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Safety Management of Textile Products in the European Union and Estimation of its Efficiency. Part 1

DOI: 10.5604/01.3001.0013.7307

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Abstract
Textiles and clothing belong to the most frequently reported category of products in the European market posing a serious risk to consumer health. To find out the reasons of this problem, an analysis of RAPEX system data covering 15 years of its operation was carried out. The purpose of this analysis was to identify the sources of dangerous products and the main threats posed by them. The problem is discussed in the two parts of the paper. In the first the authors paid attention to changes in legal requirements introduced not only within but also beyond the EU market, and analysed such variables as the activity of European countries in detecting hazards and countries of origin of dangerous products. In the second part, the authors characterised the main threats posed by textiles and analysed notifications, mainly in terms of the nature of the risk.

Key words: *consumer protection, textile safety, clothing, dangerous products, RAPEX.*

Introduction

The textile and clothing (T&C) industry plays an important role in the global economy. Exceeding a value of $1,5 billion, it is responsible for about 2% of GDP [1]. The consumption of textiles, mainly clothing, is steadily increasing. In 2015 it amounted to 62 million tons in the world, and it is estimated that by 2030 it will have increased by 63% to 102 million tons [2]. In the European Union the average consumption of these products is estimated at 9 500 thousand tons/year or 19.1 kg/EU citizen, of which about 70% are clothes, mostly tops, underwear, nightwear and bottoms [3]. World leaders in the export of T&C goods are China, the European Union (EU28), India, USA and Turkey. The European Union, which represents a turnover of €178 billion [4] and ranks second place among textile and clothing exporters, is at the same time the biggest importer of this group of products, ahead of China and the USA [5]. According to The European Apparel and Textile Confederation EURATEX [4], the value of T&C export of the European Union (EU28) in 2018 amounted to €50,0 billion. Their main customers were Switzerland, the USA, Russia, China, and Hong Kong. On the other hand, the EU imported T&C products worth almost €114.8 billion, mainly from China, Bangladesh, Turkey, India, and Cambodia.

The steadily increasing production and diversification of the import and export of clothing and textiles, the intensification of outsourcing practices connected with moving garment manufacturers from developed to developing countries, and the progressively rising global demand for T&C cause many problems related to the quality and safety of these products. The European Union market gets a lot of poor quality and cheap products, and, which is even worse, products that pose a serious risk for their users. Despite the implementation of legal and other requirements responsible for ensuring product safety, as well as the efforts of scientists in creating models of the risk assessment of T&C product safety or safe apparel design systems [6], dangerous products still occur on the market.

In the EU market, "clothing, textiles and fashion items" are the third most frequently notified category of products posing a risk to the health and safety of consumers, behind toys and motor vehicles (***Figure 1***). One can observe it by tracking the notifications of dangerous products in the European Union Rapid Information System RAPEX, established under Art. 12 of the Directive 2001/95/EC (GPSD) [7]. This system facilitates the rapid exchange of information between national authorities and the European Commission on dangerous products found on the market. The overarching goal of introducing it was preventing and limiting the sale and use of non-food products that present a serious risk to the health and safety of consumers.

Data contained in this database are published from 2004 in the form of weekly and annual reports [8] and are an important source of information not only for market surveillance authorities but also for consumers, distributors and manufacturers. They also create an interesting set of empirical data for performing scientific research presented in different publications focused on general problems related to non-food products [9] or more detailed ones applied to specific problems, such as the microbiological risks posed by these products [10] or to a specific product category, such as personal care products [11], cosmetics [12-14], or leather goods [15]. When analysing subject literature related to the safety of non-food products, it is difficult to find a compilation containing a thorough analysis of information on textile and apparel product safety.

The purpose of this study was to perform a synthetic review of legal regulations regarding safety requirements for clothing and textile products in terms of the changes in requirements introduced not only within but also beyond the EU market, and to present a detailed analysis of the RAPEX alert system database. It has been assumed that analysis of the data covering the 15 years of this system's operation will allow us to identify the most common hazards posed by T&C products and the origin of products representing a serious risk in the aspect of the safety management of these products in the EU market, and to indicate directions of activities aimed at safety improvement for this product group. The analysis is presented in the two parts of the paper. In the first, the authors discuss such variables as the activity of European countries in detecting hazards and the country of origin

Salerno-Kochan R, Kowalski M. Safety Management of Textile Products in the European Union and Estimation of its Efficiency. Part 1.
FIBRES & TEXTILES in Eastern Europe 2020; 28, 2(140): 8-14. **DOI:** 10.5604/01.3001.0013.7307

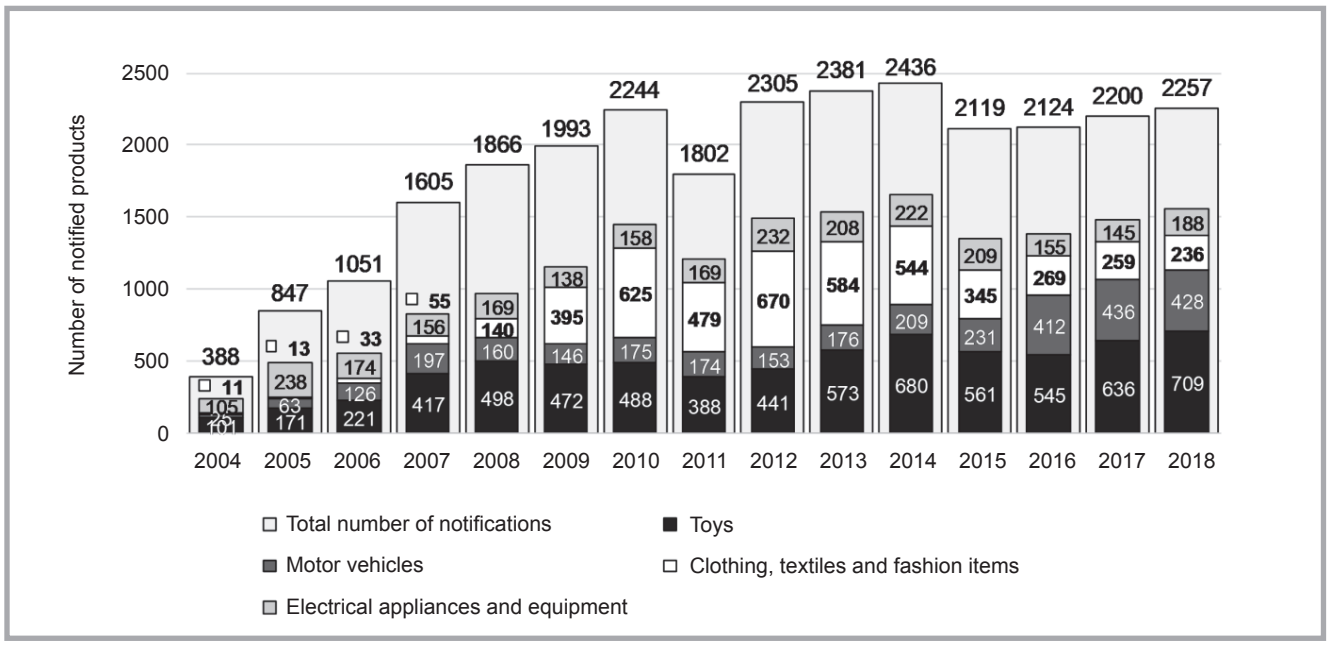

Figure 1. *Most dangerous non-food products in EU Market in 2004-2018.*

of dangerous products, while the second part highlights the main threats posed by textiles in terms of the nature of risk.

Safety requirements for textile and apparel products

Products placed on the European Single Market have to meet special requirements for the protection of consumers against any harm to their health. In this regard the EU pursues a special policy of product safety management that manifests itself by adopting specific legal regulations, appointing and stimulating market surveillance authorities, as well as by implementing market monitoring systems and information exchange between member states. Depending on the type of product, requirements that must be fulfilled are more or less specific. It should also be noted that from the date of their implementation, they have been subjected to multiple changes that affected the scope of investigations carried out.

The most important legal act stipulating general product safety requirements is Directive 2001/95/EC, regarding general product safety (GPSD), which entered into force in 1992 and was amended in 2001 [7]. An important element in this directive is the list of voluntary European harmonised standards. If a manufacturer opts to use these standards, the product is considered "safe" and in compliance with the directive. In relation to clothing, the standard EN 14682 [16], defining requirements related to cords & drawstrings on children's clothing, was developed in 2004, and harmonised with Directive GPSD in 2006. The aim of introducing these requirements was to minimise children's risk of injury or strangulation when using products due to incidental cord or drawstring tugging or hooking in children's clothes. Another standard applied in assessing children's product safety, which entered into force in 2011, is EN-71-1: Safety of toys. Mechanical and physical properties [17], harmonised with Directive 2009/48/EC [18]. It contains detailed guidelines for assessing hazards posed by using small decorative objects in children's products that may cause a risk of asphyxiation or suffocation.

Requirements which are the basis for chemical hazard assessment are specified in Regulation No. 1907/2006 (REACH), adopted by the European Parliament in 2006 and entering into force in 2007 [19]. This regulation imposes restrictions on manufactures in relation to the use of dangerous substances, mixtures and goods. It contains, among other things, a list of substances prohibited and those allowed to be used in textile manufacturing [19-20]. It should be noted that the requirements set out in this regulation are constantly updated. Recent changes, dated October 10, 2018, relate to certain substances classified as carcinogenic, mutagenic or toxic for reproduction (CMR), category 1A or 1B. In accordance with *Commission Regulation (EU) 2018/1513* [21] *amending Annex XVII to Regulation (EC) No 1907/2006 (REACH),* from 1 November 2020, for clothing and textile products that under typical use or predictable conditions of use come into contact with human skin, the permissible formaldehyde concentration limit will be 75 mg/kg. By way of derogation from this requirement, for such products as jackets, coats and furniture upholstery in the period from 1 November 2020 to 1 November 2023, the permissible formaldehyde concentration will be 300 mg/kg. After this period a limit of 75 mg/kg will be applicable. It should be emphasised that after withdrawing national laws regulating the rules of marking and safety assessment of textile products in 2012, there have been no limitations on using formaldehyde in textile and apparel products. It should be added that Commission Regulation (EU) 2018/1513 also implements the maximum concentration limits by weight in homogeneous materials for chromium(VI), cadmium, arsenic and lead compounds in clothing and textile products at a level of $\leq$ 1 mg/kg, expressed as a clear metal that can be extracted from the material [21]. So far, limits on these metals and their compounds have not been considered in legal requirements for this product group (only, for example, when using these metals in manufacturing certain polymers, jewellery, paints or in wood preservation products), and at most in ecological requirements.

Other documents containing requirements related to the use of chemicals

is Regulation (EU) No. 528/2012 [22], concerning the making available on the market and use of biocidal products in textiles to confer them with specific properties (e.g. to repel fleas, mites and mosquitoes or to avoid allergens).

Detailed requirements for T&C product labelling and marking are specified in Regulation (EU) No. 1007/2011 of the European Parliament and of the Council (EU) of 27 September 2011, having been in force since 8 May 2012 [23]. It contains detailed requirements in regard to marking the fibre composition in textiles and plays also an important role in terms of ensuring the safety of these products. An improperly labelled composition may mislead the consumer and cause allergies, for example, to a specific kind of fibre [24]. It should be noted that until this regulation was introduced, national regulation had been in force. It contained detailed requirements not only for proper labelling and marking but also for textile product safety, laying down criteria to be met by the manufacturers of textile products, and guidelines for market surveillance units for assessing product compliance to these requirements [20].

According to the GPSD, product safety shall be also assessed by taking into account such elements as voluntary national standards, Commission recommendations, product safety codes of good practice, and even reasonable consumer expectations concerning safety (Art. 3 of GPSD Directive) [7].

When analysing European Union policy in terms of product safety management, it is worth mentioning the formal cooperation between the EU and China, initiated in 2006. Bearing in mind that China is the largest exporter of textile and apparel products into the European market [1, 4-5], to minimise the number of dangerous products, the European Commission and Chinese signed government a memorandum [25] of understanding between the Commission and the Chinese Administration for Quality Supervision, Inspection and Quarantine (AQSIQ). This memorandum set up a framework for better communication and collaboration between both sides on product safety. The result of signing this document was, among other things, the start-up of the RAPEX-China system as a source of information for Chinese authorities on products considered harmful manufactured in China and the European Union with a view to eliminating such products in the future. This cooperation has also resulted in changes to the legislation on T&C safety in force in China. The first step towards ensuring the safety of textile products of Chinese origin was the voluntary standard GB 18401 National General Safety Technical Code For Textile Products, published on 27 November 2003 and effective as of Jan 1, 2005 (updated in 2010). This standard contained the principal requirements, test methods, and test rules for textile products on the Chinese market and was the benchmark for the Chinese government to monitor the quality and safety of apparel goods [26]. A definitely more important step in this area was the implementation of the first mandatory standard in 2015 – GB 31701 Safety Technical Code for Infants' and Children's Textile Products, aiming at textile products, such as clothing, bedding, towels for infants and children under 14 years [27]. This standard specifies product safety requirements and urges manufacturers to improve product safety and quality, as well as guard infants' and children's health. The provisions of this standard and coincidental, to a large extent, with requirements laid down in EN 14682 and EN 71-1, regarding the use of attached components (cords, drawings, accessories), and in addition contain requirements related to flammability, colour fastness and maximum permissible limits of lead, cadmium and phthalates. The enforcement of this mandatory standard came into effect as of July 1, 2016 [27].

Apart from implementing legal provisions pertaining to detailed requirements for product safety, the European Union also undertakes other actions aimed at improving consumer safety in its territory. It is worth mentioning Regulation (EU) 254/2014 of 25 February 2014, concerning a multiannual consumer programme for the years 2014-2020 [28]. One of its detailed goals is to reinforce and improve product safety through effective market surveillance in the whole Union. The related actions undertaken include, among other things:

- scientific advice and risk analysis in the field of consumer health and safety with respect to non-food products and services;
- developing, modernising and maintaining IT tools (such as databases, information and communication systems, including RAPEX);
- organising seminars, conferences, workshops and meetings of stakeholders and experts in risk items and law enforcement in the area of product safety;
- monitoring and assessing non-food producst and service safety (from 188.8 million EUR, being the program budget, 2.5 million EUR was assigned to support coordinated actions targeted at non-food product safety assessment) [29].

The basic tool used to measure the level of accomplishment of the goal related to improving non-food product safety is the EU rapid exchange of information system on the dangerous products (RAPEX) mentioned above. Based on data gathered in this system. the performance indicators are calculated, including the percentage of notifications that caused a reaction of at least one of the other member states and the ratio of reactions to the number of notifications (one notification may cause a number of reactions in other member states).

Analysis of clothing and textile product safety on the European market

Research object, methodology and scope

The research subject was textile and clothing products notified in the Safety Gate: the rapid alert system for dangerous non-food products [8] in the years 2004-2018 (since the set-up of the system). This database includes more than 25.000 alerts about 32 categories of products, such as chemical products, child care articles and equipment, toys, electrical appliances and equipment, cosmetics, food-imitating products, jewellery, hobby/sport equipment, motor vehicles, etc. Notifications of dangerous products come from the 28 EU countries and 3 associated countries in EFTA (Iceland, Lichtenstein, Norway). The products under consideration were selected by the elimination of notifications not related to textile products, such as leather goods, jewellery etc. from the database included in the category "*Clothing, textiles and fashion items*". Data analysis and descriptive statistics were performed with Microsoft Excel 2016. In this part of the article, the authors focused on the analysis of such variables as the activity of European countries in detecting hazards, the country of origin of dangerous products, and the types of measures adopted by notifying countries.

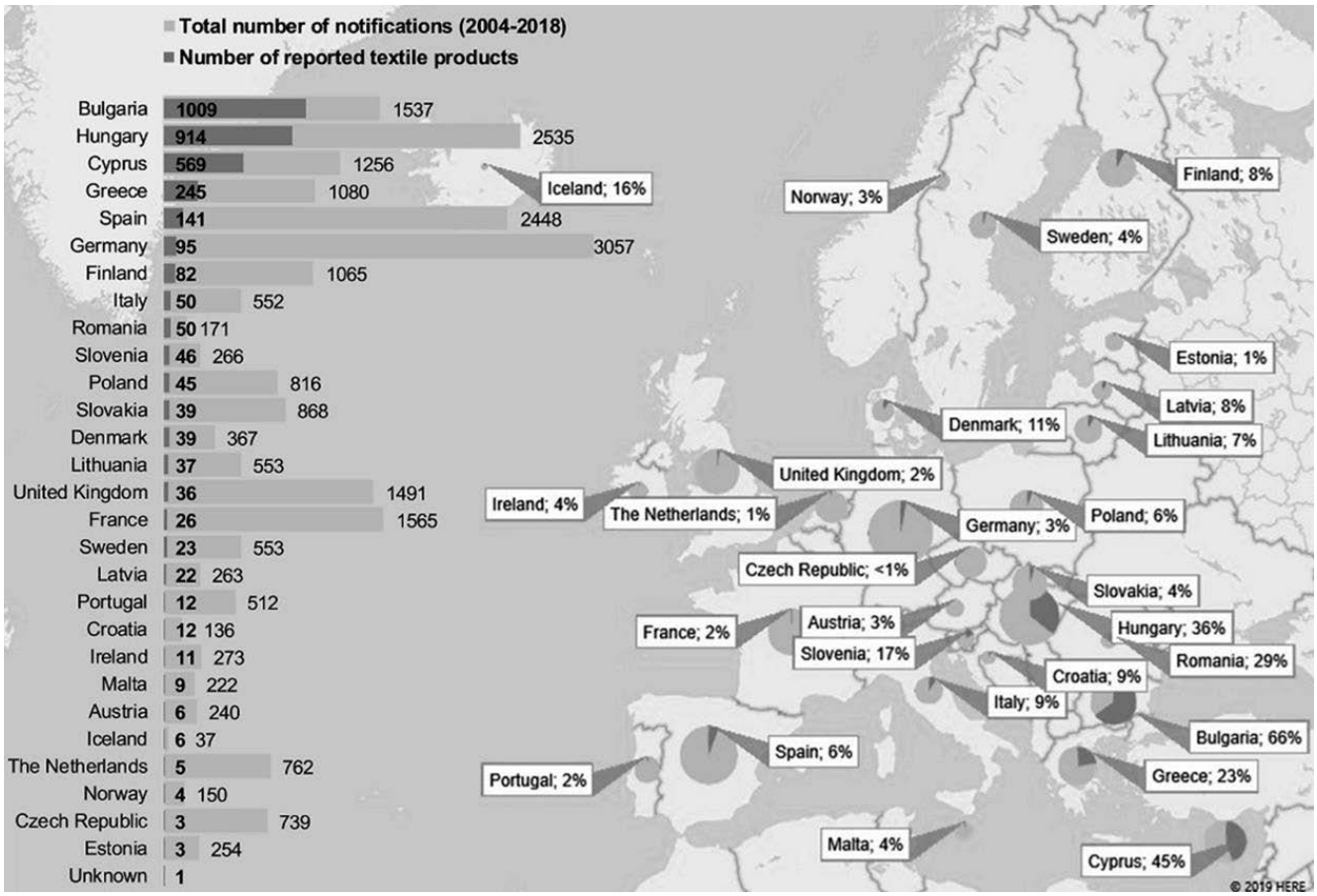

Figure 2. *Activity of countries in risk detection.*

Results and discussion

Activity of European countries in the detection of risks

4433 notifications of dangerous products in the category: "Clothing, textiles and fashion items" were recorded in the period under consideration, with almost 80% (3540 notifications) regarding textile and clothing products in four assortment groups, i.e. children's clothing and accessories (3381 notifications – 95.5% of total), women's products (3.1% notifications), men's products (0.8%), and other products (0.5%). ***Figure 2*** presents countries' activity in reporting textile products to the RAPEX system and the total number of notifications from each country. The percentage share of textile product notifications among the total number of notifications from a given country is marked on the map.

Notifications of dangerous textile and clothing products come primarily from three of the 28 countries responsible for a total of 2492 notifications, i.e. 71% of all notifications. They are in order of decreasing number: Bulgaria – 1009 notifications (29%), Hungary – 914 notifications (26%), and Cyprus – 569 notifications (16%). These countries are distinguished from other European states also in the percentage share of notifications related to textile products in the overall number of notifications coming from a specific country. For Bulgaria, this percentage was as large as 66%, and 36% and 45% for Hungary and Cyprus, respectively. Over 10% was reached by only Romania (29%), Slovenia (17%), Iceland (16%) and Denmark (11%). Beyond the first three, in terms of activity in making notifications of dangerous textile products, with the number of notifications exceeding 100, are Greece (245 notifications) and Spain (141 notifications). The sixth place is occupied by Germany, with the largest total number of notifications in all products categories – equal to 3057; but only 3% of which were related to textile products (95 notifications). Poland with 45 notifications takes eleventh position, after Finland (82 notifications), Italy and Romania (50 notifications) and Slovenia (46 notifications).

It is worth pointing out that the leaders in risk identification in textiles and their alerting in the RAPEX system stand out through notifications in the "strangulation & injuries" category, which represents 99% for Cyprus, 87% for Bulgaria, and 84% for Hungary of all notifications of these countries (***Figure 3***). These notifications result from the presence of drawstrings not allowed in children's clothing. This observation may indicate that the governments of these countries attach special attention to the safety of children's products, particularly in relation to physical hazards, which are relatively easy to detect and do not require large financial outlays for laboratory tests. Greece, which is classified fourth in this ranking, the same as for the leaders, reports the most dangerous products with hazards caused by the presence of cords and drawstrings in children's clothing, which account for 90% of all notifications of textile products from that country.

When analysing the activity of countries in risk detection, it is worth indicating Germany as standing out from the rest of the EU members in reporting chemical hazards (74 notifications), followed by Finland and Italy. These data, therefore, indicate strong activity in this area of

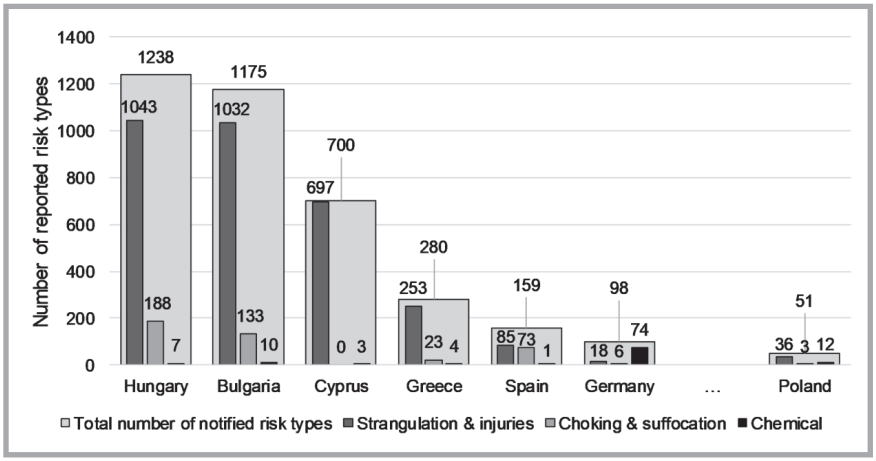

Figure 3. *Activity of selected countries for reported risk types.*

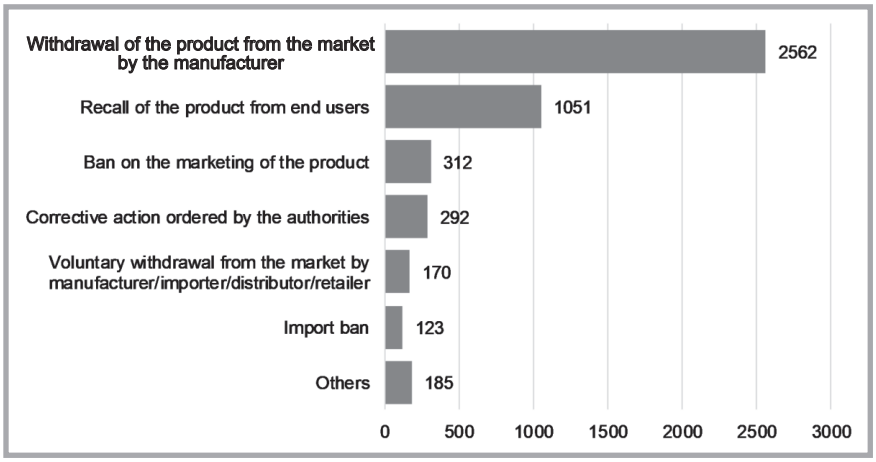

Figure 4. *Types of measures adopted by notifying countries.*

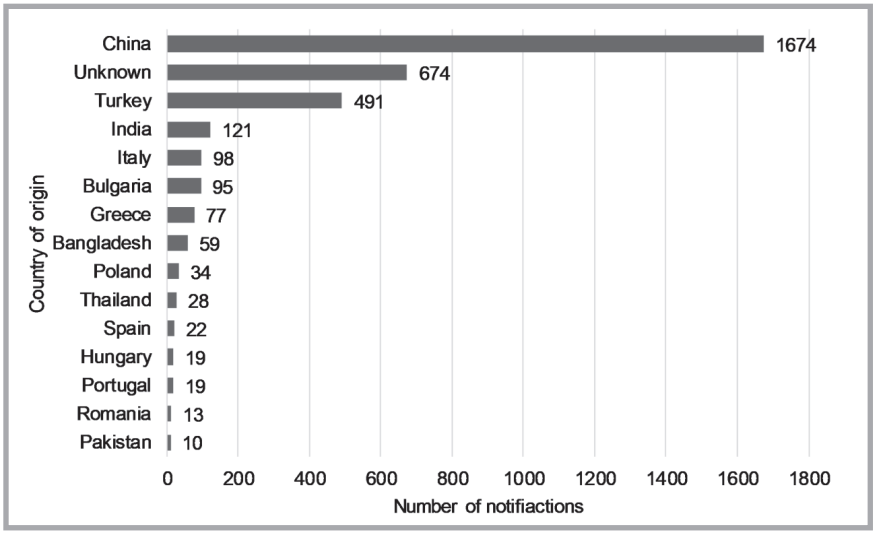

Figure 5. *Countries of origin of clothing and textile products notified in the RAPEX system.*

highly developed countries, which have bigger financial means and better research facilities required for performing laboratory tests.

Effective product safety management requires decisions aimed at the elimination of products posing a serious risk to consumers from the market. For this purpose, various corrective actions are applied. During the 2004 to 2018 period, 4695 corrective actions were taken for 3540 notifications of dangerous textile products (***Figure 4***). The indicator determining the performance of the RAPEX system, expressed by the ratio of the number of reactions to the number of notifications (one notification may cause a number of reactions in other member states), was 1.33 during that period (in 2017 the value of this indicator for all product groups was 1.15). For above 70% of notified products (n = 2562), governmental authorities ordered to withdraw them from the market, and almost 30% (n = 1051) also involved taking dangerous products from consumers. In 312 cases launching a product onto the market was forbidden, including 35 products where a conditional approval for sale was issued, if specified requirements are met and appropriate corrective actions undertaken. Necessary corrective actions, e.g. the removal of cords & drawstrings from children's clothing, were ordered for 292 products on the market. 170 products were voluntarily withdrawn from the market by responsible entities after specified non-compliances were found.

For 123 products an import ban was issued in the UE. Among other actions undertaken, the following should be noted:

- voluntary corrective actions undertaken by manufacturers, importers, distributors and retailers (82 cases);
- confiscation of dangerous products (43 cases) or an order to destroy them (22 cases);
- necessity to alert consumers of possible hazards related to the use of dangerous products (38 cases), e.g through press releases (5 cases).

Origin of dangerous products

To effectively eliminate dangerous products from the European market, it is of utmost importance to identify their origin. The countries of origin of most of the textile and clothing products considered dangerous are presented in ***Figure 5***.

Almost half of notifications (47%) are related to products coming from China. Despite such a significant disproportion to other countries, it should come as no surprise as China is both the biggest exporter and manufacturer of textile and clothing products in the world. As mentioned above, a significant part of these products is sent to European markets, where China is a leading supplier of textile and clothing products [4, 5]. Second in the number of notifications is the product group of unknown origin (19%). This is quite worrisome information and results from ambiguous EU regulations that should

Table 1. *Total number of notifications and number of reported products of China origin.*

Number of notifications	Years														
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Total (n = 3540)	11	9	29	42	120	258	531	378	556	418	412	253	156	192	175
% change	–	-18	222	45	186	115	106	-29	47	-25	-1	-39	-38	23	-9
Products from China (n = 1674)	4	3	11	16	38	123	263	171	266	215	234	120	64	69	77
% change	–	-25	267	45	138	224	114	-35	56	-19	9	-49	-47	8	12

impose an obligation on a manufacturer or importer to inform consumers about the country of origin. This is a result of the serious opposition of some EU countries to regulatory changes in this area. The third country responsible for 14% of products considered dangerous is Turkey. Like China, this country has a significant share in the worldwide export of textile and clothing products and is one of the key trade partners of the EU in textile sales. This share increases from year to year because Turkey is a very attractive manufacturing area for European corporations due to its advantageous geographical location. Among other countries not mentioned in ***Figure 5***, 31 countries of Europe, Asia, both Americas and Africa should be distinguished.

It should be noted that there is a clear relationship between notifications related to products of Chinese origin and the total number of textile and clothing products notified in particular years. It can also be clearly seen how changes in Chinese law regulations had an impact on the total number of unsafe products on the European market. Data presented in ***Table 1*** illustrate this observation.

From 2005 the total number of notifications increased every year until 2010, where one can observe a notably high number of notifications (n = 531), i.e. over 100% more compared to 2009 (n = 258) and 530% compared to the first year of reporting. In that year textiles prevailed among all dangerous products notified and represented 38% of all those notified. It is worth mentioning that a large number of notifications was perceived at that time as a positive phenomenon associated with the enhanced activity of market surveillance authorities, leading to increased detectability and elimination of hazardous products. As follows from the RAPEX report [30], 2010 was the first year of application of new guidelines for the management of RAPEX by member states and the European Commission, and this was able to contribute to a visible increase in notifications submitted. In 2011 a decrease in the number of products notified was recorded; however, textile and clothing products were still among the dangerous non-food products, representing 27% of all notifications. In the next year the number of notifications rose once again within this product group up to the highest level ever reached, namely 556 notifications. Also, in that year notifications in the product group "Clothing, textiles and fashion items" represented the highest percentage among all product groups notified in the RAPEX system (34%). Beginning from 2013, a further decrease in the total number of notifications in the RAPEX system is noticeable, although products belonging to the category "Clothing, textiles and fashion items" represented the highest percentage of hazardous products with a share of 25%. A particularly pronounced drop in notifications related to textile products was recorded in 2015, when the number of textile and clothing products notified decreased by almost 40% and up to 50% of the share of Chinese products. The decrease in the number of notifications applied primarily to risks included in the categories "injuries" and "strangulation". This trend is also noticeable in the later years and can be assigned to the implementation in China of standards containing safety requirements for textile products designed for children and infants – GB 31701-2015. These observations prove the validity of EU activities undertaken to improve product safety in the European market by concluding an agreement with Chinese authorities to harmonise the requirements for textile and clothing products.

Conclusions

Ensuring a proper safety level of textile and clothing products is a current concern and a great challenge for the European Union. As follows from the analysis, over a period of 15 years, notifications referring to these consumer goods represent one of the most numerous groups in the category 'non-food products posing a serious risk to the health of consumers'. Most of the dangerous products come from China (47%), followed by those of unknown origin (19%) and Turkey (14%). The most active countries in unsafe T&C product notifications, accounting for almost 71% of all notifications, are Bulgaria, Hungary, and Cyprus, responsible mainly for notifications in the category "strangulation & injuries" for children's clothing, while Germany stands out from the rest of the EU members in reporting chemical hazards. During the period of time under investigation, the largest number of notifications was reported in the years 2010-2014. As the analysis shows the main source of origin was China.

For over 70% of products notified, government authorities ordered to withdraw them from the market, and for almost 30% to buy them from consumers. The indicator determining the performance of the RAPEX system, expressed by the ratio of the number of reactions to that of notifications, was 1.33 during that period, which is quite good when considering that this figure for all categories of products notified in the RAPEX system was 1.15 in 2017.

Based on the analysis carried out, one may conclude that legislation changes related to safety requirements for T&C products and actions of the European Commission for the implementation of legislation of countries outside the EU have a significant effect on the product safety level. Introducing normative requirements consistent with those of the EU in the territory of China, led to a significant decrease in notifications submitted in connection with these products.

The analysis presented in this paper does not exhaust the subject. To establish the cause of the bad situation of the European market in terms of consumer protection against dangerous T&C products and to draw more precise conclusions creating a basis for undertaking further actions for

consumer protection, in the second part, the authors will analyse data in relation to product type and its designation, including harm to consumers, taking into consideration the nature of risk.

Acknowledgements

This publication was financed with subsidies for maintaining the research capacity granted to Cracow University of Economics.

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Received 31.07.2019 Reviewed 05.11.2019