</td>
<td>Nature conservation structures</td>
<td>U</td>
</tr>
<tr>
<td>Other water resources</td>
<td>S</td>
<td>Land in the vicinity of the area</td>
<td>U</td>
</tr>
<tr>
<td>Terrestrial ecosystem</td>
<td>U</td>
<td>Other (specify)</td>
<td>No</td>
</tr>
</tbody>
</table>

Tab. 7.28 Is the analysed area a part of post-mining area?  

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

Tab. 7.29 Existing area deformations related to mining activity  

<table>
<thead>
<tr>
<th>Continuous</th>
<th>Non-continuous</th>
<th>Not found</th>
<th>No information</th>
</tr>
</thead>
</table>

Tab. 7.30 Expected area deformations related to mining activity  

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>No information</th>
</tr>
</thead>
</table>

Tab. 7.31 Facilities in the local register of monuments in the analysed area  

<table>
<thead>
<tr>
<th>Register, facility number</th>
<th>Description</th>
<th>Is the facility entered in the Register of Silesian Province Monuments or KESA?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Tab. 7.32 Legally protected natural structures in the analysed area  

<table>
<thead>
<tr>
<th>Name of facility</th>
<th>Protection category</th>
<th>Number in the register of Provincial Nature Conservation Officer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Tab. 7.33 Additional important information about the area (e.g. occurrence of downslopes over 15%, water holes, shallow underground voids, particularly large parking areas or storage yards, garages, vast scrubland, etc.)  

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>

Tab. 7.34 Suggested preferences of area development directions in the light of its genesis – scoring  

<table>
<thead>
<tr>
<th>Type of works</th>
<th>Yes/No</th>
<th>Type of works</th>
<th>Yes/No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production and production service areas</td>
<td>No</td>
<td>Communication and transport areas</td>
<td>No</td>
</tr>
<tr>
<td>Service development areas</td>
<td>Yes</td>
<td>Outdoor sport and recreation</td>
<td>No</td>
</tr>
<tr>
<td>Residential development</td>
<td>No</td>
<td>Green areas, nature</td>
<td>No</td>
</tr>
</tbody>
</table>

Tab. 7.35 Possibility so multifunctional management (I work-live-rest) in the light of the genesis of the area and its size (only area over 20 ha)  

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

Tab. 7.36 Is natural valuation required in the light of area Genesis?  

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

Tab. 7.37 Is cultural valuation required in the light of area valuation?  

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>
### Tab. 7.38 Probable need for reclamation due to area genesis (tick if such a need exists and specify the type of works)

<table>
<thead>
<tr>
<th>Type of works</th>
<th>Yes/No</th>
<th>Type of works</th>
<th>Yes/No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production and production service areas</td>
<td>No</td>
<td>Communication and transport areas</td>
<td>No</td>
</tr>
<tr>
<td>Service development areas</td>
<td>Yes</td>
<td>Outdoor sport and recreation</td>
<td>No</td>
</tr>
<tr>
<td>Housing development</td>
<td>No</td>
<td>Green areas, nature</td>
<td>No</td>
</tr>
</tbody>
</table>

### Tab. 7.39 Category of mining or post-mining area

<table>
<thead>
<tr>
<th>Mining area (0, I, II, III, IV, V, not applicable)</th>
<th>Post-mining area (A, B1, B2, B3, C, not applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>not applicable</td>
<td>A</td>
</tr>
</tbody>
</table>

### Tab. 7.40 GZWP (Central Groundwater Reservoir) and groundwater intake

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Yes/No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existence of groundwater intake</td>
<td>No</td>
</tr>
<tr>
<td>Location in a groundwater intake protection zone</td>
<td>No</td>
</tr>
<tr>
<td>Location within GZWP</td>
<td>No</td>
</tr>
</tbody>
</table>

### Tab. 7.41 Exposure to flooding and partial inundation

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Yes/No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location within a hydro-isohypse of 1m below ground level</td>
<td>No</td>
</tr>
<tr>
<td>Location within the reach of emergency wave</td>
<td>No</td>
</tr>
<tr>
<td>Location within the reach of one-hundred year water</td>
<td>No</td>
</tr>
<tr>
<td>Periodically flooded area</td>
<td>No</td>
</tr>
</tbody>
</table>

### Tab. 7.42 Forms of Nature protection forms, sanctuaries and ecological corridors

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Yes/No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location within a large nature protection form (including NATURE 2000) or ECONET corridor or CORINE sanctuary</td>
<td>No</td>
</tr>
<tr>
<td>Existence of an individual nature protection form or CORINE sanctuary</td>
<td>No</td>
</tr>
</tbody>
</table>

### Tab. 7.43 Road facilities of supralocal significance

<table>
<thead>
<tr>
<th>Road facilities</th>
<th>Road number</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>The nearest motorway or major road</td>
<td>A1</td>
<td>15 km</td>
</tr>
<tr>
<td>The nearest motorway or major road – designed or under construction</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>The nearest national Road</td>
<td>78</td>
<td>10 m</td>
</tr>
<tr>
<td>The nearest motorway junction</td>
<td>A1 and A4</td>
<td>37 km</td>
</tr>
</tbody>
</table>

### Tab. 7.44 Is the area located within a terrain defined as „Environmental resources protection, strengthening of protected areas system and multifunctional development of open areas – preferred economic functions?“

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

### Tab. 7.45 Access to air transport

<table>
<thead>
<tr>
<th>The nearest air port</th>
<th>Name</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Katowice Pyrzowice</td>
<td>76 km</td>
</tr>
</tbody>
</table>
Tab. 7.46 Railway facilities of supralocal significance

<table>
<thead>
<tr>
<th>Railway facilities</th>
<th>Name</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>The nearest national railway line</td>
<td>Railway line number 158</td>
<td>30 m</td>
</tr>
<tr>
<td>The nearest railway trans-shipment</td>
<td>Rybnik Towarowy</td>
<td>200 m</td>
</tr>
</tbody>
</table>

Tab. 7.47 Other transport-related facilities of supralocal significance

<table>
<thead>
<tr>
<th>Facility</th>
<th>Name</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Container terminal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The nearest river port</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Road border crossing</td>
<td>Chałupki</td>
<td>20 km</td>
</tr>
<tr>
<td>Railway border crossing</td>
<td>Chałupki</td>
<td>20 km</td>
</tr>
</tbody>
</table>

Tab. 7.48 Area genesis versus contamination hazard

<table>
<thead>
<tr>
<th>Due to its genesis, the area belongs to a group of contaminated areas or areas characterised by high probability of contamination</th>
<th>Yes</th>
</tr>
</thead>
</table>

Tab. 7.49 Area genesis versus health hazard

<table>
<thead>
<tr>
<th>Due to the area genesis, there is a high potential threat to health of persons staying in it, detailed studies and calculations are recommended</th>
<th>No</th>
</tr>
</thead>
</table>

CONCLUSIONS

One of the conditions enabling developing an appropriate concept of management of a degraded area is to obtain knowledge about this area through specialist investigations in the legal, ecological, economic as well as social aspect.

The above presented analysis is considerably simplified. A comprehensive area study should among others include a number of specialist investigations determining the substances which contaminate the environment, hazardous substances.

Despite continuous improvement of solutions facilitating the reclamation processes (cluster connections, co-operation networks, information, communication, monitoring platforms, survey studies or environmental audits [7], [8]), data collection (including data generated in the process of co-operation between various level authorities, the enterprise sector and local community related to the area) as well as continuous updating and making this data available is still an issue which has not been completely resolved.

REFERENCES


AN ANALYSIS OF DEGRADED POST-MINING AREAS TO BE RE-DEVELOPED
– CASE STUDY: SLIME SEPARATORS

Abstract: Economic transformations in Poland in the 1980s among others started the process of liquidation of many mining plants. Areas which until recently were subject to strong influences of mining economy, are now becoming post-mining areas. Degradation of an area, incomplete or scattered information on its legal conditions, its property structure, ecological condition, the existing logistic infrastructure and provision of utilities discourage potential investors from undertaking activities to re-use the area. This article presents an initial analysis of a selected post-mining area, which should make it easier to determine the directions of its future development.

Key words: degraded area, post-mining waste landfill, slime separators, re-development

ANALIZA POGÓRNICZYCH TERENÓW ZDEGRADOWANYCH W CELU PONOWNEGO ZAGOSPODAROWANIA – ANALIZA PRZYPADKU: OSADNIKI MUŁOWE

Streszczenie: Przeobrażenia gospodarcze w Polsce w latach osiemdziesiątych zapoczątkowały między innymi proces likwidacji wielu zakładów wydobywczych. Tereny, które do niedawna podlegały silnym wpływom gospodarki wydobywczej, stają się terenami pogórniczymi. Zdegradowanie terenu, niepełne lub rozproszone informacje na temat uwarunkowań prawnych terenu, jego struktury właściwościowej, stanu ekologicznego, istniejącej infrastruktury logistycznej, uzbrojenia w media, zniechęcają potencjalnych inwestorów do podjęcia działań zmierzających do ponownego wykorzystania terenu. W poniższym artykule przedstawiono wstępną analizę wybranego obszaru pogórniczego, mającą ułatwić formułowanie kierunków jego przyszłego zagospodarowania.

Słowa kluczowe: teren zdegradowany, składowisko odpadów pogórniczych, osadniki mułowe, ponowne zagospodarowanie

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Date of acceptance of the article by the Editor: 06/29/2015
8

STRUCTURE AND FUNCTIONING
OF THE EUROPEAN CONFORMITY
ASSESSMENT SYSTEM OF PRODUCTS

8.1 INTRODUCTION

The Union is a term for a community, a community of people which is focused on a common goal, ideas, and interests. The European Union is based on 4 fundamental principles. One of them is the principle of free movement of goods and services, reflected in the liquidation of traditional customs controls between the countries of the community. No customs controls cause a complete lack of control over the "imported" products. In the case of some products being potentially dangerous, they could pose a threat to the health and life of citizens of the community. Therefore, it was necessary to develop a single solution – the conformity assessment system. This system consists of many elements constituting its structure. The European authorities and institutions, national authorities and institutions, credible assessment bodies as well as producers. This system is regulated by a number of laws, regulations, standards, and its abundance causes difficulties in navigating this complex structure. The aim of the article is to describe in an accessible, cross-sectional, and also consistent manner the currently functioning European conformity assessment system products. Consistency description of the system was achieved through a common description of these institutions at European and national level – in Poland. In particular, polish entrepreneurs so that they can develop better understanding of the current rules for the European conformity assessment system, including the principle of marking (CE) devices, which are part of the rules of that system.

8.2 ORIGINS OF THE EUROPEAN CONFORMITY ASSESSMENT SYSTEM

Name of the European Union was introduced in 1993, under the Treaty on European Union. Earlier, by means of expansion and developing of the concept of cooperation has repeatedly changed its name and structure. The beginning of the emergence of the EU dates back to the year 1952, when the European Coal and Steel Community was formed. The EU now has 28 full members. One of the fundamental aims of European integration was the creation of a single European market for goods and services and the gradual establishment of a common economic policy.
Fig 8.1 Model of The European Conformity Assessment System of Products

Source: Own elaboration
The basic condition for, and also the problem of economic integration, has become part of the community aiming to remove the technical barriers that prevented, or hindered the free movement of goods. It is not difficult to imagine how both technical development of products, their amount, type, combined with various technical norms and standards in individual countries limited the free movement of goods between the countries concerned. In order to establish an uniform technical standards for many products in all EU countries posed as a real challenge for the authorities of the community.

Harmonization of laws in the European Union so approximation of laws, has become the most basic method of removal of technical barriers. For this purpose, the directives addressed to the authorities of the Member States were forwarded. The directive is an act of European Union law, under which the legislator Union Member States are obliged to introduce specific legislation, aimed at achieving the desired state of affairs specified in the directive. However, the directive leaves member states a considerable flexibility during the implementation into national law i.e. Transpose.

Up until 1985 the law harmonization process has been named “the Old Approach to standardization”. Old Approach Directives contain concrete products, and applied only to them, as they described the requirements for technical compatibility. The advantage of such a solution was the ease to identify the product and to assess compliance. The main drawback of this solution was slow course of the enactment and amendment of this type of specific directives. As a result, such solutions remained difficult to research and develop, and as a result have become an obstacle to technological progress.

It was necessary to introduce a new solution, which was named – the New Approach. The illustrative model of structures and relations based on the New Approach are contained in Fig. 8.1.

8.3 THE EUROPEAN CONFORMITY ASSESSMENT SYSTEM OF PRODUCTS – THE EUROPEAN LEVEL

The New Approach to standardization is also based on the directives. New Approach directives were developed and implemented in the European Union, following a European Council resolution of 7 May 1985, initially called the New Approach to technical harmonization and standards [2], [8]. The New Approach has introduced the following principles [6]:

- legal harmonization is limited to essential safety requirements (or other requirements of a social nature) which need to be met by products marketed and covered in connection with the free movement within the European Union.
- the development of technical specifications of production is entrusted to competent institutions in the field of industrial standards that take into account the state of technology,
- technical specifications are not mandatory, they retain their status of voluntary standards,
• authorities are obliged to grant presumptions of conformity to products prepared according to harmonized standards with the essential requirements laid down by the directive, if the manufacturer does not produce according to these standards, it is obliged to comply with the essential requirements of products.

The illustrative model of structures and relations of the European level of the ECASP are contained in Fig. 8.2.

![Fig 8.2 Model of the European conformity assessment system of products - the European Level](source)

Source: Own elaboration

8.4 THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION

New Approach directives are adopted by the European Parliament and the Council of the European Union. New Approach directives include regulations of the Member States of the European Union in the field of product liability [8]. Each directive specifies in detail the range of products which are subject to it. This range includes the features of the products and/or type of risk that the product may pose. New Approach directives apply to new products, as well as to new and used products imported into the European Union from third countries. The same product can simultaneously be obliged by a few directives, which is to be decided by manufacturer [7]. Each of the directives has attachments along with requirements that aim to ensure a high level of product safety. This forces manufacturers to perform risk analysis and transcribe its inclusion into the technical documentation.

Under the new approach, the directives contain the essential requirements relevant as to what is to be achieved – the safety of the product. The technical requirements have been transferred to the level of European standardization. In contrast, the process of assessing demands compliance with the essential requirements needed for further regulation. Therefore, it was necessary to define criteria for a reliable assessment of the conformity of products with essential requirements, namely, the creation of conformity
assessment mode. The first step in this direction is the Council Resolution of 21 December 1989 on a global approach to certification and testing (90/C10/01) [3]. The resolution was replaced and supplemented by Council Decision of 22 July 1993. Concerning the modules for the various phases of the conformity assessment procedures and the rules for the affixing and use of the CE conformity marking, which are to be used in the technical harmonization directives (93/465/EEC) [4], [1]. Currently, conformity assessment procedures regulate the Decision of the European Parliament and of the Council No 768/2008/EC of 9 July 2008 on a common framework for the marketing of products (...) [5].

The conformity assessment procedures described in those decisions, and referred to in the New Approach Directives, are based on a system with eight basic modules. These modules help manufacturers to choose the most appropriate way during the establishment and refinement of products, with particular emphasis on hazards of the product [9].

8.5 EUROPEAN COMMISSION AND EUROPEAN STANDARDS ORGANIZATIONS

Some conformity assessment procedures require participation of independent bodies in assessing the conformity assessment, such as laboratories. In order to authenticate such bodies, the concept of the notified body was introduced [2], [7]. A notified body is an institution independent from both the producer and the consumer, operating in an objective manner, meeting certain requirements implemented in the directives. For an institution to function as a notified body, it must be notified by the authorities of the country, which is further notified to the European Commission. With the notification process is closely related to the accreditation process already taking place at national level. The accreditation process is regulated by the Regulation of the European Parliament and Council Regulation (EC) No 765/2008 (EC) of 9 July 2008. Establishing requirements for accreditation and market surveillance relating to the marketing of products and repealing Regulation (EEC) No 339/93 [10].

After receiving the notification, the European Commission puts the notified body in the list of notified bodies for precise directives. The list is published by the European Commission in the official EU journal, C series. The product conformity assessment system plays a key role for standardization bodies and standards harmonized with the directives. The main standardization organizations in Europe dealing with technical standards include CEN (European Committee for Standardization), CENELEC (European Committee for Electrotechnical Standardization), ETSI (European Telecommunications Standards Institute). These are entities that develop, each in their respective areas of competence, standards harmonized with the directives. The harmonized standards are European standards, which are developed in a special mode. They are being developed for the European Commission by one of the 3 aforementioned European standardization organizations, based on the requirements approved by the European Commission. Harmonized standards must remain upheld in accordance with the rules of the CEN/CENELEC/ETSI and officially submitted to the European Commission after
their approval. The European Commission, as part of their duties shall publish in the form of messages a list of harmonized standards for individual directives. Fig. 8.3 contains an example publication.

![Fig 8.3 A list of harmonized standards](image)

### 8.6 THE EUROPEAN CONFORMITY ASSESSMENT SYSTEM OF PRODUCTS POLISH LEVEL

Poland after joining the European Union was bound to approximate its national law to the requirements and solutions to the European Union. One of the many legal areas in which the EU law was transposed into Polish law is the conformity assessment system. Basic regulations forming the conformity assessment system in Poland include:


The basic legal act regulating the functioning of the European conformity assessment system in Poland is the Act on conformity assessment system, which aims to [11]:

---

**NOTICES FROM EUROPEAN UNION INSTITUTIONS, BODIES, OFFICES AND AGENCIES**

**EUROPEAN COMMISSION**


*Publication of titles and references of harmonised standards under Union harmonisation legislation* (text with EEA references)

![Table](image)
- eliminate the risks posed by products for life or health of users and consumers and for property, as well as environmental risks;
- elimination of technical barriers to trade and facilitating international trade;
- to create conditions for a reliable assessment of products and processes for their preparation by competent and independent bodies.

Conformity assessment system consists of [11]:
- regulations defining the general and specific requirements for the products,
- regulations and standards for the operation of the bodies involved in the conformity assessment.

![Fig 8.4. Model of the European conformity assessment system of products - the Polish Level](image)

Source: Own elaboration

The illustrative model of structures and relations of the Polish level of the ECASP are contained in Fig. 8.4.

The Act imposes specific obligations on Polish executive authorities and state institutions, including their leadership. The law puts special role on the heads of ministries, who were assigned a responsibility for different groups of products. For example, the Minister of Economy is responsible for the Directive relating to the products used in the mining industry, and the health minister is responsible for the Directive containing the essential requirements for medical products.

### 8.6.1 The minister responsible for the subject of conformity assessment

The minister responsible for the subject of conformity assessment is required to determine, by means of regulations, the essential requirements for products subject to conformity assessment and conformity assessment procedures, taking into account the types of products and the degree of hazard posed by them, as well as other requirements contained in the directives of the new approach. The minister's responsibility is to transpose the Directive to polish law. In addition, the minister responsible, within its compe-
tence, determines the authorization of bodies involved in the conformity assessment. Decision for the authorization confirms the fulfillment of all criteria by an authorized body, which are found in the Act on conformity assessment system and issued on the basis of the regulations. In a broader context, it qualifies the authorization by the minister responsible (or manager of the central office, with jurisdiction over the subject matter of conformity assessment), submitting the bodies for the notification process.

8.6.2 **President of the Polish Committee for Standardization**

President of the Polish Committee for Standardization is obliged to publish twice a year, by a notice in the Official Journal of the Republic of Polish 'Monitor Polski':

- the numbers and titles of harmonized standards together with the titles of legislation implementing the directive of the new approach and data on the place of publication,
- the information announced by the European Commission during transition periods concerning the application of the presumption of conformity and warnings concerning the restriction of the presumption of conformity, both at 30 June and 31 December of each year.

8.6.3 **President of the Central Office of Measures**

President of the Central Office of Measures has an obligation to announce every 12 months, by a notice in the Official Journal of the Republic of Polish 'Monitor Polski', the numbers and titles established in the previous years documentation of the International Organization of Legal Metrology (OIML), together with an indication of the provisions which must be met to presume the conformity with the essential requirements of the product, as well as the titles of legislation implementing the Directive a new approach for measuring instruments along with data on the place of their publication.

8.6.4 **The minister responsible for economic affairs**

The minister responsible for economic affairs has an obligation to declare by way of a notice about notified certification bodies, inspection bodies and notified laboratories in the Official Journal of the Republic of Polish 'Monitor Polski', as well as to change the scope of the notification and its revocation.

8.6.5 **Polish Centre for Accreditation – PCA**

The institution which is the Polish Centre for Accreditation accredits upon request of the certification body, inspection body, laboratory or another entity conducting conformity assessment. Accreditation is the confirmation of the competence in a specified range.

8.6.6 **Manufacturers and Notified Bodies**

The conformity assessment procedures included in the directives, their transpositions and ministerial regulations are all implemented by manufacturers. This manufacturer is responsible for carrying out conformity assessment, and if required by regulation of product marking with the CE mark.
In many cases, product conformity assessment procedures require the intervention of notified bodies – the certification body, inspection body or a laboratory. In Poland, such bodies are notified by the Minister of Economy, after obtaining the accreditation of Polish Centre for Accreditation and an authorization by the minister responsible for the subject of the assessment of conformity or the relevant head of the central office. Tasks of the notified body are described in detail in conformity assessment procedures contained in the transposition of directives – ministerial regulation.

**CONCLUSION**

European conformity assessment system plays a very important role in the functioning of the EU. Because of this system it is possible to eliminate technical barriers and to implement the principle of free movement of goods within the community, without jeopardizing the European users of the products. These important functions give rise to ECASP being based on bureaucratic rules and possessing a complex structure, which consists of the highest authorities, both at European and national level. At the European level, specific roles are played by the European Parliament and the Council of the European Union which are, responsible for the harmonization of laws and the establishment of New Approach directives. European Commission is an important institution ordering harmonized standards, which also oversees the authorities of the Member States relating to notified bodies. Of key importance is also the European standardization organizations, which are responsible for drawing up technical standards harmonized with the New Approach Directives. On a national level, such as Poland, the responsibility for the proper functioning of the system depends on the highest authorities at the level of heads of ministries and heads of the highest offices. The last participant in a system executing is the manufacturer’s conformity assessment procedures contained in the Regulations transposing directives. Important elements of ECASP of the notified body are an additional element giving proof of the quality of the entire system.

The presentation of ECASP in a cross-cutting, yet consistent manner, guaranteeing the "friendliness" of content for the reader appears to be a difficult task. Achievement of the objective should be seen taking into consideration the structural complexity of this system, its bureaucratic and extensive character.

**REFERENCES**


4 Council Decision of 22 July 1993 concerning the modules for the various phases of the conformity assessment procedures and the rules for the affixing and use of the CE conformity marking, which are intended to be used in the technical harmonization directives.


11 Ustawa z dnia 30 sierpnia 2002 r. o systemie oceny zgodności.
STRUCTURE AND FUNCTIONING OF THE EUROPEAN CONFORMITY ASSESSMENT SYSTEM OF PRODUCTS

Abstract: The article describes in a cross-sectional, yet consistent manner, the currently operating product conformity assessment system in Europe, called by author The European Conformity Assessment System of Products (ECASP). The article details the basic regulations currently in force, both at the level of European law, as well as polish domestic law that form the structure and operation of the system. The comprehension of the read shall be eased by comp model of the structure and the relationships between elements of the ECASP. The first part of the article is devoted to describe the origins of building a conformity assessment system in Europe. Another part of the study describes the European level of compliance system – a European framework and institutions that it constitutes. In the third section an overview of the system in Poland is presented. In particular, Polish entrepreneurs so that they can develop better understand the current rules for the European conformity assessment system, including the principle of marking (CE) devices, which elements are part of that system.

Key words: conformity assessment system, CE, new approach directives

STRUKTURA I FUNKCJONOWANIE EUROPEJSKIEGO SYSTEMU OCENY ZGODNOŚCI WYROBÓW

Streszczenie: W artykule opisano w sposób przekrojowy, a zarazem spójny aktualnie funkcjonujący w Europie system oceny zgodności wyrobów, nazwany europejskim systemem oceny zgodności wyrobów (ESOZW). W artykule wyszczególniono podstawowe regulacje prawne obowiązujące zarówno na poziomie prawa europejskiego, jak i krajowego – polskiego, które tworząstrukturę i zasady działania systemu. Lekturę artykułu ułatwi zawarty w nim poglądowy model struktury i relacji występujących pomiędzy elementami ESOZW. Pierwszą część artykułu poświęcono na opisanie genezy budowania systemu oceny zgodności w Europie. Kolejną część opracowania opisuje europejski poziom systemu zgodności – europejskie regulacje i instytucje, które go tworzą. W trzeciej części zawarto opis funkcjonowania systemu w Polsce. W szczególności polscy przedsiębiorcy dzięki temu opracowaniu będą mogli lepiej poznać aktualne zasady funkcjonowania europejskiego systemu oceny zgodności, w tym zasady oznakowywania (CE) wyrobów, które to zasady są elementem wspomnianego systemu.

Słowa kluczowe: system oceny zgodności, CE, dyrektywy nowego podejścia

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9

НАПРАВЛЕНИЯ ПОВЫШЕНИЯ ЭФФЕКТИВНОСТИ СКЛАДСКОЙ ДЕЯТЕЛЬНОСТИ ПРЕДПРИЯТИЙ

9.1 ВВЕДЕНИЕ

В цепях поставок часто складская деятельность является лимитирующим и вызывающим значительные дополнительные издержки звеном логистической системы, особенно в России и в других странах с переходной экономикой. Для снижения ее отрицательных аспектов необходимо использовать методы логистических технологий [2].

Первым вопросом, который должна решить фирма для обеспечения себя складскими площадями, является вопрос владения складом. Выбор между организацией собственного склада и использованием склада общего пользования (арендованного) относится к классу задач «сделать или купить», он зависит от годового грузооборота предприятия.

Если принято решение в пользу собственного склада, то в зависимости от выбранного критерия оптимизации и учета расстояний между поставщиками, потребителями и складом, используют различные методы определения координат расположения склада. Чаще всего при этом применяют так называемый «гравитационный» подход.

9.2 ЛОГИСТИЧЕСКИЙ ПОДХОД К СКЛАДСКОЙ ДЕЯТЕЛЬНОСТИ

Рациональное осуществление логистического процесса на складе – залог его рентабельности. Поэтому при его организации необходимо добиваться [5], [6]:

- рациональной планировки склада, способствующей снижению затрат и усовершенствованию процесса переработки груза;
- эффективного использования пространства при расстановке оборудования, что позволяет увеличить мощность склада;
- использования универсального оборудования, выполняющего различные складские операции, что сокращает парк подъемно-транспортных машин;
- иннезации маршрутов внутрискладской перевозки с целью сокращения эксплуатационных затрат и увеличения пропускной способности склада;
осуществления унитизации партий отгрузок и применения централизованной доставки, что позволяет существенно сократить транспортные издержки;
максимального использования возможностей информационной системы, что значительно сокращает время и затраты, связанные с документооборотом и обменом информации, и т. д.

В процессе анализа складской деятельности в ряде крупных торговых организаций Калининграда выявлялись их проблемы в этой области, которые затем с помощью метода экспертных оценок и «дерева целей» [3] ранжировались по их значимости и приоритетности решения для повышения эффективности работы фирм в целом. Ранжированный перечень проблем выглядит следующим образом:

- отсутствие автоматизации процессов приема, учета и хранения продукции;
- устаревшее оборудование и отсутствие энергосберегающего оборудования;
- недостаточные складские емкости;
- неэффективные условия подъезда к складу, транспортировки и перемещения продукции;
- недостаточное число работников высокой квалификации, обслуживающих склад.

Иногда резервы рациональной организации логистического процесса, пусть и не столь значительные, заключаются в весьма простых вещах: расчистке загроможденных проходов, улучшении освещения, организации рабочего места. В поиске резервов эффективности функционирования склада нет мелочной, все должно анализироваться, а результаты анализа - использоваться для улучшения логистического процесса. Для управления складской системой предусматривается выполнение следующих функций:

- планирование;
- оперативное управление;
- контроль;
- анализ с целью установления причинно-следственных связей между достигнутыми результатами и затраченными средствами;
- расчет эффективности управления и функционирования системы в целом.

Полученная аналитическая информация используется для новых циклов управления и новых плановых расчетов. Комплексную проблему повышения эффективности складских процессов можно разложить на несколько направлений. Их анализ по большому числу источников [1], [2], [4], [5], [6] позволил сконцентрировать необходимые мероприятия (табл. 9.1).
Таб. 9.1 Направления повышения эффективности процессов складирования

<table>
<thead>
<tr>
<th>Направления работы</th>
<th>Мероприятия</th>
</tr>
</thead>
<tbody>
<tr>
<td>Логистическая экспертиза</td>
<td>Идентификация основных логистических процессов и операций. Увязывание элементов складской деятельности с позиции процессного подхода. Определение характеристик, входов и выходов логистических процессов. Установление ключевых проблем («узких» мест) с назначением индикаторов для контроля сбоев. Ранжирование ключевых проблем с установлением приоритетности их решения.</td>
</tr>
<tr>
<td>Разработка объемно-планировочных решений</td>
<td>Установление интенсивности материального потока на складе. Определение весогабаритных характеристик хранимых грузов и параметров товародвижения. Выявление несоответствий между параметрами складских зон и интенсивностью потоков. Зонирование склада и разработка модели потоков товаров по зонам склада. Разработка алгоритмов эффективного размещения товаров по местам хранения, маршрутам комплектации, передвижения АВС и XYZ-анализ. Определение необходимого количества и конструкции зон и мест хранения.</td>
</tr>
<tr>
<td>Проектирование технологии работы склада</td>
<td>Установление функций, полномочий и зон ответственности персонала по процессному подходу. Установление параметров качества обслуживания клиентов и условий обеспечения его уровня. Разработка документации и привязка ее к программному обеспечению. Разработка служебных инструкций с минимизацией времени на выполнение складских операций.</td>
</tr>
<tr>
<td>Автоматизация работы склада</td>
<td>Привязка программного обеспечения к условиям работы конкретного склада. Установление необходимого оборудования (сканеров и принтеров штрих-кодов, электронных весов, интегрированных счетчиков). Обучение персонала работе со средствами инфоармации и автоматизации.</td>
</tr>
<tr>
<td>Работа с персоналом</td>
<td>Создание системы обучения и передачи опыта для персонала. Разработка системы мотивации для персонала. Разработка мероприятий и условий охраны труда и соблюдения техники безопасности.</td>
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Источник: Собственная разработка

В рамках данной работы для одной из компаний (ООО «Горная Лаванда») методом экспертных оценок было выявлено, что в настоящее время первоочередными являются разработка объемно-планировочной компоновки и проектирование эффективной технологии работы склада. Целесообразно разработать последовательность действий по этим направлениям. Например, алгоритм разработки объемно-планировочной компоновки представлен на рис. 9.1.
Рис. 9.1 Алгоритм разработки объемно-планировочных решений:

1. Корректное определение технологических зон склада.
2. Планирование потребностей складских мощностей.
3. Разработка объемно-планировочных решений.
4. Установление среднесрочной и максимальной интенсивности потоков на складе.
5. Зонирование и разработка модели потоков товаров по зонам склада.
6. Определение весогабаритных характеристик хранимых грузов и параметров товародвижения.
7. Выявление несоответствий между параметрами складских зон и интенсивностью потока.
8. Определение необходимого количества конструкций, зон и мест хранения.
9. Учет пропускной способности аллей и коридоров.
10. Разработка алгоритмов эффективного размещения по местам хранения, маршрутов комплектации.
11. Учет скорости выполнения операций на складе.
12. Использование складских емкостей эффективно?
13. Изменение структуры и назначения зон склада.
14. Проблема решена.

Источник: Собственная разработка

9.3 ABC И XYZ АНАЛИЗ В СКЛАДСКОЙ ДЕЯТЕЛЬНОСТИ

ABC-анализ – метод, позволяющий классифицировать ресурсы фирмы (в том числе и запасы на складе) по степени их важности. Этот анализ является одним из методов рационализации и может применяться в сфере деятельности любого предприятия. В его основе лежит принцип Парето: «За большинство возможных результатов отвечает относительно небольшое число причин» (в торговой деятельности, например, 20% всех товаров дают около 80% оборота).
9.3.1 **ABC-анализ**

Анализ делит товарные запасы на три категории:

- **A** – наиболее ценные, 20% — ассортимента; 80% — продаж;
- **B** – промежуточные, 30% — ассортимента; 15% — продаж;
- **C** – наименее ценные, 50% — ассортимента; 5% — продаж.

В зависимости от целей анализа может быть выделено произвольное количество групп. Чаще всего выделяют 3, реже 4-5 групп. Следует отметить, что границы групп являются приблизительными.

По сути, ABC-анализ – это ранжирование ассортимента по разным параметрам. Ранжировать таким образом можно и поставщиков, и складские запасы, и покупателей, и длительные периоды продаж – всё, что имеет достаточное количество статистических данных. Результатом ABC анализа является группировка объектов по степени влияния на общий результат. ABC-анализ завершается построением графика зависимости совокупного эффекта от количества элементов. Такой график называется кривой Парето или ABC-кривой.

9.3.2 **XYZ-анализ**

В отличие от ABC анализа XYZ-анализ подразумевает использование единственного критерия классификации запасов – коэффициента вариации. Коэффициент вариации рассчитывается по формуле:

\[ v = \left( \frac{S}{R_{cp}} \right) \cdot 100\% \]  \hspace{1cm} (9.1)

где: \( S \) – стандартное (среднее квадратическое) отклонение объемов реализации за наблюдаемый период;

\( R_{cp} \) – средний объем реализации за этот же период.

Стандартное отклонение определяется:

\[ S = \sqrt{\frac{(R_i - R_{cp})^2}{n-1}} \]  \hspace{1cm} (9.2)

где: \( n \) – число наблюдений;

\( R_i \) – объем i-ой реализации.

Чем меньше значение коэффициента вариации, тем более стабильны продажи товаров. В соответствии со значением коэффициента вариации все товарные позиции делятся на три группы: X, Y и Z. В группу X попадают товары с коэффициентом вариации менее 10%. В группу Y – товары с коэффициентом вариации от 10% до 25%. В группу Z – товары с коэффициентом вариации более 25%. Для проведения XYZ-анализа необходимо:

- установить средний расход каждой номенклатурной позиции с учетом колебания потребности в них по периодам, это могут быть, например, сезонные колебания;
- рассчитать коэффициент вариации по каждой позиции;
- расположить позиции по мере возрастания коэффициентов вариации;
• суммировать данные о количестве материалов в соответствии с возрастанием коэффициентов вариации, нанести их на схему;
• разбить материалы на группы в зависимости от вариации спроса.

Результатом XYZ-анализа является построение кривой Лоренца. Совместный ABC и XYZ-анализ. В логистике наиболее существенными факторами, предопределяющими выбор той или иной системы планирования запасов или метода расчета потребности в материалах, являются их объемы, стоимость и регулярность потребления. В связи с этим можно классифицировать материальные ресурсы по критериям, которые учитывают перечисленные факторы. Результаты ABC-анализа и XYZ-анализа имеет смысл комбинировать [4]. При объединении данных о соотношении стоимости и количества ABC-анализа с данными о соотношении структуры и количества потребления XYZ-анализа, мы получим важные инструменты управления, контроля и планирования для всей системы обеспечения материальными ресурсами (табл. 9.2).

Табл. 9.2 Классификационная группировка ресурсов по методу ABC и XYZ

<table>
<thead>
<tr>
<th>Группы материалов</th>
<th>A Высокая стоимость объема потребления - 80%</th>
<th>B Средняя стоимость объема потребления - 15%</th>
<th>C Низкая стоимость объема потребления - 5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>X Регулярное потребление: v &lt; 10%</td>
<td>AX</td>
<td>BX</td>
<td>СХ</td>
</tr>
<tr>
<td>Y Колеблющееся потребление: 10 &lt; v &lt; 25%</td>
<td>AY</td>
<td>BY</td>
<td>CY</td>
</tr>
<tr>
<td>Z Нерегулярное потребление: v &gt; 25%</td>
<td>AZ</td>
<td>BZ</td>
<td>CZ</td>
</tr>
</tbody>
</table>

Источник: Собственная разработка

Комбинация данных анализов дает возможность получить дополнительную информацию для рационального регулирования товарных запасов, находящихся на складах предприятия. Для упомянутой выше компании товарные запасы, разделенные на 10 позиций, в соответствии с анализом распределены в соответствии с табл. 9.3.

Табл. 9.3 Классификационная группировка товарных позиций по методу ABC и XYZ

<table>
<thead>
<tr>
<th>Группы товарных позиций</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>X 1; 9</td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Y 7; 10</td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Z 4; 8</td>
<td></td>
<td></td>
<td>3; 5</td>
</tr>
</tbody>
</table>

Источник: Собственная разработка
Группы AX, AY и AZ требуют наибольшего внимания, для них необходимо тщательное планирование потребности, нормирование расхода, тщательный (ежедневный) учет и контроль, постоянный анализ отклонений от запланированных показателей. Причем для категории AX следует рассчитывать оптимальный размер закупок и использовать технологию “just in time” (точно в срок). А для категории AZ эффективнее использовать систему снабжения по запросам с обязательным расчетом величины страхового запаса. Для ресурсов категории CX, CY, CZ применяются укрупненные методы планирования.

ЗАКЛЮЧЕНИЕ
Для оптимизации складской деятельности предприятий необходимо управлять ею выстраивать в соответствии с логистическим подходом, который предполагает использование многих качественных и количественных методов: алгоритмизацию, метод экспертных оценок, процессный подход, ABC и XYZ- анализ и другие. Часть из этих методов применена для разработки рекомендаций, используемых в ряде организаций Калининграда (в основном, торговых). В дальнейших исследованиях предполагается расширить как охват предприятий, так и применяемых методов с позиции логистического подхода.

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DIRECTIONS OF EFFECTIVIZATION OF WAREHOUSING ENTERPRISES

Abstract: The article points to the need of improving warehouse operations, which are ineffective in many enterprises across Russia. The list of all the necessary measures is compiled on the basis of logistical approach, the development and implementation of which will help to solve system problems and to eliminate "bottlenecks" for one of the directions of an algorithm for sequences of action, allowing rational planning work management.

Key words: warehouse, warehousing, logistical approach, method of expert evaluations, process approach, algorithm

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10

THE ESSENCE OF COMMUNICATION PROCESS IN WASTE MANAGEMENT SYSTEM

10.1 INTRODUCTION

National Waste Management Plan 2014 (NWMP 2014) with the prospect for years 2015-2022, describes the creation an integrated waste management system based on the principle of sustainable development. Basic activity aimed to integrate waste management system is mainly to point the waste hierarchy, and then determine the long-term goals which would allow to full integration. As part of these activities is planned among others creation of a database with waste, intensification of educational measures in the field of environmental protection and waste segregation, strengthening control of the companies in waste management sector, as well as many other solutions in the area of development of existing utilities and investment in advanced technology. NWMP 2014 also points out the problems associated with the system of collecting and storing information, monitoring and controlling of the entities participating in the system of waste management and insufficient environmental awareness of society [6]. The source of these problems can be traced in wrong conducted communication process and information exchange in the waste management system, because it forms the basis of this system and is largely responsible for its effectiveness.

Information plays an important role in any system and organization, whether it is a manufacturing company or government entity – each of them bases its work on specific information. It is important not only how to gather and process information, but also how to distribute them, within and outside of the organization. Information allows organizations to exist and function in their environment, the effectiveness of multiple systems depends precisely on accurate and factual information. The communication process is based on the exchange of messages between participants, the more these participants, the more complicated becomes an exchange of information between them.

10.2 COMMUNICATION PROCESS

In the process of communication we can point out some stable components, which include: receiver, sender and message; these are elements without which we cannot make the communication process. In addition to the three basic elements in the communication process occur or may occur also other parts, such as a communication channel, interference distorting the process, feedback and the process of encoding and
decoding of broadcasted message. One should remember that feedback occurs only in two-way communication process in which the receiver becomes the new sender – the response to the broadcast message [7]. The following diagram illustrates a two-way communication process (Fig. 10.1).

The presented two-way communication process should proceed as follows [7]:

1. The sender creates a message – he should take into account the type of information and the characteristics of the receiver. Also the nature of the sender, his competence and personality has significant impact on created message.

2. When the message is ready, the sender must encode it – a message in the communication process takes the form of symbols, e.g. in writing, image, gesture, etc.

3. The sender, after encoding a message in the manner he chooses, he selects the appropriate communication channel – medium. The simplest partition of communication channels divides them into written and spoken; Communication channels also use storage media – traditional and modern media like internet.

4. The next stage is decoding – the receiver, upon receipt of the message, should interpret it. Decoding, as well as encoding process, is affected by the characteristics of the recipient's personality characteristics, experience, knowledge or convictions.

5. The final stage of the communication process is feedback – response given by the receiver to the sender of the message. At this stage, the receiver becomes the sender and forms, and then encodes the return message addressed to the earlier sender. This message goes through all the stages, up to the point where there is no need to send another feedback to the sender.

![Diagram of two-way communication process](image)

*Fig. 10.1 Diagram of two-way communication process*

Source: Own elaboration based on: [7]

It must be remembered that the communication process is also a subject of various disturbances and distortions, the so-called noises. They appear both in the form of internal and external disturbance, when the message is distorted by treating it with factors present in the environment. These disturbances also apply to the receipt of the message; receiver can make a mistake while decoding the message given by the sender [7].
Misunderstood message distorts the process of communication, context of transmitted information is changed sufficiently that the decisions taken in pursuance thereof may be wrong. On effectiveness of the communication process in the organization or between organization and the environment, depends also other processes in organization, which are accompanied by constant exchange of information. Therefore, it is important, in communication, to select of appropriate communication channels or encoding information with regard to the characteristics of the receiver of a message.

10.3 COMMUNICATION MODEL IN WASTE MANAGEMENT SYSTEM

The waste management system involve many various entities, which through the exchange of information relevant to each other, provides an effective process of collecting, sorting, manufacturing, disposal and storage of waste. A place in the system of waste management have also other entities, not directly connected with the system, but interested in feedback information about the course and effectiveness of it. The communication process in waste management system is best to considered at community level, because they are largely responsible for its effectiveness, and they take a number of actions aimed at ensuring its successful course.

Responsibilities of communities in waste management are detailed in the Act of 13 September 1996 on maintaining cleanliness and order in municipalities (Dz. U. of 2013 item 1399, as amended). To other legislative documents indicating entities and scope of the exchange of information in the waste management system are:

- Act of 14 December 2012 on waste (Dz. U. of 2013 item 21, as amended),
- Act of 27 April 2001 Environmental Protection Law (Dz. U. of 2013 item 1232, as amended),
- Act of 20 July 1991 Environmental Protection Inspectorate (Dz. U. of 2013 item, as amended),

and a number of other Acts and Regulations of the Minister of Environment, also in cooperation with other ministries. Due to the local government units participating in the communication process in the waste management system, we can also distinguish Acts relating directly to their actions, i.e. among others: Act of 8 March 1990 Local Government (Dz. U. of 2013 item 594, as amended), Act of 5 June 1998 Province Self-Government (Dz. U. of 2013 item 596, as amended) and other laws relating to public administration. It should be also important to remember about Acts related to the activities of other entities and companies producing and processing waste, which have to report back their activities.

When analysing the communication process in waste management system we should also mention its various character; communication occurs both inside the public administration units and between different units at many levels, as well as outside of them – when these units communicate with citizens and other entities in waste management. In most cases, it is a two-way communication, but not always self-government units are focused on feedback or they just underestimate them; particularly in the process of external communications [9].
The first step in the analysis of the communication process is to identify all the senders and receivers, and the information exchanged between them. It is important not only what information is transmitted, but also that they reach consumers by media. Conducting a reliable analysis becomes essential to ensure the effective operation of the communication process in the waste management system and hence increase the efficiency of the system itself.

### 10.3.1 Entities involved in the communication process

Entities participating in the exchange of information in the waste management system can be divided into several important groups:

- public administration units,
- residents and property owners,
- companies of waste management sector,
- other sectors companies,
- other interested entities.

Public administration units mainly include municipal government, who as part of their duties designates the entity responsible for municipal waste management system in the community. Most often it is one of community's department or in the case of smaller communities – an independent position. Apart from municipal entities we can also identify: Marshal’s Office, Chief Inspectorate of Environmental Protection (CIEP) with Voivodeship Inspectorate of Environment Protection (VIEP), State District Sanitary Inspectorate, and also Ministry of Environment and other ministries involved in formulating Acts in area of waste management. Amongst property owners residents we can distinguish private owners and housing cooperatives and associations that on behalf of their tenants, deposit the declarations concerning the number of inhabitants, the way of collecting waste, etc. The owners are becoming intermediaries in the exchange of information between the tenants and the community. Another entity in the communication process are companies from the waste management sector; they collect, segregate, recycle, utilize and store different types of waste. Also the companies that produce the appropriate municipal equipment, and their offer is addressed to other companies in the waste management sector and public administration units, controlling them. To indicate an important role of municipal installations and companies collecting waste in the waste management system, it is worth to ring-fence them from the above group of municipal enterprises and considered them as a separate entity participating in the communication process. The specific entities belonging to the group of companies of the waste management sector, consist of: National Chamber of Waste Management (KIGO) and Polish Chamber of Waste Management (PIGO), associating hundreds of companies and other entities participating in waste management. KIGO and PIGO on behalf of members companies conduct a dialogue with the authorities and local governments, and other interested in system stakeholders, they provide training courses and discussion panels, and fighting for the rights of its members. These Chambers have open character and into their association may also join communities unions [5], [8].
Amongst entities involved in the communication process in waste management system, there can be distinguished the companies that produce waste; companies from different sectors and various nature of the activity. This refers to the manufacturing and service enterprises that conduct their business in community area. This specific group of companies also includes companies from the mining sector, where wastes are covered by separate laws.

The last group of entities include all entities that do not take part directly in the waste management system, but they are looking for information that its relate. We classified here all types of research and development units, other research institutions, experts and other private individuals. The diagram below (Fig. 10.2) presents entities taking part in the communication process in waste management system, from the point of view of the community as the unit of public administration, which largely deals with ensuring the efficiency of the system. The diagram also contains the designations (explanation below the figure) which relate to the functions performed by the participants in the waste management system. They were divided into several functions: supervisory, decision-making, legislative, executive, supportive, independent associations and the waste producers.

### 10.3.2 Basic information exchanged in waste management system

Information exchanged in the process of communication between entities of waste management system relate among others: the amount of waste received and processed in community, efficiency of each utility lines, the number of inhabitants residing in the property or undertaken in the system actions. This information is provided in the form of reports, complaints, contracts and orders or informative and educational leaflets. Public administration units are obliged to pursue activities informative and educational residents activities, which use different advertising media such as billboards, newsletters, public bulletins, and even social networks and their own websites. There are also published reports on the implementation of the waste management plan and important contact details. Entities responsible for municipal installations and enterprises engaged in waste collection are required to submit on a regular basis reports about their actions and weights of received and processed waste. Thanks to feedback information, companies are able to dispose of collected waste between various utility installations that have the ability to process them.

The following matrix (Tab. 10.1) contains only an example of information exchanged between the main entities in the waste management system. The main entities are the ones that have the biggest impact on the waste management system in community area:

- community or department designated by it,
- residents and property owners,
- entities responsible for utility installations and waste collection companies,
- production and service companies located in the community,
- Marshal’s Office.
Fig. 10.2 Diagram of the exchange information in waste management system

* CIEP and VIEP – Chief Inspectorate of Environmental Protection and Voivodship Inspectorate of Environmental Protection.
** SDSI – State District Sanitary Inspectorate.
Source: Own elaboration based on: [1], [2], [3], [4], [10]
Between them it flows the biggest amount of information that ensure the effectiveness and efficiency of the waste management system. Other entities, such as the Ministry of Environment, SDSI or CIEP and VIEP appear here mostly as supervisory, control or ancillary entities. With the exception that the Ministry of Environment first and foremost establishes laws concerning waste management system at the national level. However, the communities in acts of local law apply to regional conditions of existence of the system. The Ministry of Environment also collects the reports provided by the Marshal’s Office and CIEP, and holds control over them. While the SDSI together with community unit determined Rules of Maintaining Cleanliness and Order in the community.

The above matrix (Fig. 10.2) shows how many different pieces of information are exchanged between the entities in the waste management and these are only the major participants and just some of the transmitted information. Wider analysis of the transmitted information should be primarily municipal entities, residents and property owners, companies dealing with waste collecting, service and manufacturing companies producing waste and owners of utility installations located on the community territory. Between these entities there flows biggest amount of information that is valuable from the perspective of efficiency and effectiveness of the waste management system. Information is also exchanged within appointed previously appointed groups of entities; for instance, between utility installations and companies collecting waste. As we can see the exchange of information in the waste management system is very broad, and the process is quite complicated because of the number of entities which participate in it.

Finally, it is also worth to mention the types of information channels and media used to exchange information between participants in the communication process. Communities as units supervising and ensuring the efficiency of municipal waste management system are also committed to educational and informational activities aimed at all residents and property owners.

They use such forms as public consultation, advertising in public spaces, websites, other advertising media such as local TV or radio station, as well as information leaflets and social media. A part of the communication process in waste management system it also applies to the exchange of classified information between public authorities and various companies which exchange with each other information about fees, recommendations, reports, complaints, technical specifications, etc. It is used not only the traditional way of transmission of information, when a report or complaint is sent in paper form to the postal address of institution or company, but also, for example specialized programs for creating reports in the form of digital documents, which allows submission of them electronically. Some information between participants is sent via e-mail as attachments. There are many basic file formats and programs through which it is possible to create a digital version of transmitted information. But it has its drawbacks – the number of different programs that are used to create and transmit information, significantly extends the communication process, and introduces a problems with its receiving. Not every participant of the process have the same software, so reading submitted information becomes difficult.
### Tab. 10.1 Example of information exchanged between the main entities in the waste management system

<table>
<thead>
<tr>
<th>Marshall's Office</th>
<th>Production and service companies</th>
<th>Utility installations and waste collection companies</th>
<th>Property owners</th>
<th>Residents</th>
<th>Community</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community</td>
<td>Completeness of reports</td>
<td>A list of contracts for waste collection and evidence of payment</td>
<td>Types and amount of waste, complaints, comments on the waste collection</td>
<td>Complaints, declarations, fees</td>
<td>Complaints</td>
</tr>
<tr>
<td>Residents</td>
<td>Plans</td>
<td>-</td>
<td>Segregation of waste, schedule</td>
<td>Segregation of waste</td>
<td>-</td>
</tr>
<tr>
<td>Property owners</td>
<td>Plans</td>
<td>-</td>
<td>Segregation of waste, schedule</td>
<td>-</td>
<td>Number of people residing property, fees</td>
</tr>
<tr>
<td>Utility installations and waste collection companies</td>
<td>Integrated permits</td>
<td>Waste collection request, complaints</td>
<td>-</td>
<td>Complaints, number of containers needed</td>
<td>Complaints</td>
</tr>
<tr>
<td>Production and service companies</td>
<td>Permits</td>
<td>-</td>
<td>Amount received and handled waste, fees</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Marshal's Office</td>
<td>-</td>
<td>Mass produced and exported packaging, batteries</td>
<td>Types and weights received and processed waste</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: Own elaboration based on: [1], [2], [3], [4], [10]
Another concern is security of information transmitted electronically, the information transmitted and stored in this way are at risk of hacker attacks, especially when used for this poorly secured e-mail. Also the use of traditional media is burdened with some negatives, e.g. low durability. Therefore, it is important to select the appropriate communication channels, taking into account the nature of outgoing information and their receivers, but also the media durability, safety and their usefulness in the information exchange process.

CONCLUSIONS

The waste management system is such a complicated system, that the process of communication between all the entities identified in it, becomes significantly complex. There are here different levels of communication, we are dealing with internal and external communication, and both are equally important from the point of view of the system. The selection of appropriate communication channels and media, is also relevant, which is not easy with such a large number of receivers and senders, and the information exchanged between them. There is a lack of comprehensive tools that would facilitate this process; merge used by participants software for creating digital documents and allow for their rapid transfer to selected target groups. So, to high-quality information only getting in interested in its entities.

It should be remembered that the information exchanged in the waste management system have a significant impact on the functioning of the whole system, as well as of each entities located there. Also the decisions taken in the framework of the activities of those entities – of companies and public administration units are based largely on information coming from the system. At the foundations of the waste management system it is the exchange of accurate and factual information – it’s how residents approach to separate waste, and to what extent it agrees with the model proposed by the community, based on information received in a variety of campaigns and informational and educational folders. The rest of the system is based on how the waste are segregated “at source”, methods of their collecting, sorting and possibilities of their recycling or eventually, their utilization.

Due to analyzing the communication process between entities of the waste management system, it has become possible to define several significant areas and issues that should be subjected to more extensive research, they include among others:

- assessment of the effectiveness of communication channels used in process, which will allow in the future to their streamlining and adjusting to the specificities of participants;
- identification of all entities in the communication process, as well as their analysis in terms of role performing in the waste management system and the degree of impact on system efficiency;
- the quality of the information transmitted in the system, their influence on decision-making and the ability to implement integrated decision support systems in this field;
the possibility of using advanced IT tools in the process of communication that would be adapted to the requirements of all its participants and would combine the functions needed to ensure the effectiveness of the waste management system;

- security of information in the communication process – protection of classified information exchanged between entities in the waste management system, as well as an analysis of information available to a wider audience (e.g. residents);

- manoeuvrability of transmitted information in the system and the degree of user satisfaction in the communication process.

These issues are among the areas in which there are some loopholes, essentially affecting the functioning of the waste management system. The high quality of the information transmitted between the entities involved in the communication process is the basis for an effective and efficient system. However, this is often not enough, so we should undertake to carry out a broader research on the communication process in waste management system, taking into account the above-mentioned critical areas of the process.

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1  Act of 13 September 1996 on maintaining cleanliness and order in municipalities (Dz. U. of 2013 item 1399, as amended).
2  Act of 14 December 2012 on waste (Dz. U. of 2013 item 21, as amended).
3  Act of 20 July 1991 Environmental Protection Inspectorate (Dz. U. of 2013 item 165, as amended)
4  Act of 27 April 2001 Environmental Protection Law (Dz. U. of 2013 item 1232, as amended).
THE ESSENCE OF COMMUNICATION PROCESS IN WASTE MANAGEMENT SYSTEM

Abstract: The purpose of the article was to identify some trends and directions of changes in the process of communication between all entities in waste management system. Streamlining of the process should be followed by identifying the participants and information exchanged between them. It is important to recognize all the communication channels and media used in the process, as well as distortions occurred. Identification of gaps and potential barriers in the communication process of waste management system will designate areas for further analysis and extended research.

Key words: waste management system, communication process, the act of maintaining cleanliness and order in municipalities, the act of waste

ISTOTA PROCESU KOMUNIKACJI W SYSTEMIE GOSPODARKI ODPADAMI

Streszczenie: Celem niniejszego artykułu było wskazanie kierunków rozwoju i zmian w procesie komunikacji pomiędzy wszystkimi podmiotami systemu gospodarki odpadami. Usprawnienie tego procesu należy zacząć od identyfikacji jego uczestników oraz wymienianych pomiędzy nimi informacji. Istotne staje się również rozpoznanie kanałów komunikacyjnych i wykorzystywanych nośników, jak i występujących w procesie zniekształceń. Identyfikacja luk i potencjalnych barier w procesie komunikacji w systemie gospodarki odpadami pozwoli wyznaczyć obszary wymagające dalszej analizy i pogłębionych badań.

Słowa kluczowe: system gospodarki odpadami, proces komunikacji, ustawa o utrzymaniu czystości i porządku w gminach, ustawa o odpadach

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11

ANALYSIS OF PRODUCTION PROCESS AND COMPLAINTS IN AN AUTOMOTIVE COMPANY

11.1 INTRODUCTION

This article presents the diagnosis of particular production process, which is realized in automotive company. At the beginning the extrusion process has been generally described and then risks and quality points are presented. The diagnosis embraces problems connected with complaints and potential defects.

11.2 EXTRUSION PROCESS

A large number of companies closely monitor their production processes, because they would like to provide high-quality products and minimize the bad quality costs. The way to achieve this aim is very difficult. Each process should be identified and analyzed for risks which could handicap production and have incorrect influence on the product [7]. The process of extrusion consists in drawing the plastic material through a special nozzle at appropriate temperature. It consists of few phases. First phase is connected with preparing products and loading them manually. Then the upper edge of product is subjected to the plasma and the product is positioned on a rotary table where successive operations are performed (Fig. 11.1) – second phase.

Fig. 11.1 Rotary table where extrusion process is performed
Source: Own elaboration based on: [4]

These operations are the most important and they include:
- activation of product performed by using cleaner,
• placing a prime coat which makes it possible to join the pressed profile with the product,
• pressing the profile into the proper shape.

Third phase is linked with auxiliary operations such as: gluing different kind of brackets, removing a machining allowance of pressed profile, gluing of spacers, soldering, mounting assembly frames, injection and treatment of corners. These operations depend on a produced model of product [4], [5], [8].

11.3 THE IMPORTANCE OF COMPLAINTS FOR COMPANIES

A base to analysis processes in company is complaints received from customers. Each complaint is different and its character depends on the type of business that is provided by the company. The common denominator of each complaint is dissatisfaction or non-acceptance situation that occurred. There are several types of complaints, from observation to serious claims. So the company could receive [9], [12]:
• external unofficial complaint in the form of comments about a product or delivery,
• external official complaint requiring immediate actions,
• internal complaint.

Complaints should not be treated as threats. This is a very important element of system, because it gives information about what is going wrong in processes. This information also gives the company opportunities to improve processes. Of course complaints generate additional problems for company, but employees should solve them by taking appropriate actions which could develop production [1], [2], [11].

11.4 ANALYSIS OF COMPLAINTS IN EXTRUSION PROCESS

In this part of article will be presented quality approach and quantification of complaints, which occurred this year in extrusion area. The Tab. 11.1 shows 13 different kinds of products defects which were identified in January, February, March and April in 2015: defects of primer, incorrect position or lack of brackets, improperly glued tape, incorrect or lack of barcode, incorrect labeling of racks, scratches, smudge, incorrect packaging, incorrect position or lack of spacers, defects of assembly frame, defects of seal position, defects of extruded profile and not removed logo. This table contains also information about amount of complaints and amount of defects in particular months. The biggest number of complaints was in March, the amount of them is 19 but the most defective products occurred in February, the amount of them is 5064 pcs [4].

Based on the above table Pareto Chart was prepared. The aim of Pareto Chart is to highlight the most substantial set of factors. The diagram clearly depicts the gradual downslide in presented value. First Pareto Chart is connected with amount of complaints (Fig. 11.2) and second with amount of defective products (Fig. 11.3).

During four months Extrusion Department received the most complaints (12 complaints) for incorrect position or lack of brackets. This is the most popular and difficult quality problem which should be solved in the near future. On the second position in Pareto Chart are defects of primer, such as: not dried primer, spilled primer or spots
of primer. There were 7 complaints of that type. This proves the prominence of primer in the extrusion process. On the third position (4 complaints) equally are incorrect packaging, often connected with cracks of products and also incorrect or lock of barcode. Other segments of this diagram are less crucial. However, they generate financial loss. This analysis showed quality approach to complaints [4].

### Tab.11.1 Amount of claims and amount of defective products in extrusion area

<table>
<thead>
<tr>
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<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Amount of complaints</td>
<td>Amount of defective products</td>
<td>Amount of complaints</td>
<td>Amount of defective products</td>
<td>Amount of complaints</td>
</tr>
<tr>
<td>Defects of primer</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Incorrect position/lack of brackets</td>
<td>3</td>
<td>14</td>
<td>2</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Improperly glued tape</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Incorrect/lack of barcode</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Incorrect labeling of racks</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Scratches</td>
<td>1</td>
<td>5</td>
<td>13</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Smudge</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Incorrect packaging</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>45</td>
</tr>
<tr>
<td>Incorrect position/lack of spacers</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Defects of assembly frame</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Defects of seal position</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Defects of extruded profile</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Not removed logo</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>8</td>
<td>27</td>
<td>8</td>
<td>5064</td>
<td>19</td>
</tr>
</tbody>
</table>

Source: Own elaboration based on: [4]

In regard to Fig. 11.3, it could be concluded that the most products, more than 5000 pcs. had scratches. This defect can occur everywhere but if it is detected in company, it will be repaired. Clearly the repair also depends on the size of the defect. Next in Pareto Chart are defects of primer (142 pcs.) and incorrect position or lack of brackets (73 pcs.). This analysis showed quantification of complaints [4].

After recognition of extrusion process and identification complaints, a detailed analysis of the production process of paying attention to the risk points and control quality points was conducted. These quality points could be covered emerging threats. The Fig. 11.4 presents flow of extrusion process with particular operation realized by workers. In rectangles with red contours manual operations are marked. A manual operation included: loading of products, removing a machining allowance of pressed profile, gluing of spacers, soldering, mounting assembly frames and packaging.
In eight green rectangles occurred aspects which are controlled after particular operation – quality points. Only Black Primer presence and position are controlled automatically. Instead workers controlled shape of pressed profile, presence of LL Primer and also Black Primer, position of brackets, resistance, gap and adhesion of mounted frame, shape and adhesion of corners, labels used to mark the racks, way of packaging. In addition all products could be controlled one more time in terms of defined characteristics. It depends on customers. Sometimes they would like to control the final product with “their eyes”. Hence in the production there is a special place prepared only to this specific control [4].

**Fig. 11.2 Pareto Chart presented amount of complaints**

Source: Own elaboration based on: [4]

**Amount of complaints - Pareto Chart**

![Pareto Chart](image)

**Fig. 11.3 Pareto Chart presented amount of defective products**

Source: Own elaboration based on: [4]

**Amount of defective products - Pareto Chart**

![Pareto Chart](image)
Fig. 11.4 Extrusion process map with risk and quality points

Source: Own elaboration based on: [4]
In yellow rectangular explanations risk points are identified, or defects that may have appeared in the described process, such as: improperly glued tape, defects of cleaner and primer (not enough/too much/lack of cleaner/primer, not dried primer), incorrect position/lack of brackets, defects of extruded profile or seal (incorrect position/shape, lack of adhesion), incorrect position/lack of spacers, incorrect resistance, lack of continuity of heating system, defects of assembly frame (incorrect gaps, lack of adhesion), defects of corners (incorrect position/shape, lack of adhesion), incorrect labeling of racks, incorrect/lack of barcode, scratches, smudge, incorrect packaging. At all phases of process could also have occurred scratches on the products [4].

CONCLUSIONS

Process improvement is very important from the point of view of each company. Indeed organizations must take care to maintain its high level of efficiency to be competitive in the market. Process development is related to improving the quality of products [3], [9]. The above analysis of the process showed that, despite a large number of controls, the company received repeated complaints. This situation testifies to the fact that the process is not quite stable, and the taken actions are not effective.

In the Fig. 11.4 proposed actions to improve extrusion process are also presented. They are marked in blue round explanations. To identify presence and position of primer used under extrusion special scanner has been proposed which will verify these aspects. The laser scanner could also be used to measure the height pressed profile. Other solution to improve process is implementation of a device which will be applying a specific tape to support correct position of components. This action is very important, because problem of components position is the first quality issue. To detect incorrect position or lack of brackets, the company could also use the laser scanner. This solution will be expensive in view of different kinds of brackets, but it gives clear information about conformance of position with requirements. In this case it will also help to store the products in a horizontal position. Additional proposed action is Electrical Check Machine. This is a device to automatically control resistance taking into account temperature of products and controlling also continuity of heating system. The last proposition is scanner to recognize if used labels and barcodes are correct.

All described actions lead up with automate the process. The company should also pay attention to the fact that the majority of controls are done manually by workers. Hence the company should look carefully at staff training system and implement the skills matrix based on the approved work instructions. Clearly the workers skills should be verified by prepared tests which results give the information about level of particular skill [6]. It is also necessary to have knowledge for employees in the field of dealing with non-conforming products. If workers detect the nonconformity they should react in defined way (procedure of dealing with non-conforming products). This knowledge is very important because it can allow to minimize effects of incorrectly realized actions or incorrect control. Procedure of dealing with non-conforming products is also a part of containment in case of both internal and external complaints.
A key aspect is proceedings in accordance with analyzed flow. Clearly the flow should be reflected in the Failure Mode and Effect Analysis, where risks in the process are precisely analyzed. Without such recognition is not possible to lead the process in a correct way. After each complaint the FMEA should be updated.

Proper analysis of production process guarantees the real benefits that result in the increase of productivity and efficiency of the process, as well as improvement the quality of produced products.

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12 Company materials.
ANALYSIS OF PRODUCTION PROCESS AND COMPLAINTS IN AN AUTOMOTIVE COMPANY

Abstract: Analysis of production process enabling to identify weakness points in the company. It should be used in all the spheres of the company. The article provides the theoretic description of extrusion process and complaints which the company received from internal and external customers. The authors also describe a case study based on gained experience.

Key words: Extrusion, complaint management, process improvement

ANALIZA PROCESU PRODUKCYJNEGO ORAZ WYSTĘPUJĄCYCH REKLAMACJI PRZEDSIĘBIORSTWIE Z BRANŻY MOTORYZACYJNEJ

Streszczenie: Dla każdego przedsiębiorstwa dokładna analiza procesu produkcyjnego, z uwagi na możliwość identyfikacji nawralgicznych jego punktów, jest podstawą doskonalenia. Analiza ta swoim zasięgiem powinna obejmować wszystkie obszary przedsiębiorstwa. W artykule autorzy poddali analizie proces ekstruzji, a oceniając go uwzględnili zarówno własne doświadczenia jak i przesłanki teoretyczne. Dodatkowo przeprowadzili analizę reklamacji otrzymanych od klientów wewnętrznych jak i zewnętrznych. Wszystkie badania i analizy umożliwiły ocenę procesu i uszczegółowienie opracowanych zasad postępowania z wyrobem niezgodnym.

Słowa kluczowe: ekstruzja, zarządzanie reklamacjami, doskonalenie procesów

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WORKPLACE QUALITY DURING THE WELDING PROCESS

12.1 INTRODUCTION

Despite the constant development of the industry, greater awareness of employers and employees in the field of Occupational Health and Safety, the man largely exposed to the harmful and disruptive factors in the environment of economic activity. According to research conducted by the Central Statistical Office (CSO) one in ten Polish employees work in their life-threatening conditions. Over 50% of workers are exposed to noise, while 20% are exposed on the dusts. The dust is one of the main factors harmful occurring in the workplace. According to the CSO in 2014 year in terms of their exposure to the harmful effects of working in the industry 125,000 workers. 95,500 people were exposed for industrial dusts, 29,500 of them were exposed for carcinogenic dusts. The harmful effects of dust on the human body can cause many diseases, including pneumoconiosis. In 2014 year, CSO found 890 cases of pneumoconiosis, which represents 15.7% of the ascertained occupational diseases. According to the Labour Code in all workplaces should be carried out actions to effectively reduce or eliminate occupational risks resulting from exposure to harmful factors, including dusts. Noise is the most common factor in harmful work environment. According to the Central Statistical Office in 2014 year. In terms of noise pollution employed 220 thousand people, which accounted for more than 1/3 of the total number of employees worked in hazardous conditions harmful work environment.

There are more than 80 different types of welding and associated processes. Some of the most common types of welding are: arc welding, which includes “stick,” or shielded metal arc welding (SMAW), the gas-shielded methods of metal inert gas (MIG) and tungsten inert gas (TIG), plasma arc welding (PAW) and submerged arc welding (SAW). Other welding processes may use oxy-acetylene gas, electrical current lasers, electron beams, friction, ultrasonic sound, chemical reactions, heat from fuel gas and robots. Welding is a potentially hazardous activity and precautions are required to avoid electrocution, fire and explosion, burns, electric shock, vision damage, inhalation of poisonous gases and fumes, exposure to intense ultraviolet radiation and noise. Welding creates major problems for health and safety, e.g.: fumes that may cause airway disease and contain carcinogenic substances, and working in confined places and/or in awkward positions. Different technology, substrates, fillers, and working conditions create many different scenarios [9].
Welding “smoke” is a mixture of very fine particles (fumes) and gases. Many of the substances in welding smoke, such as chromium, nickel, arsenic, asbestos, manganese, silica, beryllium, cadmium, nitrogen oxides, phosgene, acrolein, fluorine compounds, carbon monoxide, cobalt, copper, lead, ozone, selenium and zinc, can be extremely toxic. Generally, is used; coatings and paints on the metal being welded, or coatings covering the electrode; shielding gases supplied from cylinders; chemical reactions which result by the action of ultraviolet light from the arc and heat; process and consumables used; and contaminants in the air, for example vapors from cleaners and degreasers. The health effects of welding exposures are difficult to list, because the fumes may contain so many different substances that are known to be harmful. The individual components of welding smoke can affect any part of the body, including the lungs, heart, kidneys and central nervous system. Exposure to welding smoke may have short-term and long-term health effects [7].

Noise emitted by welding equipment is occasionally discussed in research concerning welding workers’ health. However, investigations into noise exposure and its effects among welding workers are scarce. The aim of the study was to present the exposure to noise and dusts in the workplace of the welder.

12.2 HEALTH PROBLEMS GENERATED BY WELDING

During the welding process different substances are generated and they can have the various effects in humans [2], [11]:

- the fumes generated by welding have diameters in the range of 8 to 0.01 µm and can enter the deeper parts (alveolae) of the lungs,
- metal contained in fumes like iron oxides and aluminium oxide place a strain on the respiratory tract and lungs, meaning that effects in the sense of a chronic inflammation (chronic bronchitis) may occur by an overload of particles,
- fumes containing fluorides, manganese oxide, copper oxide, have a toxic or toxic-irritating effect,
- fumes containing chromium (VI) compounds and nickel oxides are carcinogenic, may cause allergies and can occur when stainless steel is being welded,
- ozone in high concentrations is very toxic, it irritates the respiratory system and the eyes; it leads to tussive irritation, shortness of breath and sometimes oedema of the lungs,
- NOₓ can also cause oedema of the lungs,
- carbon monoxide is a very toxic gas that can cause oxygen deficiency in tissues and asphyxiation; it is also a reproductive toxicant,
- as presented in the literature a wide variety of additional hazardous substances may be generated during the process that cause additional problems in humans, such as formaldehyde (cancerogenous), isocyanates (sensitising) and additional metal oxides (e.g. zinc oxide causing metal fume fever).

Epidemiological studies on welders have shown respiratory effects such as bronchitis, airway irritation, lung function changes, and a possible increase in the incidence
of lung cancer [11]. In some few cases nasal septum perforation occurred in long time stainless steel welders [6]. A recent study among 6000 Danish welders pointed at an increased risk of cardiovascular disease as well [11]. Siderosis (welder’s lung) is an acknowledged occupational disease on the list of the European Union [13].

Medical surveillance of the workers may be needed, if there is:

- an exposure to carcinogenic compounds, such as chromium VI, nickel, cadmium,
- an exposure to fluorine and inorganic fluorine compounds,
- an exposure to dust concentrations above the OEL,
- need to wear breathing protection; a surveillance is needed because of the high strain from wearing PPE, carrying heavy equipment, working in uneasy postures and confined spaces and in high temperatures or outdoors.

Some hazardous substances which pass into the human organism through the inhalation of welding fumes can be determined in biological material (especially urine, full blood or blood serum or in the red blood cells). Thus, biomonitoring could be included in the medical examinations.

Noise effects were divided into two groups [3]: health effects and functional. Functional effects of the impact of noise on the human body primarily affect the efficiency, as well as on the quality of the work on the workstation through loss of concentration, orientation in the environment, or the loss of comfort. Health effects that have serious consequences can be divided into acting on the ear, and those who by their actions interfere with the work of the whole organism, that is, the effects other than on hearing [10]. Exposure to noise may pose a variety of health and safety risks to workers:

1 Hearing loss: Excessive noise damages the hair cells in the cochlea, part of the inner ear, leading to loss of hearing. "In many countries, noise-induced hearing loss is the most prevalent irreversible industrial disease". It is estimated that the number of people in Europe with hearing difficulties is more than the population of France.

2 Physiological effects: There is evidence that exposure to noise has an effect on the cardiovascular system resulting in the release of catecholamines and an increase in blood pressure. Levels of catecholamines in blood (including epinephrine (adrenaline)) are associated with stress.

3 Work-related stress: Work-related stress rarely has a single cause, and usually arises from an interaction of several risk factors. Noise in the work environment can be a stressor, even at quite low levels.

4 Increased risk of accidents: High noise levels make it difficult for staff to hear and communicate, increasing the probability of accidents. Work-related stress (in which noise may be a factor) can compound this problem.

The Control of Noise at Work Regulations 2005 requires employers to take action if daily or weekly exposure to noise is at or in excess of exposure action levels. It is recommended employers take the following steps: conduct a noise assessment, take steps to prevent or control the risks, where possible eliminate exposure to noise.
at source, control exposure to noise, provide Personal Protective Equipment (PPE), provide information and training, and regularly monitor and review the effectiveness of the measures. All these negative effects of noise on the human body have the social and economic aspects. It was estimated that about 50% of accidents occurring during the use of machinery and technological devices are caused by excessive noise, resulting in a general distraction. The body itself is unable to defend itself, before all existing threats, it is important to use prevention and training of employees and employers in the field of prevention and elimination of hazards caused by noise.

The most common instruments used for measuring noise are the sound level meter (SLM), the integrating sound level meter (ISLM), and the noise dosimeter. In Tab. 12.1 some properties of the equipment are presented [4].

<table>
<thead>
<tr>
<th>Tab. 12.1 Guidelines for instrument selection</th>
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<tbody>
<tr>
<td><strong>Type of Measurement</strong></td>
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<tr>
<td>----------------------------</td>
</tr>
<tr>
<td><strong>Personal noise exposure</strong></td>
</tr>
<tr>
<td>ISLM*</td>
</tr>
<tr>
<td>SLM**</td>
</tr>
<tr>
<td><strong>Noise levels generated by a particular source</strong></td>
</tr>
<tr>
<td>ISLM</td>
</tr>
<tr>
<td><strong>Noise survey</strong></td>
</tr>
<tr>
<td>ISLM</td>
</tr>
<tr>
<td><strong>Impulse noise</strong></td>
</tr>
</tbody>
</table>

*ISLM stands for Integrating Sound Level Meter.
** SLM stands for Sound Level Meter.
Source: [1], [5]
12.3 EXPERIMENTAL PART

12.3.1 Characterization of the welder’s workplace

An employee in this position is responsible for the assembly of parts and components made of steel with a welding Magomig 550. In this work, a semi-automatic welding MIG (Metal Inert Gas) is used. This method consists of welding with an electric arc that forms between a consumable electrode in the form of wire, weld material argon. The welding industry is the most commonly used method is characterized by versatility, good quality welds, and welding high efficiency and relatively low cost of consumables. The duties of the person holding the position of the welder include: transport works, preparatory work, welding of steel structures.

Welding works are performed on the part of the production hall equipped with cranes controlled from the cab, smaller cranes controlled from the operating level and welding screens (Fig. 12.1). The hall, transport track or forklift truck, construction should be fully prepared for the welding process. The edges of the structural elements are carefully cleaned, chamfered and dotted stuck spot together. View the final design prepared material for welding is presented in (Fig. 12.2). Transport employee begins work on connecting structural elements located in a designated place for four chains crane fitted with hooks (Fig. 12.3). Thus prepared, the material is transported to the position of the welder and placed directly on the floor or rack welding (Fig. 12.4).

Fig. 12.1 View of the production hall designed for the welding process
Fig. 12.2 The material prepared for final welding
Source: [14]  
Source: [14]

According to the observations, due to the nature of the work in this position, workers are exposed to: excessive noise, dust and fumes inorganic, the impact of the radiation emitted by the welding arc, and burns.

The main way to reduce harmful factors in the working environment of the welder is to use personal protective equipment. Worker welding protective clothing consisting of: welding helmet, welding hood, welding gloves, protective footwear, proofing suit dielectric properties, and helmet (used during transport using a crane).

Regulations concerning the requirements for protective clothing against welders and related occupations are included in the PN-EN 470-1. Requirements and recommen-
ations for welding and welding stations, equipment and materials technology, skills and how to perform welding work are contained in the Regulation of the Minister of Economy, Labour and Social Policy of 14 January 2004 on safety and health at work for cleaning the surfaces, spray painting and thermal spraying.

![Fig. 12.3 Transportation construction on the weld](source: [14])

![Fig. 12.4 The construction is placed on racks welding](source: [14])

### 12.3.2 Methods used in the work

Noise measurements were made on the basis of the following standards: PN-N-01307:1994, "Noise – Permissible values of noise in the workplace – Requirements for measurement" [12] and PN-EN ISO 9612:2011 "Acoustics – Determination of occupational noise exposure – Engineering method" [8]. Measurement of noise made by the indirect method. The research was carried out during the three basic operations. The position of the welder was welding operations on steel structures, preparatory work and transport, as well as social break. The studies included measurements of the unit, the sound equilibrated A, the maximum sound level A, C peak sound level and the level of noise exposure in relation to 8-h dimension of work. Measuring instruments used were: sound level meter SVAN 955, SV 30A acoustic calibrator.

Dust measurements were made on the basis of the following standards:

1. PN-91/Z-04030.05. „Air purity protection. Total dust content tests on workstations with filtration-weight“.
2. PN-91/Z-04030.06. „Air purity protection. Research dust content. Determination of reparable dust on workstations with filtration-weight“.
4. PN-91/Z-04018.04. „Air purity protection. Studies of the free crystalline silica“ [3]. Determination of free crystalline silica in the respirable dust completely and in the presence of silicates in workplaces. Measuring instruments used were: aspirators measuring AP-2, AP-8, SKC, and rotameter R 06.

All the measurements were done in period 2012-2014.
12.4 RESULTS OF THE STUDY

In Tab. 12.2 and Tab. 12.3 the concentration of particulate matter in both total dust and respirable and noise levels are presented, respectively.

**Tab. 12.2 The concentration of total and respirable dusts**

<table>
<thead>
<tr>
<th>Name factor</th>
<th>Circumstances sampling</th>
<th>Years</th>
<th>Sample numbers</th>
<th>Individual concentration [mg/m$^3$]</th>
<th>Exposure index [mg/m$^3$]</th>
<th>Cw/ NDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other toxic industrial dusts including free crystalline silica below 2%</td>
<td>Consumption during welding steel structures, welding automatic welding Magomig, preparatory works and social gaps. Exposure time: 480 min</td>
<td>2012</td>
<td>Total dust 12/C</td>
<td>3.5</td>
<td>Cw=3.5</td>
<td>0.35</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Respirable dust 12/R</td>
<td>1.4</td>
<td>Cw=1.4</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2013</td>
<td>Total dust 13/C 13A/C</td>
<td>11.4</td>
<td>Cw=9.8</td>
<td>0.98</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Respirable dust 13/R</td>
<td>3.7</td>
<td>Cw=3.7</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2014</td>
<td>Total dust 14/C 14A/C</td>
<td>8.4</td>
<td>Cw=8.3</td>
<td>0.83</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Respirable dust 14/R</td>
<td>1.3</td>
<td>Cw=1.3</td>
<td>–</td>
</tr>
</tbody>
</table>

Source: Own elaboration

**Tab. 12.3 Results of the measurement noise**

<table>
<thead>
<tr>
<th>Measure-date</th>
<th>The action at the workplace</th>
<th>Duration of activity working T[m][min]</th>
<th>The duration of the measurement n[min]</th>
<th>Individual results [dB]</th>
<th>At the same weighted sound level A [dB]</th>
<th>Max. sound level A [dB]</th>
<th>Peak sound level C [dB]</th>
<th>Noise exposure level for 8h LEX,8h [dB]</th>
<th>Multiple limit LEX 8h</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>1. Welding of steel structures</td>
<td>230</td>
<td>15</td>
<td>86.2 85.1 84.9</td>
<td>85.4</td>
<td>93.4</td>
<td>110.4</td>
<td>83.3</td>
<td>0.68</td>
</tr>
<tr>
<td></td>
<td>2. Preparatory work, transport +noise from the hall</td>
<td>220</td>
<td>15</td>
<td>80.7 79.6 79.8</td>
<td>80.1</td>
<td>84.4</td>
<td>101.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Social break</td>
<td>30</td>
<td>15</td>
<td>56.8 56.0 56.2</td>
<td>56.3</td>
<td>68.7</td>
<td>85.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>1. Welding of steel structures</td>
<td>230</td>
<td>5</td>
<td>90.6 91.0 91.1</td>
<td>90.9</td>
<td>95.1</td>
<td>124.2</td>
<td>88.4</td>
<td>2.19</td>
</tr>
<tr>
<td></td>
<td>2. Preparatory work, transport +noise from the hall</td>
<td>220</td>
<td>5</td>
<td>85.1 83.0 82.8</td>
<td>83.8</td>
<td>103.2</td>
<td>123.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Social break</td>
<td>30</td>
<td>5</td>
<td>60.5 57.6 58.6</td>
<td>59.1</td>
<td>79.0</td>
<td>94.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>1. Welding of steel structures</td>
<td>230</td>
<td>5</td>
<td>90.1 89.4 89.7</td>
<td>89.7</td>
<td>95.3</td>
<td>118.1</td>
<td>87.0</td>
<td>1.58</td>
</tr>
<tr>
<td></td>
<td>2. Preparatory work, transport +noise from the hall</td>
<td>220</td>
<td>5</td>
<td>80.1 81.0 80.7</td>
<td>80.6</td>
<td>84.5</td>
<td>101.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Social break</td>
<td>30</td>
<td>5</td>
<td>57.1 57.5 58.0</td>
<td>57.5</td>
<td>68.3</td>
<td>86.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Own elaboration

Although not exceeded NDS (maximum concentration) values for total dust containing free crystalline silica was less than 2% and the downward trend in 2014, these values were dangerously high. In 2013 the levels of both total and respirable dusts were the highest and amounted to 9.8 mg/m$^3$ and 3.7 mg/m$^3$, respectively. By contrast, in 2014, the concentration of dusts showed decrease. In the case of respirable dust was
a significant decrease in the concentration and reached a value from 2012. However, total dust concentration slightly decreased to the value of 8.3 mg/m$^3$, compared to 2013, which was 9.8 mg/m$^3$ (Fig. 12.5). The persistence of high levels of total dust may be due to the deteriorating state of used machinery/equipment and ventilation equipment, causing no routine use of personal protective equipment, as well as an increase in the production capacity. The estimated risk of occurring in the described position in the three-tier scale based on the PN-N-18002:2000 specifies a little in 2012, while in the years 2013 to 2014 as an average.

The position of the welder in 2012-2013 found a high level of equilibrated sound level, which consists of separate measurements obtained. The results showed a downward trend in 2014. For the first step of the process, e.g. welding of steel structures, described parameter exceeded the limit of 85 dB over three years. In 2012, the value of the NDN (maximum exposure) has been exceeded by 0.4 dB. But, in the years 2013 and 2014 the values were 5.9 dB and 4.7 dB (Fig. 12.6). A similar situation occurred during other activities including the preparatory work and transport.

![Fig. 12.5 Summary of the measured values of dust on the position of the welder in 2012-2014](source)

![Fig. 12.6 Overview of the noise exposure level for an 8-hour operation at the position of the welder in 2012-2014](source)
During these measurements into account noise coming from the hall. In this case no exceeding of the maximum of intensity. It should be noted that in 2013 the value of the noise level was close to the upper limit value. On the other hand, in the years 2012 and 2014, the level of noise was at a similar level close to 80 dB. Measurements made during the third action, i.e. social gap, were in the range of 56.3 dB – 59.1 dB. Both, the maximum sound level and peak sound level C the position of the welder did not show NDN exceeded the measuring period. In 2013, compared to 2012, there was a significant increase in the parameters studied, even by several decibels. The highest value of the maximum sound level recorded during the operations in the number 2 (preparatory work, transport + noise from the hall) – 103.2 dB. The highest peak sound level C measured in step 1 (welding of steel structures) and amounted to 124.2 dB. The noise exposure level was exceeded for 8-hours working time of 85 dB in both 2013 and 2014 (Fig. 12.6). Times the limit value was 2.19 and 1.58 respectively, where 1 corresponds to the NDN. In 2012, the level of exposure for 8-hours limit value was not exceeded, and is characterized by multiplicity of 0.68 level.

CONCLUSIONS

Risks arising from the harmful and annoying noise, and industrial dusts are often underestimated, because the effects of the activities of these factors accumulate over time, and the measurable effect of the lack of protection is often very serious. Access means of individual and collective is unlimited. The only serious barrier is finance, which today are often layered over the health of the employee.

Measurements of the level of exposure for an 8-hours operation, which is a meaningful value that specifies the noise when changing jobs over three years significantly more likely to exceed the specified limit, or were close to the upper limit of the action causing a nuisance. During a visit to the property which is the subject of research on the position of the welder not found to be protective against noise and industrial dusts. Production hall, designed to produce large structures conducive to the production of noise coming from a variety of sources. Transport processes and those associated with strokes to remove a thin layer of slag welding are the main source of noise generation. The main source of industrial dust formation on the position of the welder is welding smoke containing particles. Regardless of the risk assessment, concentration of the industrial dust and noise level in the workplace should be monitored in accordance with the indicated frequency, and the actions and preventive measures standard. Besides the pulsed current welding machines, which improve the quality of the welds and reduce the amount of fumes, the technological development has brought more “quick and dirty” welding machines on the market as well, such as flux cored wire welding without shield gas. These can be used very easily, because they need very little training and preparations, but may cause high exposures. Therefore it is all the more necessary that the enterprises find equally easily accessible health and safety guidelines and assistance. More efforts should be put in the development of such tools or the improvement of existing ones.
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WORKPLACE QUALITY DURING THE WELDING PROCESS

Abstract: The article presents the exposure to noise and dusts occurring during the welding process. The results of the measurements of industrial dust and noise at the welder’s workplace in the period 2012-2014 are presented. Health problems generated during the process are presented. In particular, the attention is paid how to improve the quality of the work during the welding process. Proactively proposing actions that will improve the quality of the work during the welding process are described.

Key words: occupational exposure, welding process, industrial dust and noise, health risk

JAKOŚĆ PRACY PODCZAS PROCESU SPAWANIA

Streszczenie. W artykule omówiono narażenia związane z hałasem i pyłem przemysłowym występujące podczas procesu spawania, wpływające w istotny sposób na jakość pracy i zdrowie spawacza. W części doświadczalnej przedstawiono wyniki pomiarów pyłu przemysłowego oraz hałasu na stanowisku pracy spawacza w latach 2012-2014. Zaproponowano działania prewencyjnie, które poprawią jakość pracy podczas procesu spawania i ograniczają zagrożenia zdrowotne.

Słowa kluczowe: narażenie zawodowe, pył przemysłowy, hałas, proces spawania, ryzyko zdrowotne

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13

THE RELATIONSHIP BETWEEN THE IMPLEMENTATION OF CSR AND THE DISTANCE TO AUTHORITY

13.1 INTRODUCTION

Cultural aspects permeate the life and behavior of each person, causing a variety of situations he behaves and reacts in a different way. They affect the functioning of the organization in each of its aspects. Among other things, may have an impact on the functioning of CSR in the organization. Unity of the most common cultural typology according to G. Hofstede. In the following sections, the organizational aspects of culture, one of the dimensions analyzed by G. Hofstede – distance to the government and paid attention to how far to authority (small or large) positive effect on the implementation of CSR.

13.2 CULTURE AND ORGANIZATIONAL ASPECTS

Every country and every society in the world has a different, or at least recognized team of differing values and standards of behavior [3], [4]. The same behavior that in a single circle culture is seen as a positive somewhere else may be defined as objectionable.

The term culture is derived from Latin, from the Latin cultura deadlines, colere, which means – tillage, cultivation method, treatments, exercise, improvement, improving the ability [26]. Even today the word is still used in agriculture in the original sense, as can be seen in such phrases as: agricultural culture, bacterial culture, or monoculture. For the first time in the new meaning of this term was used by Cicero, who in his work Disputationes Tusculanae used the term cultura animi (literally: the cultivation of the mind).

In the literature there are many definitions of the concept of culture. As an example should be mentioned [27], [28], [35], [40], [55]:

- call the culture of shared system of beliefs, values, habits, behaviors, and artifacts that members adhere to a community in their everyday life and transmit it from generation to generation.
- culture is a unique whole determining how people behave or groups,
- culture, or civilization, it is a complex whole which includes knowledge, belief, art, morals, law, customs and any other capabilities and habits acquired by people as members of society,
• culture or civilization, taken in its wide ethnographic sense, is a complex whole that includes knowledge, belief, art, morals, law, customs, and many other capabilities and habits acquired by man as a member of society.

Research carried out in the world of different cultures helped to determine some basic cultural dimensions that significantly determine the way we think and act in management. Among them, the most important are [15], [16], [17], [18], [19], [20], [21], [22], [23], [24], [25]:

• distance to authority – a measure of inequality between the boss and subordinates, which can be accepted,
• uncertainty avoidance – the extent to which a given society is able to tolerate uncertainty, it determines how people feel new and unstructured situations,
• individualism collectivism – whose defining "good" the more we go in everyday life: his own and the entire community or a group in which we live or work,
• femininity and masculinity – Men's orientation based on the orientation rather on achieving success and desire to relate differently conceived "victories" while the feminine orientation implies a greater focus on the overall quality of life,
• orientation for a short or long period – the period from the point of view that we consider the implications of the decision, the time you are inclined to expect to actions brought visible, positive results.

Another typology of cultural dimensions, developed on the basis of previous studies is the typology of Ch. Humpden-Turner and A. Trompenarsa. They led in the 80s and 90s of the twentieth century large-scale survey of managers from different countries of the world. Their interesting project but has not gained such recognition, as previously discussed typology. Some researchers such as eg. Shalom Schwartz and ignore it.

Based on their research Hampden-Turner Ch and A. Trompenaars mention the following seven dimensions of culture [8], [9]:

• Universalism-particularism – specifies the procedure when it is not exactly as described rules. Can be used in such a situation, any of the rules (although this solution is not perfect) or consider in detail the case and find a new way out of the situation. Dimension within a certain range corresponds to the dimension of the components to avoid the uncertainty of G. Hofstede.
• Individualism-Collectivism – determines whether it is more important to an entity focused on its rights, motives of action, awards, abilities, view or should devote more attention to the development of the company as a community and the good of the company should be more important than the good of the individual employees. Dimension corresponds to the dimension of G. Hofstede.
• Analysis-synthesis – whether or not the analysis of phenomena to break them apart, or explore wider relationships, patterns, contexts. To some extent, the dimension connects to the dimension of femininity and masculinity by G. Hofstede.
• Internal vs. external control – that our internal judgments, decisions and commitments are what it should be guided in the daily conduct or should we adapt our behavior to the views of the outside world. Dimension to some extent connected with individualism-collectivism dimension of research G. Hofstede.

• Sequential-synchronicity – or prioritize the action as soon as possible, or do you have exactly synchronize efforts to complete the action later, but in a more precise and coordinated. To some extent size is combined with orientation of the short dimension and a long period of G. Hofstede.

All these cultural dimensions are important for social responsibility. Different cultural dimensions depending on what values can take to create an environment more or less conducive to achieving CSR. In this paper we addressed in detail the first of these areas – distance to authority.

13.3 DISTANCE TO AUTHORITY – THE DEFINITION OF THE PROBLEM

Distance to authority defines the problem of inequality in society. In every country in the world, of course, there are inequalities. In each country, regardless of its culture are richer and poorer. This is evident in any country or in any era was no different. They have always been people who have distinguished themselves: physical strength, cunning, authority, wealth, or other factors. Always, since the time of ancient and primitive tribal organization of power belonged to the few who stood at the head of the community and managed it. While other people have to listen to them, and are subject to their authority. However, in different countries different is the belief of the permissible size of social inequalities. There are countries where people are willing to accept even very large differences in income between the richest and the poor. However, are those in which there is egalitarianism and they are trying to strive for equality of opportunity, which should be equal for all, regardless of their social status or position. Of course this is an ideal that in practice it is very difficult to achieve. Nevertheless, it shows the aspirations and views of the majority of people [43], [45], [46]. In order to encourage employees to maximum effort in cultures with high power distance against the authority of the hierarchy must emphasize that governs them and evaluates the work. However, in cultures with low power distance as the equal treatment of employees brings a similar effect. In cultures with low power distance treat people as equals. In countries with a considerable distance to the government stresses [52]:

• limiting desires,
• moderation and compromise,
• maintaining impartiality and innocence,
• the importance of hierarchy,
• striving for centralization,
• large differences in wages between the positions,
• fear of expressing opinions different from your boss,
• autocratic management,
• approval by subordinates for all the boss’s decision
The concept of distance to authority can be defined as follows \[44, 45\]:

Distance to authority is the range of expectations and acceptance for the unequal distribution of power, expressed by less influential subordinates (members) of the institution or organization.

Distance to authority is expressed by the following three issues \[44\]:

- the ability of subordinates to oppose the supervisor,
- the actual decision-making style by the superior,
- style of decision-making by the superior most suitable employees.

In countries where the distance to authority is large there is a significant dependence of subordinates by their superiors. In this situation, the most common form of government takes autocratic or paternalistic. In contrast, so, where the distance to the authorities is low subordinates may ask the boss, take the initiative, to invent new ideas and concepts.

13.4 THE IMPACT OF THE IMPLEMENTATION OF THE DISTANCE TO THE POWER OF CORPORATE SOCIAL RESPONSIBILITY

Research conducted in the world allowed to extract the most important features of societies with small and large distance to authority.

In this section of the publication we will present the impact of the same distance on the various aspects of corporate social responsibility. Speaking of social responsibility adopted classical approach to the problem \[5, 6, 12, 14, 31, 32, 36, 48\]. In Tab. 13.1 and Tab. 13.2 show presenting a detailed analysis of the impact on the implementation of the concept of corporate social responsibility to the government of a small distance (Tab. 13.1) and the long distance to authority (Tab. 13.2).

<table>
<thead>
<tr>
<th>Factor</th>
<th>Impact on the achievement of corporate social responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Governance should be sanctioned by law and based on the criteria of good and evil</td>
<td>Very positive Implementation of corporate social responsibility requires the organization’s involvement in activities that do not always lead to a direct financial gain. In this context, a clear definition of the values that we should follow and the ability to separate the good from the bad is very important for a number of CSR activities. Especially the ethical aspects of CSR implementation are impossible without a strict definition of the criteria of good and evil.</td>
</tr>
<tr>
<td>The middle class is the most</td>
<td>Positive It is not possible to implement the concept of corporate social responsibility without a well-educated and prosperous middle class. It’s the middle class is usually the most committed to building a prosperous and implementation of CSR principles. In a situation where dominates the lower class, the main objective is to fight for survival and achieving tangible benefits. Then there is no place for social activities. Excessive concentration of wealth in the hands of a narrow group, also makes it difficult to achieve social goals. Implementation of CSR requires awareness that not only profit and material values are important, but you should also pay attention to social issues, environmental and ethical considerations. It is difficult to achieve without a developed, educated and democratic society.</td>
</tr>
<tr>
<td>Government which refused to emphasize its position a status symbol</td>
<td>Positive Overemphasis power and status, whether by means of a hierarchy, or material goods, eg. An expensive brand products leads to “chase” a sign of status and unnecessary excessive consumerism. As a result of consuming more goods and operates limited resources. This hinders the realization of sustainable development.</td>
</tr>
</tbody>
</table>
The information contained in Tab. 13.1 and Tab. 13.2 clearly shows the advantage of a small gap to the government in the implementation of solutions in the area of corporate social responsibility, our large distance to authority. The only exceptions are the issues of centralization, which, though characteristic of the large distance to the government, it is also beneficial for the implementation of CSR, especially in terms of its reporting processes.
Native management theories emphasize the role of supervisors

Weight grassroots action causes the excessive concentration of power when it is difficult to implement the principles of CSR. On the other hand CSR also requires planning that must be carried out arbitrarily.

Skills, wealth, power and status should be linked

In a situation where the power comes from the status of the unit and is associated with wealth, there are problems associated with lack of motivation ordinary employees. Employees whose social status is low and does not see the need to in their efforts, creativity and effort. They focused on the pursuit of signs of status, even if it is not beneficial to the environment and leads to unnecessary consumption of natural resources. Problems occur in this area especially in large industrial organizations [1], [2], [7], [37], [53], [54].

The middle class is a minority

If the middle class is a minority of the population, there is a large market shortage of highly skilled workers. Their absence, the society does not have enough people aware of environmental problems or ethical. Under such conditions, the implementation of the CSR is very difficult.

Incumbents in the company emphasized its position as a status symbol

In a situation where management overemphasised sign of their power status (expensive cars, clothes, housing in another district, etc.) Employees feel less and less relationship with the people who manage the company. In addition, all trying to make every effort to achieve them. Given limited resources, it is impossible that all of mankind to live on the level of the most developed countries. The attempt of the achievements has negative consequences for the environment or the public, which is contrary to the concept of CSR.

The privilege of authority to decide connections, charisma and the propensity to use of force

Propensity for use of force leads to a reduction of creativity and innovation. Additionally, intimidated society or organization easily appear unethical behavior or discrimination, which is contrary to the concept of CSR.

Conflicts in the internal affairs often lead to the use of force

Suppressed conflicts erupt with even greater force, and the need for more drastic measures. In this situation, the conflict instead of helping the organization becomes dysfunctional conflict, which can lead to problems the organization and even in the extreme case to its collapse. Revolutionary usually reflect negatively on social issues. Implementation of CSR is easier in a stable neighborhood.

Large differences in income populations are also maintained by the tax system

On the one hand, the differences in incomes allow for the accumulation of capital, which can be used to achieve social goals. On the other excessive differences in income lead to the disappearance of the middle class, this is the main driving force behind the prosperity of society and socially responsible society.

The authority is above the law: the exercise of authority gives the privilege of infallibility and is doing good

In this case, the top management of companies in many cases leads an activity contrary to corporate social responsibility / authority, when standing above the law tends to unethical actions, excessive pursuit of profit, disregarding the environment or good employees. For example, non-democratic countries, it can be concluded that the excess power at some point cease to care about the welfare of society.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Impact on the achievement of corporate social responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>The authority is above the law: the exercise of authority gives the privilege of infallibility and is doing good</td>
<td>Negative</td>
</tr>
<tr>
<td>Skills, wealth, power and status should be linked</td>
<td>Negative</td>
</tr>
<tr>
<td>The middle class is a minority</td>
<td>Negative</td>
</tr>
<tr>
<td>Incumbents in the company emphasized its position as a status symbol</td>
<td>Negative</td>
</tr>
<tr>
<td>The privilege of authority to decide connections, charisma and the propensity to use of force</td>
<td>Negative</td>
</tr>
<tr>
<td>Conflicts in the internal affairs often lead to the use of force</td>
<td>Negative</td>
</tr>
<tr>
<td>Large differences in income populations are also maintained by the tax system</td>
<td>Ambiguous</td>
</tr>
<tr>
<td>The dominant political ideologies emphasize the theory and practice to fight for power</td>
<td>Negative</td>
</tr>
<tr>
<td>Native management theories emphasize the role of supervisors</td>
<td>Somewhat negative</td>
</tr>
</tbody>
</table>
Factor | Impact on the achievement of corporate social responsibility  
---|---
**Striving for centralization** |  
Positive | Centralization is positive from the point of view of the implementation of CSR because it allows both the formation of the implementation of CSR standards and reporting systems. Especially in the case of reporting systems, national or international solutions to facilitate transparency GRI CSR results and allow you to compare performance results by different organizations [41], [42], [47], [49], [50], [51].

Negative | This kind of subordinates may include, from the point of view of the theory of motivation Mc Gregor to the group X. This means that people who work under duress, must be monitored and screened to have done his job properly. Under such conditions it is very difficult to implement CSR. If, despite it is introduced from above, eg. At the level of the state, are beginning to emerge phenomena of greenwashing, eg. Such offer products that seemed more pro-social environment or less than in reality, falsification of environmental and social data, and the like.

Source: Own elaboration

**CONCLUSION**

The publication analyzes the relationship between distance to authority and implementation of CSR suggests that for effective implementation of CSR is definitely favorable low distance towards power. In a society characterized by a low ratio of the distance to the authority of the people are better educated, more likely to participate in social initiatives, as well as act more ethically. The only exceptions are the issues of centralization, which are necessary to ensure a sufficient level of transparency and comparability in the implementation of a particular measure used CSR activities.

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THE RELATIONSHIP BETWEEN THE IMPLEMENTATION OF CSR AND THE DISTANCE TO AUTHORITY

Abstract: Cultural issues exert a significant influence on the functioning of the organization and implementation of CSR. In the following paragraphs paper presents aspects of organizational culture, one of the dimensions analyzed by G. Hofstede – distance to the government and it is pointed out that the distance to authority (small or large) positive effect on the implementation of CSR.

Key words: CSR, organizational culture, Corporate Social Responsibility, the distance to authority

ZALEŻNOŚCI POMIĘDZY IMPLEMENTACJĄ CSR A DYSTANSEM WOBEC WŁADZY

Streszczenie: Kwestie kulturowe maja istotny wpływ na funkcjonowanie organizacji i implementację koncepcji CSR. W kolejnych punktach publikacji przedstawiono aspekty organizacyjne kultury, przeanalizowano jeden z wymiarów według G. Hofstede – dystansu wobec władzy oraz zwrócono uwagę na to, jaki dystans wobec władzy (mały czy też duży) wpływa korzystnie na implementację CSR.

Słowa kluczowe: CSR, kultura organizacyjna, Społeczna Odpowiedzialność Biznesu, dystans wobec władzy

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QUALITY MANAGEMENT AND CORPORATE SOCIAL RESPONSIBILITY

14.1 INTRODUCTION

From the 50s of the twentieth century, the world is developing the concept of quality management, which especially from the time when, in the 80s of the twentieth century the standards of ISO has become one of the most popular approach to managing an organization. At the same time, in recent years more and more likely many managers and scientist developed the concept of Corporate Social Responsibility and reporting of these practices [4], [5], [6], [27], [28], [30], [31], [32], [33]. On closer inspection, it turns out that these concepts have a lot in common, starting from the basic principles of standing in the ground, through the implementation of methods to use standardization.

14.2 SOCIAL RESPONSIBILITY AND QUALITY MANAGEMENT – THE BASIS

The founders of modern quality management and excellence in business, Crosby, Deming and Juran, believe that ethics, principles and respect for people are the key rules of conduct.

Deming in his 14 Principles advocate organizational climate, where the interests between managers, employees and customers are conducted in accordance with ethical principles. Juran spoke about the system consisting of the values, attitudes and behavior, individual and group, created within the organization that is necessary for organizational success. TQM should be recognized by focusing on people, manifested in the quality of life and satisfaction of employees [2], [19], [20], [22], [23].

Concepts based on the principles do not detract from gaining of profit but put more emphasis on sustainable results by valuing people and the environment. Summary of Deming’s principles and social responsibility is illustrated in Tab. 14.1, while the common characteristics of quality management and social responsibility are presented in Tab. 14.2.

Quality Management concept is similar to the concept of corporate social responsibility, because it has ethical grounds as it has deemed necessary in the development of corporate social responsibility.
<table>
<thead>
<tr>
<th>Tab. 14.1 Comparison of Deming quality principles and Corporate Social Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Deming principles</strong></td>
</tr>
<tr>
<td>Create stability objectives and directions of development, management involvement.</td>
</tr>
<tr>
<td>Everyone learns a new philosophy.</td>
</tr>
<tr>
<td>Remove the need for mass inspection as a means of achieving quality.</td>
</tr>
<tr>
<td>Unsubscribe from the practice of business management in only the price level.</td>
</tr>
<tr>
<td>Improve constantly and forever every process of production and service.</td>
</tr>
<tr>
<td>Input the-job training.</td>
</tr>
<tr>
<td>Learn and establishing leadership.</td>
</tr>
<tr>
<td>Remove fear, create an atmosphere of trust and a climate conducive to innovation.</td>
</tr>
<tr>
<td>Destroy the barriers between departments and areas of work of the crew</td>
</tr>
<tr>
<td>Eliminate slogans and inciting workers to overcome shortcomings and to higher levels of productivity.</td>
</tr>
<tr>
<td>Eliminate quantitative performance norms, explore methods to improve and cancel the periodic evaluation of employees.</td>
</tr>
<tr>
<td>Remove barriers that rob the hourly employees of their right to be proud of their work.</td>
</tr>
<tr>
<td>Encourage learning, determine effective refresher training program related to work and serving as personal development.</td>
</tr>
<tr>
<td>Take action to achieve this transformation.</td>
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</tbody>
</table>

Source: Own elaboration based on: [9], [26]

It could be argued that the implementation of the concept of corporate social responsibility can proceed efficiently and in a shorter period of time through the use of existing processes and organizational change channels within the existing enterprise of total quality management. CSR is sometimes regarded as an extension of the science of total quality management (TQM). The development of CSR leads to more and more account of criteria relating to corporate social responsibility by the creators of the international rankings, awards and rankings in the field of quality management and competitiveness.
14.3 SOCIAL RESPONSIBILITY AS A QUALITY MANAGEMENT SYSTEM EXTENSION

Problems of social responsibility are not directly referred to in ISO 9001 standard, but they are found in improvement models based on this standard. In the first place, it is worth paying attention to ISO 9004 standard. Paragraph 4.4 of the standard lists the interested parties, needs and expectations. Taking into consideration the issues of corporate social responsibility, it is worth paying particular attention to the examples of needs and expectations quoted in the standard, which include [14]:

- environmental protection,
- ethical conduct,
- compliance with the provisions of law and other regulations.

Corporate social responsibility issues have been included in the content of the standard, especially from the point of view of an organisation’s attitude to the achievement of a lasting, sustainable success. Such a success is achieved by fulfilling the needs of not only customers, but all the interested parties over a long period of time. One of the stakeholders, being particularly important from the social perspective, is the previously mentioned customers [1], [3], [10].

Tab. 1.4.3 contains an evaluation of issues related to corporate social responsibility which are raised in particular normative documents. The scope of issues has been marked with the following symbols:
• “+” little,
• “++” medium,
• “+++” big.

The new version of the ISO 9004 standard as of 2010 contains numerous statements compliant with the principles of corporate social responsibility. The concept regarding the interested parties and the fact that an organisation should pay attention not only to the needs of customers, but also all the stakeholders, is compliant with the CSR concept. The ISO 9004 standard says that interested parties are entities or persons who contribute an added value to an organisation, are interested in the organisation’s activity in another way or have an influence on the organisation’s activity. The fulfilment of interested parties’ needs and expectations contributes to achieving a lasting success of the organisation.

According to the standard, the needs and expectations of interested parties are in many cases contradictory. For this reason, an organisation should apply such measures as cooperation, negotiations etc. so as to reach a consensus in this matter.

A very important factor of corporate social responsibility is paying attention to the needs of people in an organisation and managing the organisation in such a way that their needs are satisfied. Regarding this issue, paragraph 4.2 of the standard in question says directly that an organisation should make sure that its people have a possibility of learning both to keep the organisation viable and for their own benefit. At this point, it is particularly worth quoting selected issues contained in paragraph 6.3.1 of the standard related to corporate social responsibility, where it is stated that people are the most valuable and crucial resource in an organisation. Therefore, it is necessary to make sure that the working environment encourages them to pursue personal development, to learn, share their knowledge and work in a team. It is recommended that people should be managed in a planned, transparent and responsible way from the ethical and social point of view.

Tab. 14.3 Standards concerning quality and environment management versus corporate social responsibility

<table>
<thead>
<tr>
<th>Standard</th>
<th>Scope of issues concerning corporate social responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO 9001:2008</td>
<td>None</td>
</tr>
<tr>
<td>ISO 9004:2000</td>
<td>+</td>
</tr>
<tr>
<td>ISO 9004:2008</td>
<td>++</td>
</tr>
<tr>
<td>ISO 14001:2004</td>
<td>++</td>
</tr>
<tr>
<td>ISO 19011:2010</td>
<td>+</td>
</tr>
<tr>
<td>ISO 10014:2007</td>
<td>+</td>
</tr>
</tbody>
</table>

Source: Own elaboration based on: [11], [12], [13], [14], [15]

Point 4.4 regarding the interested parties emphasises such issues as: environmental protection, ethical behaviour or observance of law regulations in relation to communities as well as transparency in relation to stakeholders. Another point of the standard
draws attention to the fact that when planning a strategy or policy, it is necessary to identify and determine the needs and expectations of the above mentioned interested parties. It is completely compatible with the concept of corporate social responsibility and, in a developed form, all these issues are discussed in specialist standards dedicated to CSR, which will be analysed in the further part of this publication.

In the case of the standard concerning environmental management [12], all issues which regard environmental policy, including in particular contamination prevention, comply with CSR principles. Also the process of environmental aspects’ identification as well as determination of the ones that are significant and recommended to be treated by the organisation’s environment management system as priority issues [12] is an important element compliant with CSR.

In a broad understanding of corporate social responsibility, which includes ethical issues, these problems are raised in the ISO 19011 standard. The auditing rules comprise among others: ethical conduct, reliability, confidentiality and prudence. It is assumed that auditors will act with diligence and audit findings will be precise and true. Ethicality is also quoted in the case of competences required from auditors [13].

Although, as written above, in standards concerning quality management the issues related to CSR are not extensively discussed. Mentioned standards provided a basis for specialist standards directly dedicated to these issues. The most frequently applied standards in this scope include: ISO 26000, SA 8000 as well as AA1000 or polish RESPECT index. Tab. 14.4 contains characteristics of the above mentioned normative documents.

ISO 26000 provides guidance on how businesses and organisations can operate in a socially responsible way. This means acting in an ethical and transparent way that contributes to the health and welfare of society. The standard provides guidance rather than requirements, so it cannot be certified to unlike some other well-known ISO standards. Instead, it helps clarify what social responsibility is, helps businesses and organisations translate principles into effective actions and shares best practices relating to social responsibility, globally. It is aimed at all types of organisations regardless of their activity, size or location. The standard was launched in 2010 following five years of negotiations between many different stakeholders across the world. Representatives from government, NGOs, industry, consumer groups and labour organisations around the world were involved in its development, which means it represents an international consensus.

The SA 8000 standard is the central document of Corporate Social responsibility System. It is one of the world’s first auditable social certification standards for decent workplaces, across all industrial sectors. It is based on conventions of the ILO, UN and national law, and spans industry and corporate codes to create a common language to measure social compliance. It takes a management systems approach by setting out the

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2 There are more standards concerning CSR, the above table presents three major ones. Readers interested in other documents can refer to publication [7], [8], where the majority of the most important normative documents related to CSR have been contained along with their characteristics.
structures and procedures that companies must adopt in order to ensure that compliance with the standard is continuously reviewed. Those seeking to comply with SA 8000 have adopted policies and procedures that protect the basic human rights of workers.

**Tab. 14.4 Characteristics of major standards referring to CSR**

<table>
<thead>
<tr>
<th>Standard</th>
<th>Characteristics</th>
</tr>
</thead>
</table>
| ISO 26000 | Defines social responsibility as responsibility of an organisation for the impact of the decisions it takes on the society and environment through transparent and ethical conduct. 7 principles of social responsibility:  
  Responsibility – an organisation should be responsible for its impact on the society and environment.  
  Transparency – an organisation’s decisions and activities which influence the society and environment should be transparent.  
  Ethical conduct – activities undertaken by an organisation should be based on the ethics of honesty, equality and integrity.  
  Respect for the interests of stakeholders – an organisation should respect and take into consideration its stakeholders’ expectations.  
  Respect for law regulations – an organisation should accept and respect the regulations of the law in force.  
  Respect for international standards of conduct – an organisation should respect international standards of conduct specified in the law regulations in force.  
  Respect for human rights – an organisation should respect human rights, taking into consideration both their weight and universality.  
  The standard is not subject to certification. |
| SA 8000 | The standard is focused chiefly on human rights and relations with employees (it can be said that it elaborates on two areas referred to in the ISO 26000 standard). The standard specifies minimal requirements in the following scope:  
  Children’s work,  
  Forced labour,  
  Health and safety,  
  Freedom of association and the right to collective negotiations,  
  Discrimination,  
  Disciplinary actions,  
  Working hours.  
  Remuneration.  
  Management systems.  
  The standard is subject to certification. |
| AA 1000 | The standard is aimed at including social and ethical issues in the strategic management of an organisation and the fields of its activity. It is focused in particular on the stakeholders of an organisation. It takes into consideration 5 major stages of the management of relations with stakeholders:  
  Planning – an organisation embark on the process.  
  Defining the principles of responsibility.  
  Conducting an audit and preparing a report.  
  Implementation – process reinforcement.  
  Co-operation with stakeholders – groups related to the organisation (customers, suppliers etc.). |

Source: Own elaboration based on: [21], [24], [25], [34]

AccountAbility’s AA 1000 series are principles-based standards to help organisations become more accountable, responsible and sustainable. They address issues affecting governance, business models and organisational strategy, as well as providing ope-
rational guidance on sustainability assurance and stakeholder engagement. The AA 1000 standards are designed for the integrated thinking required by the low carbon and green economy, and support integrated reporting and assurance. The standards are developed through a multistakeholder consultation process which ensures they are written for those they impact, not just those who may gain from them. They are used by a broad spectrum of organisations -- multinational businesses, small and medium enterprises, governments and civil societies.

We can say, standards relating to CSR can be considered to be an extension of standards concerning quality management. The quality management standard is a first step towards good integrated management system. But the improvements of the quality management or even integrated management system are not sufficient nowadays. We think CSR systems are extension of quality management system and there is a need for integration of these system toward one fully integrated management systems based on the principles of social responsibility.

14.4 SIGNIFICANCE OF CORPORATE SOCIAL RESPONSIBILITY FOR MANAGERS DEALING WITH QUALITY MANAGEMENT

On the basis of investigations in the field of parameterisation of the criteria of quality management systems’ evaluation in Poland [29], it can be said that managers dealing with quality management (the ones who completed questionnaires in the research) consider CSR problems as insignificant. Factors related to social issues in the above mentioned studies had a weight of 4-5 on a 10-point scale. It is a very low value given the fact that issues which concern competitiveness, customer etc. were evaluated on a level of 8-9 [29].

As shown by the studies, representatives of the examined organisations’ management regard corporate social responsibility as an issue of little significance. This implies that for an organisation a market success is more important than fulfilling the needs of its employees or the society [17].

The phenomenon itself is not negative, as an organisation should in the first place be oriented to the customer. However, such an attitude may lead to problems with corporate ethics, which is particularly visible in the case of quality management systems certification. For example, K. Lisiecka draws attention to numerous negative tendencies which have been observed in this field in recent years, such as among others [17], [18]:

- lack of the knowledge of the idea and the meaning of quality standards,
- depreciation of certificates and their weakened credibility resulting from unprofessional implementation of the system and limited „managerial competences” of the consultants,
- lack of individual approach on the part of consulting companies,
- auditor’s fear of revealing the inconsistencies of the system subjected to certification due to the fact that the audited clients are interested mainly in a positive evaluation of the system instead of an honest list of observations.
It seems that such little importance attached to the problems of CSR may become a barrier in the process of implementation of standards related to corporate social responsibility. It is one of the reasons causing that despite a development of this field in our country it is not as dynamic as it was in the case of other standardised management systems.

CONCLUSION

The concept of corporate social responsibility is paralleled to quality management in many points of view. From the Deming principles through basic concepts there are many similarities between them.

Corporate social responsibility makes it possible to supplement and expand basic issues contained in the ISO 9001:2008 standard as well additional instructions regarding the achievement of a lasting success with issues related to sustainable development, society and ethics. It is compliant with contemporary trends in management and classic concepts of quality management. We think that there is a need for development of integrated management system which can contain issues related to

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QUALITY MANAGEMENT AND CORPORATE SOCIAL RESPONSIBILITY

Abstract: The paper presents the relationship between quality management and corporate social responsibility. We presented, in the paper, the most important relationships between these concepts. Were also examined issues related to the presence of Corporate Social Responsibility in a variety of standards for quality management and related matters. In addition, the publication has been the most important characteristics of CSR standards.

Key words: quality management, Corporate Social Responsibility, ISO 9001, ISO 26000, SA 8000

ZARZĄDZANIE JAKOŚCIĄ A SPOŁECZNA ODPOWIEDZIALNOŚĆ BIZNESU

Streszczenie: W publikacji przedstawiono relacje pomiędzy zarządzaniem jakością a społeczną odpowiedzialnością biznesu. Przedstawiono najważniejsze związki między tymi koncepcjami. Dokonano również analizy obecności kwestii dotyczących Społecznej Odpowiedzialności Biznesu w różnych normach dotyczących zarządzania jakością i spraw pokrewnych. Dodatkowo w publikacji dokonano charakterystyki najważniejszych standardów dotyczących CSR.

Słowa kluczowe: zarządzanie jakością, Społeczna Odpowiedzialność Biznesu, ISO 9001, ISO 26000, SA 8000

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15

SELECTED METHODS AND TOOLS FOR ANALYSING PRODUCT NONCONFORMITY IN THE AUTOMOTIVE INDUSTRY

15.1 INTRODUCTION

When buying a car, the customer pays attention not only to the colour of the chassis, the equipment, dimensions or performance, but also to the make, which, in his opinion, proves the quality of the car. To ensure a high quality of products, car manufacturers worked out systems, methods and tools which, when implemented in a process, allowed achieving very good results in the manufacture of read-made products.

In the conditions of constantly changing technologies, specialization of particular companies and cost reduced by car concerns, car manufacturers have been forced to resort to outsourcing in the production of parts, focusing only on sub-assembling. Only strategic processes, like pressing car body sheets and paint job are still performed by car manufacturers, whereas the remaining process is a long production line with assembly and subassembly of such elements as engine, gear box, windows, body or suspension, which make up a car [5]. With so advanced outsourcing, concerns had to force suppliers to ensure high quality, among others by auditing the processes, monitoring of quality indicators or implementing methods and tools to solve quality problems [7]. When searching for cheap suppliers in so-called low-cost countries or countries offering cheap labour force, it is increasingly difficult to maintain a high quality of manufactured parts, which may result in a larger number of defects spotted in the process at the customer’s place [3]. The aim of the study is to present tools applied to solve quality problems, with a focus on the phenomenon related to deterioration of the quality of parts delivered by suppliers.

15.2 OVERVIEW OF TOOLS

In the automotive industry a number of quality management methods and tools are used. They include methods widely used in other branches, such as: FMEA, SPC, Ishikawa diagram or Pareto chart [9]. However, automotive concerns have developed many quality management tools and methods which are not commonly applied. The study focuses on three of them:

- Seven Diamonds,
- 5WHY,
• Drill deep and wide.

All the methods and tools described below are used when a problem occurs at the supplier's or customer's place. Results obtained after their application are a starting point for taking preventive and corrective measures.

15.2.1 Seven Diamonds

Seven diamonds is a structured method used to identify the cause of a problem, whether it is related to the production process or product nonconformity. Each of the diamonds is a question requiring a positive or negative answer. A positive reply in any diamond results in a move to the next diamond. As a result of a negative answer, appropriate corrective measures are undertaken [10]. Below has been presented the algorithm of the procedure in the 7 Diamonds Method (Fig. 15.1).

![Fig. 15.1 Algorithm of the procedure in the Seven Diamonds Method](Image)

Source: [1]

Diamonds 1 to 4 concern the production process and are used to establish whether the organisation of production complies with the project assumptions. Initially, an analysis through 1-4 diamonds is conducted on the spot (e.g. at a workstation), in the place where a problem occurred. If the analysis reveals that the problem arose at the earlier stage of the production process, the analysis should also address the source of the problem. If, in the process of analysis, the answer to any of the below questions is negative, ambiguities should be resolved; if the process does not comply with the assumptions, it should be improved and revalidated so that it complies with the design. Positive answers to all the questions from diamonds 1-4 allow continuing the analysis and proceed-
ing to the next diamond. When conducting an analysis, one should answer questions focusing on the areas marked in the diagram: Diamonds 1 to 5.

Diamond 1 – proper process? Questions contained in the first diamond concern the compliance of operator’s work with requirements to be observed at a particular workstation and his general knowledge of procedures which have to be followed in non-standard situations, such as spotting a nonconformity at the workstation.

Diamond 2 – proper tool? The second area contains questions related to the correct use of workstation tools, the use of appropriate tools during an operation or control of machines at the workstation.

Diamond 3 – proper part? In the third diamond the correctness of a workstation’s organisation, their layouts as well as the layout of parts at the operator’s disposal are checked.

Diamond 4 – quality of parts? The person responsible for establishing whether a part has been changed or for checking the general quality of a product should collect the following information: data provided by the supplier (internal or external), results of tests and inspections of tangible values (dimensions, properties etc.), comparison of parts, comparison of batches.

Diamonds 1 to 5 are an evaluation of the production process stability. After the problem has been identified, answers should be provided automatically according to steps 1-4. This procedure algorithm should be a spontaneously performed activity in the problem solving process.

Diamond 5a – required support of engineers? Diamond 5a is used to filter and solve less complex problems before support of specialist in a given area is required. An analysis should be conducted using available quality management tools, such as: SPC, 5WHY, Ishikawa Diagram etc. If the problem is not solved after an analysis was carried out or its size has not been reduced, the matter should be referred to relevant departments (assembling, production etc.). Diamond 5b – change in the process solved? After filtrating the problems found as a result of analyses in Diamond 5a, a team of department engineers should think about making some changes in the process which will allow the problem to be solved. The fact that the problem has reached Diamond 5b means that the process was improperly designed or some important issues were neglected at the stage of new product implementation.

Diamond 6 – required changes in the design? Reaching Diamond 6 in the process of analysis is usually caused by permanent problems with a part, confirmed by many complaints from the customer, which have not been solved in a proper way. At this stage the problem should be referred to a team of engineers responsible for the part design. A change in the design of the part should not alter the established property or its key characteristics. Most frequently it is a minor modification of a tool making this part (e.g. tools for presses) or a foundry mould, a change of which will solve a problem related to e.g. collision with another part.

Diamond 7 – extremely complex problem? Problems solved in Diamond 7 are complex problems resulting from an unsuccessful process combined with an improperly de-
signed part. This kind of problems are solved by outsourced teams of engineers or specialists, who will approach the problems in an objective way and, owing to their experience and knowledge, will be able to deal with them. However, it is extremely expensive as it usually involves a complete change of the process, purchase of a modern technology and paying the outsourced specialists.

15.2.2 5 WHY

5WHY is a very good tool, which allows getting to the root of the problem [2]. 5WHY analysis is two-level as it should answer two questions:

- why did the problem occur?
- why was the defect not spotted in the process or during an inspection of the part?

Before undertaking an analysis, one should collect as much information on the problem as possible so as to be able to engage appropriate people to find the root of the problem. Therefore, the following questions should be answered:

- establish what happened? on the basis of parts received,
- if there is information regarding the production batch on the part, we can define when it happened?
- what is the scale of the problem? how many nonconforming parts might we have?
- what the defect may cause in our place and at the customer’s? Is there a big threat which obliges us to immediately inform the customer?

After answering the above problems, we should appoint a team of specialists that will help us construct the questions and find the real cause of nonconformity. Such a team could include engineers responsible for processes as well as operators, as they have the greatest knowledge about the place in which the defect might have arisen.

![Fig. 15.2 5WHY form at Fiat Auto Poland](source: [8])
The last activity before starting an analysis is thorough and unambiguous formulation of the problem so that it will make us follow a certain thinking track and prevent us from going off course during the analysis. In general, 5WHY can be defined as a cause and effect analysis, because answering one question automatically leads us to another one until the real cause of the fault is found. Of course life shows that 5 WHY analysis is not limited to 5 questions, but can finish with a good result after 3 or 7 questions. We cannot restrict ourselves to 5 questions because we would either get stuck or we would come to wrong conclusions. Example of a 5 WHY method form has been presented in Fig. 15.2. In the above presented Fig. 15.2 potential causes of a problem have been identified. One can see that in the case of some questions there are a few alternative answers. As a result of analysis, one answer in the fifth question has been selected as the cause of nonconformity, for which target activities have been formulated.

15.2.3 Drill Deep and Wide (DDW)

DDW is one of the most developed tools applied for analysis in General Motors group (Fig. 15.3). It can be divided into two separate forms.
- the first one is Drill Deep form,
- the second one is a Drill Wide form.

![Fig. 15.3 Procedure algorithm in Drill Deep Method](source)

Source: [4]

Drill deep is a developed and modernised version of 5WHY. The informative part of the form contains basic information about responsible persons from the customers and supplier’s side as well as data on the plate where the problem occurred. The analytical part of the drill deep form contains 4 aspects, which the supplier has to deal with and analyse the problem in these areas. Drill Deep is also called 3X5 WHY, because
the general principle of operation in this case is the same as that applied in 5 WHY, except that an analysis is conducted in three major aspects.

The first aspect is „Prevent“. This aspect concerns the production line, specifically the process of assembling, protection against the so-called Error Proofing defect and operation standards for operators. In this aspect the supplier must ask himself the question why the production system did not protect the customer against the defect described in “Failure Mode”. In this aspect the quality assurance system in the plant is analysed. The second aspect is „Protect“. This aspect concerns the area of quality control. When analysing this area, the supplier should consider issues related to the fact that quality control was not effective enough to protect the customer against its detection. The third aspect is „Predict“. It is a new aspect compared to 5 WHY and equally important as the previous ones, as it concerns the area of quality planning in a plant. As it is known, one of quality planning methods is FMEA, therefore most considerations in this aspect are related to this method.

The fourth aspect is the field devoted to additional shortcomings or defects found in the process of analysis. Creating such a field does not cause limitations and provides possibilities for streamlining the process, the system of quality, planning and ensures implementation of corrective measures.

Similarly to 5 WHY, this analysis is not limited to asking 5 questions, but, if necessary, can be supplemented with additional questions. Since the analysis is conducted on a few planes, it can more effectively prevent the occurrence of a defect in the future, because every aspect consists of at least one corrective measure. To verify the rationale behind the conducted analysis, it is necessary to read it backwards, i.e., from the root (cause) of the problem upwards, by replacing the question “why” with the statement “because”. If we come to the same conclusions and do not lose the logic of the analysis, the analysis can be considered properly conducted. The universal character of this tool is reflected in the fact that apart from obligatory corrective measures which must be implemented after the cause of the problem has been found, a corrective measure can be proposed at each stage of analysis, as the structure of the form makes it possible.

Drill wide is an additional tool that complements Drill Deep, creating a very broad analysis under the name Drill Deep & Wide. This tool is used to standardize and thoroughly analyse significant problems and its aim is to supervise the implementation of corrective measures in all the areas listed in the forms. The extended name of this tool is Drill Wide – Read Across, which clarifies how it should be used. An analysis should be started with creating a template for the corporation because corporations such as Bosch, Delphi, Denso or Yazaki produce very similar products in many factories, frequently for one customer. Due to the fact that the form regards a few plants, its supervision is the responsibility of high-rank managers who are authorised to take decisions that can be simultaneously implemented in a few factories. Since Drill Wide is a tool applied only for serious problems, it should be used after a Drill Deep analysis has been conducted. Except differences related to the location for which the forms are applied, they contain the following data: information about the supplier, i.e. its name, DUNS, per-
son responsible for the form, telephone number and e-mail address, legend regarding the manner of completing the template in “Symbol” rows. The meaning of the legend is as follows:

- O – means location of the problem occurrence, the accuracy including the machine where the problem was identified,
- X – means locations with similar processes in which corrective measures should be implemented,
- N/A – means that in a given plant or process corrective measures cannot be applied, as the process is considerably different from that in which the problem occurred. In short – not applicable.

Each of the above mentioned symbols is also accompanied by colours denoting the status of undertaken activities:

- red colour – means that measures have not been implemented or are currently being implemented,
- green colour – means that measures have been implemented and confirmed only by the supplier,
- blue colour – means that measures have been implemented and confirmed by GM or the authorised company (third party).

Next, according to the „Read Across” principle, the following can be found in the form:

- name and number of the part – which is connected with the number of complaint from Drill Deep,
- plant affected by the problem,
- description of nonconformities copied from Failure Mode cell contained in the linked Drill Deep analysis,
- description of the problem at the customer’s place copied from Effect of Failure Mode cell contained in the linked Drill Deep analysis,
- number of nonconformities,
- type, status and date of implemented controlled delivery,
- date and person responsible for approving the Drill Deep analysis as well as the date and person responsible for approving the corrective measures in Drill Wide,
- number of complaint related to the problem,
- corrective or other measures implemented in the following areas:
  - confirmation of problem cause identification and implementation of corrective measures,
  - confirmation of implementing corrective measures for the production process – data from Drill Deep analysis for the Prevent aspect,
  - confirmation of implementing corrective measures for the quality system – data from Drill Deep analysis for the Protect aspect,
  - confirmation of implementing corrective measures for the area of quality planning – data from Drill Deep analysis for the Predict aspect,
- confirmation of implementing corrective measures for the fourth aspect in Drill Deep, i.e. additional defects found in the process of analysis,
- confirmation that the whole documentation is complete and updated, in particular applying to:
  - workstation instructions,
  - instructions for operation and tests,
  - notes from trainings devoted to the problem.

**READ ACROSS MATRIX**

<table>
<thead>
<tr>
<th>SUPPLIER</th>
<th>PQE/5OE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name:</td>
<td>Company</td>
</tr>
<tr>
<td>Location:</td>
<td></td>
</tr>
<tr>
<td>Phone:</td>
<td></td>
</tr>
<tr>
<td>Date:</td>
<td>GM Location / Provider</td>
</tr>
<tr>
<td>Contact Name:</td>
<td>Contact Phone</td>
</tr>
<tr>
<td>E-mail:</td>
<td></td>
</tr>
<tr>
<td>Right:</td>
<td>Week Period:</td>
</tr>
<tr>
<td>Date:</td>
<td>Date:</td>
</tr>
</tbody>
</table>

Each of these measures requires appointing a person responsible for supervising its course and confirming that the activities were completed after successful validation [4]. The last element in the form is the template related to corrective measures and, depending on the level of the form, plants, production lines as well as operations and machines. In this template the symbols and colours denoting the status of implemented measures according to the legend are marked. An example of a Drill Wide form has been presented in Fig. 15.4.

**CONCLUSION**

The presented methods are used mainly for identifying the causes of nonconformities in a product or production process as well as documenting the implemented improvement activities. The simplest tool – 5 WHY is applied to solve uncomplicated
problems related to product quality. It allows exploring the basic causes of the problem, which is necessary to develop effective corrective measures. The 7 Diamonds Method is more universal – it can be used for solving simple and complex problems. Its biggest advantage is the fact that it allows starting an analysis without knowing the scope of the problem. The method is adjusted to the level of problem complexity (the first four diamonds for uncomplicated problems or all the diamonds for complex problems).

The most elaborate method in the discussed set is the DDW method. It consists of two parts: Drill Deep and Drill Wide. The Drill Deep part enables identification of the causes of a problem and the reasons for failure to detect it in the process. The Drill Wide part allows identifying the scale of a negative phenomenon subjected to analysis in the whole concern. It helps in the process of documentation and management of improvement activities in many plants at different locations.

The presented methods and tools used in the automotive industry should have a more universal application. Applying them in other branches of industry can provide a lot of benefits by reducing product failure frequency, streamlining the production processes and improving co-operation with suppliers of half-products.

REFERENCES
Abstract: The study contains a review of seldom encountered quality management methods and tools which are applied in the automotive industry to solve problems related to nonconforming products. Three tools have been discussed: 5WHY, 7 Diamonds and Drill Deep and Wide. The tools differ from each other in terms of their complexity and the scope of application: from the simplest problems related to product quality to complex problems occurring in the production process. The scope of their application may refer to one product, the whole production process as well as to all processes in the corporation.

Key words: quality, tools, 7 Diamonds, management, nonconformity, automotive industry, 5WHY, DDW

WYBRANE METODY I NARZĘDZIA ANALIZY NIEZGODNOŚCI WYROBÓW STOSOWANE W PRZEMYŚLE MOTORYZACYJNYM


Słowa kluczowe: jakość, narzędzia, 7 diamentów, zarządzanie, niezgodność, motoryzacja, 5WHY, DDW

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DISAGGREGATION OF SO$_2$ AND PM$_{2.5}$ EMISSIONS FROM SMALL DOMESTIC COMBUSTION SOURCES LOCATED IN SOUTHWESTERN POLISH PROVINCES - CASE STUDY

16.1 INTRODUCTION

Fine particulate matter and sulphuric oxides are widely known as pollutants connected with combustion processes [21]. Long-term exposure to air polluted with SO$_2$ and PM$_{2.5}$ can strongly affect the human health [1]. Small combustion sources, particularly of height up to 40 m [18] can strongly affect air quality in local scale. According to current report by Polish Ministry of the Environment [20], emission from fuel combustion in domestic boilers causes roughly 90% of air quality level exceeding’s. Moreover, pollutants from small combustion sources are tend to be deposited locally [18], so struggle with that problem can be very difficult in national level.

This paper presents analysis carried out for three of 16 provinces (voivodeships) located in southwest Poland (Lower Silesia, Opole and Silesia) also their districts. In analysed region are located important centers of Polish industry, such as: public power (mainly located in Silesia), quarrying of copper (Lower Silesia) and chemical industry (Opole). Apart from number of operating industrial emission sources, the inhabitants (almost 21% of Poland’s population) are exposed to pollution emitted from their settlements.

Compared to the newest analysis carried out by the Central Statistical Office of Poland [17] the share of emission from small domestic sources in national total emission for three analysed provinces is slightly greater than 20% for both analysed pollutants.

16.2 MATERIALS AND METHODS

16.2.1 Emission estimation

The methodology of emission estimation for small domestic combustion is widely described in national report [14]. The emission (on national level) is presented using following formula:

\[ E^X = \sum F \cdot A_F \times EF_F^X \]  

(16.1)

where: \( E^X \) - emission of pollutant \( X \) [Mg],
16.2.2 Selection of emission surrogates

Considering Formula (16.1), to disaggregate the national total total to scattered sources located quasi-accidentally in particular districts was surrogate methodology adopted [12]. In general, the surrogate method relies on selection auxiliary value suitable for disaggregation. Very often the surrogate is chosen as economical parameter, such as GDP [5] or by the expert judgement [7]. After selection of desired value, the Formula (16.1) is presented as:

\[ E^X = \sum \lambda A_F \times EF_F^X \]  \hspace{1cm} (16.2)

where: \( \lambda \), - selected surrogate.

16.2.3 Heat demand

To disaggregate emissions from combustion in small domestic sources, we determined the heat demand in particular districts using formula similar to presented by Hławiczka et al. [9]:

\[ H_d = A_{IH} \times HDD \times 24 \times 3600 \times 10^{-12} \times \sum Q H_d(Q) \times F_Q \]  \hspace{1cm} (16.3)

where: \( H_d \) - total heat demand in provinces: Lower Silesia, Opole and Silesia [TJ];
\( A_{IH} \) - floor space heated individually [m²] [15];
\( HDD \) - heating degree days, separately for provinces, by Dopke [6] [K\times d];
\( H_d(Q) \) - heat demand assessed considering age of the building, insulation quality and heat losses [9] [W\times m²\times K^{-1}] (low losses: 1.1; medium losses: 1.6; high losses: 2.5);
\( F_Q \) - \( F_Q \), floor space of buildings in particular age [m²].

16.2.4 Age of buildings

According to data derived from the current National Census of Population and Housing [15] and year of built given (8 separated age classes \( c \) since 1918 to 2011) the were estimated as:

high loss: \( F_H = c_{1+2} + 0,45 \times c_3 \); medium loss: \( F_M = 0,55 \times c_3 + c_4 + 0,75 \times c_5 \); low loss: \( F_L = 0,25 \times c_5 + c_{6+7+8} \), where floor spaces in particular age class was estimated by average floor space per capita in particular district and number of residents [15].

Age classes are defined as follows: \( c_1 \), before 1918; \( c_2 \), 1918-1944; \( c_3 \), 1945-70; \( c_4 \), 1971-78; \( c_5 \), 1979-88; \( c_6 \), 1989-2002; \( c_7 \), 2003-2007 and \( c_8 \), 2008-2011.

16.2.5 Top-down limitation

Disaggregated heat demand was limited with top-down value \( B \) [TJ] derived from eurostat, assuming average efficiency (\( \eta \)) of boilers and stoves as 50%, then accepted value had to be smaller than reported internationally:

\[ H_d \times \eta^{-1} \leq B \]  \hspace{1cm} (16.4)

Top-down methodology is widely discussed in [24]. Limitation given by Formula (16.4) was necessary for purposes of national emission inventory due to maintaining compliance with datasets taken from international statistics.
16.2.6 LHDI

LHDI (Local Human Development Index) is an indicator elaborated by Polish Ministry of Infrastructure and Development [3]. Construction of factor is based on three dimensions of human development: wealth, education and health. As a result the $0 \leq LHDI \leq 100$ is geometric mean of sub factor describing particular dimension, as:

$$LHDI = (F_W \times F_E \times F_H)^{1/3}$$ (16.5)

where: $F_W$ - „wealth” sub factor, considers incomes of inhabiting taxpayers and social benefits (social assistance and family policy);
$F_E$ - „education” sub factor, basing on information about percentage of children attending preschool education also results of primary education exam (mathematical part) related to annual average;
$F_H$ - „health” sub factor, similarly considers 2 components: life expectancy of an infant and number of deaths from cancers and (separately) cardiovascular failure (related to 100 thousands of people).

16.2.7 Spatial autocorrelation models

To investigate spatial emission patterns of SO$_2$ PM$_{2.5}$ also the LHDI we used local Moran statistics was used [13]. This statistics is widely use due to its effectiveness and simplicity. Moran lets analyse if particular region is surrounded by similar or distinguishing values in neighboring regions. This statistics can be also used for detections of hot-spots (separated cluster of outlying values) or local clusters Kopczewska. Local Moran is given below:

$$I_i = \left( (x_i - \bar{x}) \sum_{i=1}^{n} w_{ij} (x_j - \bar{x}) \right) \left( \sum_{i=1}^{n} \frac{(x_i - \bar{x})^2}{n} \right)$$ (16.6)

Parameters of Moran are: $s^2 = \frac{1}{n} \sum_{i=1}^{n} (x_i - x^\star)$ and $x^\star = \frac{1}{n} \sum_{i=1}^{n} x_i$. For purposes of presented analysis matrix assumed as matrix of 6 nearest neighbors as was suggested by Dong and Liang [5].

16.3 RESULTS AND DISCUSSION

For each district, the total floor space of buildings in particular age class was estimated as product of average floor space (per capita) and number of residents (due to building in particular age), data derived from 2011 Census of Population and Housing [15]. That operation let derive general age structure of floor area in each district. According to analysis carried out by Hławiczka et al. [9], the age structure of floor space was adjusted to particular heat demand class. The way of analysis is presented in Fig. 16.1.

$d.b. \text{ district} \uparrow d.b. \text{ age class and district} \uparrow$

average floor space $\times$ number of residents $\rightarrow$ floor area $\downarrow$

$d.b. \text{ age class and district}$

$d.b.$ – disaggregated by

Fig. 16.1 Age structure of buildings: analysis scheme

Source: Own elaboration
Basing on obtained data for 8 age classes (see: 16.2.2), the floor area in each age class was corrected, so heat demand structure was compliant with analysis [9]. Results are presented in Tab. 16.1. Basing on methodology derived from [14], for purposes for this analysis assumed the average efficiency of individual boilers and stoves as 50%. This assumption was necessary due to keeping compliance with international balance.

**Tab. 16.1 Structure of heat demand disaggregated by province**

<table>
<thead>
<tr>
<th>Heat demand class</th>
<th>Hlawiczka et al. [9]</th>
<th>This paper</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[%]</td>
<td>[%]</td>
</tr>
<tr>
<td>Lower Silesia</td>
<td>33</td>
<td>19</td>
</tr>
<tr>
<td>Opole</td>
<td>45</td>
<td>16</td>
</tr>
<tr>
<td>Silesia</td>
<td>41</td>
<td>40</td>
</tr>
</tbody>
</table>

Source: Own elaboration

Emissions of SO$_2$ and PM$_{2.5}$ in each province were calculated using top-down methodology derived from official emission estimation [14] applying factors taken from [17]. Disaggregated emissions basing on methodology introduced above are shown in Fig. 16.2. Comparing presented figures can be notice facts that lower values in case of SO$_2$ and PM$_{2.5}$ emissions corresponded to the locations with higher values of local human development index. This fact can be explained by occurrences of highly developed areas (cities with usually better socioeconomic conditions). Further analysis of scatterplots did not provided premises on significant correlation between these variables. According to a fact that variables SO$_2$ vs. LHDI and PM$_{2.5}$ vs. LHDI are not tend to be correlated (Pearson’s correlation coefficients: 0.023 and −0.097, respectively), the hypothesis is that LHDI indicator could be used as spatial surrogate for SO$_2$ and PM$_{2.5}$ emissions [12].

**Fig. 16.2 Spatial distributions of SO$_2$, PM$_{2.5}$ emissions [t] and LHDI [dimensionless]**

Source: Own elaboration

For analysis of local Moran statistics $I_s$, the 6 nearest neighbours distance binary matrix was chosen. The 6 nearest neighbours distance matrix (between districts) is shown in Fig. 16.3.
For purposes of further analysis prepared Moran scatterplots (see Fig. 16.4, pseudo significance level 0.05). Preliminary analysis suggested insufficiency of Moran statistics in majority of cases. The disaggregated emissions of SO\(_2\) and PM\(_{2.5}\) were tend to be located randomly, which is commonly known as the checkerboard effect occurrence [23]. However the emissions were not spatially correlated, the majority of SO\(_2\) scatterplot points are focused in „Low-low” sector. This fact suggested occurrence of Low values surrounded by low values with significantly strong influence of outliers. In contrast, in the scatterplots of PM\(_{2.5}\) emission and LHDI were not visible such as clear pattern. That suggested bigger effect of randomness.

![Fig. 16.3 K nearest neighbours for k=6 (districts located in analysed provinces)](source)

Source: Own elaboration

Maps presenting Moran statistics are shown below. Analysis of local Moran statistic maps confirmed big extent of Moran insignificance (\(I_i \approx 0\), pseudo significance level 0.05). Possible clusters are presented in Fig. 16.5.

![Fig. 16.4 Moran plots of SO\(_2\), PM\(_{2.5}\) emissions [t] and LHDI](source)

Source: Own elaboration
CONCLUSIONS

Our analysis presented in this paper applied new approach to spatial disaggregation of emission values derived from top-down analysis. Analysis using approach elaborated by Hlawiczka et al. [9] generated spatially random of values. Significance was checked using local Moran statistics with pseudo significance level 0.05. Statistics was tested using Monte-Carlo simulation Kopczewska.

The result of analysis could be interpreted as lack of clear spatial dependencies between sub regions (checkerboard effect), which means nearly random location of designated emissions (designation to each sub region its own unique disaggregation factor). We found that LHDI could be good disaggregation factor for emissions from small domestic combustion sources.

REFERENCES


DISAGGREGATION OF SO$_2$ AND PM$_{2.5}$ EMISSIONS FROM SMALL DOMESTIC COMBUSTION SOURCES LOCATED IN SOUTHWESTERN POLISH PROVINCES – CASE STUDY

Abstract: The aim of this study is to present disaggregation for SO$_2$ and PM$_{2.5}$ emissions from small domestic sources. As suggested by Dong and Liang [5], the problem is to analyse air emission from scattered sources (households). Data submitted for Poland [14] indicate that small domestic boilers are one of main sources of air pollutant emission. Their shares in 2013 national total were about 34% for SO$_2$ and 51% for PM$_{2.5}$ respectively. Results from [21] underline the significance of that source. Moreover, the current analysis found connection between small domestic combustion and air quality worsening in local scale. Despite the fact, solid fuels will remain the main energy resource in the near future [22]. To carry out presented analysis, we used emission data submitted for international purposes [14] and selected statistics published by the Central Statistical Office of Poland [15, 16]. Selected data were derived also from study carried out by Hławiczka et al. [9] for Polish-Czech Republic border region.

Key words: emission, SO$_2$, PM$_{2.5}$, spatial statistics, small domestic combustion

DEZAGREGACJA EMISJI SO$_2$ ORAZ PM$_{2.5}$ Z GOSPODARSTW DOMOWYCH POŁOŻONYCH W POŁUDNIOWO-ZACHODNIEJ POLSCE: STUDIUM PRZYPADKU


Słowa kluczowe: emisja, SO$_2$, PM$_{2.5}$, statystyka przestrzenna, gospodarstwa domowe

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