

The Role of Packaging Supply Chain in Food Packaging Safety Assurance

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The article is devoted to the issue of maintaining food packaging safety across its supply chain. It is essential to assure the safety of packaging, which is possible only by implementation and maintenance of specific safety assurance systems and standards used in the food industry. Food packaging enterprises are obliged to carry out activities and provide appropriate conditions to assure the safety of packaging materials and packaging intended to come into contact with foodstuffs. The article presents the results of research, conducted among packaging supply chain enterprises, on the level of compliance with the requirements.

Keywords: packaging supply chain, food packaging safety, safety assurance in supply chain.

1. INTRODUCTION

Physical flow of food packaging materials and packaging is realized in supply chain, in which main stakeholders are: suppliers and converters delivering packaging materials or packaging, fillers or users, sellers, consumers and end-of-life managers¹. All of them are obliged by legal regulation. In order to protect human health and life there were established special legal regulations and other requirements concerning assurance of food packaging safety.

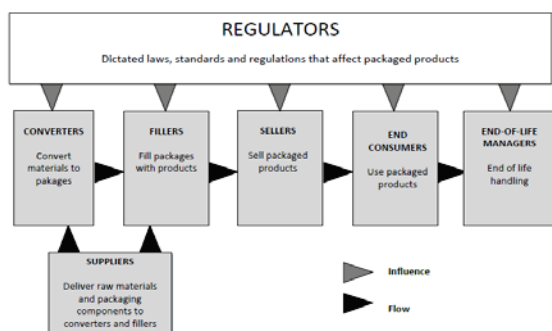


Fig. 1. Packaging supply chain stakeholders

Source: Bix L., et al 2009.

Lisińska-Kuśnierz and Kawecka proposed food packaging attributes: technical - concerning packaging materials and primary packaging, technical - concerning secondary packaging and attached documentation, system - concerning conditions of hazard minimization, their execution is purposeful only in whole supply chain².

The main goal of presented research was to survey packaging supply chain enterprises about level of compliance with requirements stated by European legal acts and other conditions assuring packaging safety. The research was conducted among 150 enterprises from packaging industry (producers and distributors of packaging materials and packaging), and from food industry (food and beverages production, gastronomy and retail), performing on the territory of Poland.

¹ Bix L., de la Fuente J., Sundar R. P., Lockhart H., [2009], *Packaging Design and Development*, [in:] The Wiley Encyclopedia of Packaging Technology, ed. K. Yam, 3rd ed., J. Wiley and Sons, Danvers.

² Lisińska-Kuśnierz M., Kawecka A. [2012], Attributes of food packaging safety, [in:] Selected aspects of food quality ed. by Jerzy Żuchowski, Ryszard Zieliński, Wydawnictwo Naukowe Instytutu Technologii Eksploatacji – PIB, Radom.

2. LEGAL REQUIREMENTS CONCERNING FOOD PACKAGING SUPPLY CHAIN

The legal act regulating requirements which should be met by food packaging and their operators is Regulation (EC) No 1935/2004 of the European Parliament and of the Council of 27 October 2004 on materials and articles intended to come into contact with food and repealing Directives 80/590/EEC and 89/109/EEC. The fundamental condition to use packaging into contact with foodstuffs is that packaging must be sufficiently inert to preclude substances from being transferred to food in quantities large enough to endanger human health or to bring about an unacceptable change in the composition of the food or a deterioration in its organoleptic properties.

This fundamental requirement is realised by implementation and maintenance of Good Manufacturing Practice (GMP) by food packaging operators³. GMP means “those aspects of quality assurance which ensure that materials and articles are consistently produced and controlled to ensure conformity with the rules applicable to them and with the quality standards appropriate to their intended use by not endangering human health or causing an unacceptable change in the composition of the food or causing a deterioration in the organoleptic characteristics thereof⁴”. In accordance with Regulation (EC) 1935/2004 and Commission Regulation (EC) No 2023/2006 of 22 December 2006 on good manufacturing practice for materials and articles intended to come into contact with food, it is only possible to produce food packaging materials and packaging in accordance with Good Manufacturing Practices principles.

Regulation (EC) No 1935/2004 also determines necessary labelling which should be attached to food contact materials, regulates

obligatory documentation in food contact materials trade, sets down the compulsory regulation concerning traceability of materials flow in supply chain⁵. Basic document which confirms utility of packaging materials to come into contact with foodstuffs is a declaration of compliance.

Materials and articles intended to come into contact with foodstuffs must be appropriately identified among others present on the market. That causes a need for labelling⁶. Obligatory labelling should include such information as⁷:

- the words „for food contact”, a specific indication as to their use, or the symbol,
- if necessary, special instructions to be observed for safe and appropriate use,
- the name or trade name and, in either case, the address or registered office of the manufacturer, processor, or seller responsible for placing on the market established within the European Union,
- adequate labelling or identification to ensure traceability of the material or article.

One of the most important requirements is the traceability of food packaging materials and packaging. The materials and articles which are placed on the common market shall be identifiable by an appropriate system, which allows their traceability, by means of labelling or relevant documentation or information. Regarding technological feasibility, business operators shall have in place systems and procedures to allow identification of the businesses from which and to which materials or articles, where appropriate, substances or products covered by this Regulation and its implementing measures used in their manufacture are supplied. The traceability of materials should be ensured at all stages in order to facilitate control, the recall of defective products,

³ Lisińska-Kuśnierz M., Kawecka A., Attitude of food packaging supply chain stakeholders toward packaging safety, [in:] *Current Trends in Commodity Science. Packaging and Product Quality*, edited by Henryk Szymusiak, Natalia Czaja-Jagielska, *Zeszyty Naukowe* nr 217, Wydawnictwo Uniwersytetu Ekonomicznego w Poznaniu, Poznań 2011.

⁴ Commission Regulation (EC) No 2023/2006 of 22 December 2006 on good manufacturing practice for materials and articles intended to come into contact with food, *Official Journal of the European Union* L 384/75.

⁵ Pogorzelska Z. [2013], *Bezpieczeństwo zdrowotne materiałów i wyrobów przeznaczonych do kontaktu z żywnością w świetle aktualnych przepisów, "Opakowanie"*, nr 4.

⁶ Lisińska – Kuśnierz M., Ucherek M. [2006], *Opakowania w ochronie konsumenta*, Wydawnictwo AE w Krakowie.

⁷ Regulation (EC) No 1935/2004 of the European Parliament and of the Council of 27 October 2004 on materials and articles intended to come into contact with food and repealing Directives 80/590/EEC and 89/109/EEC, *Official Journal of the European Union* L 338/4.

consumer information and the attribution of responsibility⁸.

3. ACTIVITIES INFLUENCING FOOD PACKAGING SAFETY ASSURANCE

Enterprises from food packaging supply chain are obliged by European legal acts, so their activity must assure special, required conditions in food packaging turn over. Most of the activities concern maintaining GMP guidelines or quality management systems requirements^{9,10}. Results of research concerning execution of these activities are presented in table 1.

Among frequently realized activities in food packaging supply chain companies respondents indicated hygiene maintenance in production, storage and means of transport areas. Though it is condition imposed by Good Hygiene Practice which is not obligatory for packaging materials and packaging producers and distributors, this activity is indicated rather frequently. Important activity among respondents is also legal requirement concerning adequate documentation evidencing compliance of materials intended to come into contact with foodstuffs. As often realized it is also mentioned having special procedures or instructions about processes of materials manufacture or sale, storing procedures and systemic requirements like evaluation of suppliers, complaints reviewing and ensuring high level of staff. It is important to notice that majority of examined companies have realized at least some of the most important activities to assure food packaging safety.

Conducted research revealed also that only 31% of packaging material and packaging producers demanded declaration of conformity from their suppliers. Much higher share of investigated companies which were distributors of this kind of food contact materials required these documents from suppliers. The share was equal 63% of all surveyed companies. From food industry in average 72% of them demanded

declaration of compliance. Such low share of companies which requested basic documentation stating the safety of present on Polish market food contact packaging materials and packages was very disturbing.

Assuring food packaging safety due to legal acts requires Good Manufacturing Practice enforcement at every stage of food packaging supply chain. That means that every food packaging operator including packaging production and distribution should implement and maintain GMP guidelines¹¹.

⁸ The Rapid Alerts System of Food and Feed Annual Report 2003, Office for Official Publications of the European Communities, Luxembourg, 2004.

⁹ Guidelines for Good Manufacturing Practice for Plastic Materials and Articles Intended for Food Contact Applications [2008], Plastic Europe, Cefic-FCA, EuPC.

¹⁰ Good Manufacturing Practice for the Manufacture of Paper and Board for Food Contact [2010], CEPI, Brussels.

¹¹ Global Standard BRC/IOP for Packaging and Packaging Materials [2008], Issue 3, British Retail Consortium, London.

Table 1. Activities influencing safety assurances of food packaging materials and packaging in enterprises

Activities inside enterprises influencing food packaging materials and packaging safety assurances	Packaging materials and packaging producers		Packaging materials and packaging distributors		Packaging materials and packaging users	
	Indications (%)	Rank	Indications (%)	Rank	Indications (%)	Rank
Hygiene maintenance in production, storage rooms and means of transport	94,9	1	72,7	4	97,0	1
Requiring from suppliers of raw materials for the production of packaging materials and packaging materials and finished packaging materials and packaging evidence of their compliance with legal requirements	92,3	2	90,9	2	88,0	2
Periodic evaluation of suppliers	92,3	2	63,6	5	67,0	8
Having detailed manufacture or sale procedures / instructions of packaging materials and packaging	89,7	3	81,8	3	-	-
Ensuring a high level of awareness of the staff responsible for the selection of suppliers and raw materials for the production of packaging materials and packaging	87,2	4	72,7	4	88,0	2
Periodic complaints reviewing	84,6	5	63,6	5	62,0	9
Having the exact procedures / manuals for the packaging process of packaging materials	84,6	5	63,6	5	79,0	4
Having detailed storage procedures / instructions of packaging materials and packaging	82,1	6	100,0	1	79,0	4
Periodic evaluation of incoming raw materials for the production of packaging materials, packaging and finished packaging materials and packaging such as outsourced or managed within the company laboratory	79,5	7	54,5	6	78,0	5
Conducting a systematic review and analysis of the threats to the safety of packaging materials and packaging	76,9	8	72,7	4	67,0	8
Ensuring a high level of awareness of the staff responsible for packaging materials and packaging handling	74,4	9	54,5	6	74,0	6
Ensuring proper handling of packaging materials and packaging	66,7	10	36,4	7	69,0	7
Monitoring of storage conditions (temperature and humidity records)	53,8	11	54,5	6	80,0	3

Source: Own elaboration.

Besides GMP other formal quality management systems are preferable for food packaging safety assurance such as ISO 22000 and ISO 9001 and also Hazard Analysis and Critical Control Point system which is widespread in food industry¹².

There are also standards dedicated to packaging industry like BRC/IoP. In research the number of enterprises with implemented safety and quality assurance and management systems was analyzed, outcome is presented in table 2.

¹² Sikora T., Nowicki P. [2008], Obligatory and Non-obligatory Quality and Food Safety Management System in United Europe, „Towaroznawcze Problemy Jakości” („Polish Journal of Commodity Science”), no 4(17).

Table 2. Share of enterprises with implemented safety and quality assurance or management standards and systems.

Standards and systems	Packaging materials and packaging producers [%]	Packaging materials and packaging distributors [%]	Packaging materials and packaging users [%]
GMP/GHP	74,4	27,3	74,0
HACCP	59,0	18,2	79,0
ISO 9000	48,7	18,2	28,0
ISO 22000	10,3	18,2	13,0
BRC or BRC/IoP	7,7	0,0	18,0
Lack of implemented systems	10,3	45,5	10,0

Interpretation: % of indication does not sum up to 100% because of possible indication more than one implemented system or standard in enterprise.

Source: Own elaboration

Due to legal requirements in enterprises providing packaging materials and packaging, it is obligatory to implement and maintain Good Manufacture Practice. However, companies of food industry (food producers, distributors, gastronomy) are obliged to implement and maintain Good Manufacture Practice, Good Hygiene Practice and Hazard Analysis and Critical Control Point system. Having the obtained results analyzed it might be clearly stated that companies did not meet basic legal requirements. Among packaging materials and packaging producers almost 25% of them did not implement GMP. The level of GMP implementation was even worse in distribution companies where 75% of them did not implement it. Also the packaging users did not fulfil legal requirement concerning obligatory implementation of GMP/GHP and HACCP system. 74% of these enterprises implemented GMP/GHP and 79% of them implemented HACCP. It is interesting that more enterprises declared that had implemented HACCP because realization of GHP/GMP is a basic step in HACCP implementation. That situation shows lacks of knowledge and incomprehension for safety systems concept.

4. PACAKGING SUPPLY CHAIN REPRESENTATIVES AWARENESS AND ITS INFLUENCE ON ACTIVITIES ASSURING FOOD PACKAGING SAFETY

Respondents evaluated the importance of packaging features, safety assurance activities, hazards categories, they were also declaring which activities ensuring food packaging safety were used in their companies. The statistical analysis of dependence between selected elements importance and activities realization was conducted. Results of independent variables were tested with χ^2 test, the value p less than 0,05 indicates that the variables are dependent on each other. Obtained effects are presented in table 3.

Table 3. Dependence analysis between importance evaluation of selected elements influencing packaging materials and packaging safety and its application in the surveyed enterprises

Elements influencing food packaging materials and packaging safety	% of respondents realizing selected activities in dependence of its importance evaluation (in points)						P value
	0	1	2	3	4	5	
Importance of traceability of materials and articles in whole supply chain	0	1	2	3	4	5	0,004
Declaration of compliance requirement from suppliers	0,00	1,89	1,89	11,32	49,06	35,85	
Importance of communication enable to unsafe product from market recalling	0	1	2	3	4	5	0,027
Declaration of compliance requirement from suppliers	0,00	0,00	0,00	2,86	40,00	57,14	
Importance of documentation confirming compliance of packaging materials with legal requirements delivery	0	1	2	3	4	5	0,008
Requirement from suppliers of documentation confirming compliance of packaging materials with legal requirements	0,00	0,75	3,01	15,79	50,38	30,08	
Importance of periodical evaluation of suppliers	0	1	2	3	4	5	0,020
Realization of periodical suppliers' evaluation	0,00	0,92	7,34	22,94	44,95	23,85	
Importance of periodic quality assessment of delivered materials	0	1	2	3	4	5	0,001
Realization of periodic evaluation of delivered raw materials and finished packaging materials	0,87	2,61	0,87	18,26	44,35	33,04	
Importance of compliance with the procedures / manuals for manufacturing process	0	1	2	3	4	5	0,081
Having detailed manufacture or sale procedures/ instructions	0,00	0,00	2,27	13,64	36,36	47,73	
Importance of compliance with storage procedures / instructions of packaging materials and packaging	0	1	2	3	4	5	0,048
Having detailed packaging materials and packaging storage procedures/ instructions	0,00	0,83	1,65	16,53	48,76	32,23	
Importance of packaging surfaces microbiology cleanness	0	1	2	3	4	5	0,964
Keeping in production, storage and transport	0,00	0,71	2,14	2,86	28,57	65,71	
Importance of high level of awareness of the staff responsible for the selection of packaging materials and packaging	0	1	2	3	4	5	0,000
Ensuring a high level of awareness of the staff responsible for the selection of packaging materials and packaging	0,00	0,00	1,54	5,38	56,15	36,92	

Source: Own elaboration.

Conducted statistical analysis of dependence between importance evaluation of selected elements, activities and realization of chosen activities in enterprises revealed that in most cases the highest rating on survey, the highest possibility that activity was realized in company. This situation was noticeable in relation between importance of traceability of materials and articles in whole supply chain, importance of communication enable to unsafe product from market recalling and declaration of compliance requirement from suppliers. There was also noticeable relationship between importance of documentation confirming compliance of packaging materials with legal requirements delivery and requirement from suppliers of

documentation confirming compliance of packaging materials with legal requirements and dependence between importance of periodical evaluation of suppliers and realization of periodical suppliers' evaluation. It was evident that evaluation of periodic quality assessment of delivered materials importance, the most likely company is realizing. Activities concerning requirements of quality management or assurance systems like having detailed packaging materials and packaging storage procedures/ instructions, ensuring a high level of awareness of the staff responsible for the selection of packaging materials and packaging or periodic evaluation of delivered raw materials and finished packaging materials. There were no relationship (variables were

independent) between having detailed manufacture or sale procedures/ instructions and importance of compliance with the procedures / manuals for manufacturing process, also between keeping in production, storage and transport and importance of packaging surfaces microbiology cleanness

5. INFLUENCE OF MARKET PARTICIPANTS ON FOOD PACKAGING MATERIALS AND PACKAGING SAFETY

Respondents from all surveyed groups were agreeable. By the stakeholders with the biggest influence were admitted producers of

6. SUMMARY

The role played by packaging supply chain stakeholders is essential to assure food packaging safety. Without a doubt the most influential role is played by producers of packaging materials and packaging, but one cannot skip the importance of other supply chain stakeholders. Only realization of defined activities in whole supply chain may give satisfactory effect. Research has proven that very important in safety assurance is awareness of hazards. The higher the level of knowledge represented by respondents the more likely that enterprise was to carry out the tasks resulting from maintenance of safety systems. Raising awareness

Table 4. Influence of packaging supply chain subjects on packaging materials and packaging safety in respondents' evaluation.

Influence of packaging supply chain	Packaging materials and packaging producers		Packaging materials and packaging distributors		Packaging materials and packaging users	
	Average ratings (in points)	Rank	Average ratings (in points)	Rank	Average ratings (in points)	Rank
Packaging materials and packaging producers	4,42	1	4,64	1	4,53	1
Packaging materials and packaging users	4,00	2	4,27	2	3,92	2
Packaging materials and packaging distributors	3,63	3	3,91	3	3,42	3

Source: Own elaboration.

packaging materials and packaging. The manufacturers were noticeable as the stakeholders with the biggest responsibility due to the strongest influence on packaging materials and packaging composition, structure and properties. In manufacturing process most of the properties are shaped and the role of the rest of supply chain stakeholders was seen as less responsible. However, there was one function of packaging users underlined as important in supply chain, this was the role of packaging adjuster. These enterprises were responsible for selecting optimal packaging to packaged food products. This was the reason why they were indicated on the second position in the resulting ranking. As the group with the smallest influence were indicated distributors. Their role was defined only as the function of maintenance of manufactured products quality. This was very passive attitude to the role of packaging materials distributors, for respondents there was no added value on this stage of supply chain.

is important especially because of the failure to comply with the legal requirements for a very large part of surveyed companies. It is essential to ensure high level of awareness among entrepreneurs, that will have a direct impact on the present market of food packaging safety.

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