Harmonized Risk Indicators: A Matric Study of Potential Risks for the Pesticide Business in the EU-27

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Abstract: This study aimed to analyze the Harmonized Risk Indicator to study the potential risks for the pesticide business in the EU-27 (European Union-27). This study also focused on total pesticide sales to observe the progress of pesticide business in the EU-27 toward pesticide risk reduction. Data for pesticide sales for the EU-27 was obtained from the Eurostat database from 2011 to 2021. Data was analyzed for trends and regression using Microsoft Excel. The finding revealed that the pesticide market in EU-27 has grown significantly in previous years, and the trend has recently declined. Overall, pesticide sales increased in 2011 in EU-27 and decreased between 2012 and 2103. Sales increased significantly in 2014, 2016, and 2018. However, in 2019, sales saw a drastic decline; that could be a consequence of the COVID-19 pandemic. Again, a rise in sales from 2020 to 2021 was observed, but in 2022, a remarkable decline was observed in the pesticide business in EU-27. This study also discussed the risk reduction index based on the type of pesticide used, and analysis of the harmonized risk indicator showed that EU-27 has been very concerned with reducing the risk to human health and the environment from pesticides since 2011 and is using low-risk active substances and microorganisms to combat pests instead of active and toxic chemicals. It was concluded that the EU- 27 pesticide business fluctuated significantly by 2022, and rising food production demands and sustainable agricultural practices drove the risk reduction index.

Keywords: EU-27, Pesticide sale, Harmonized risk index, Pesticide business, Chemical pesticides, Risk Reduction

JEL Classification: G14, Q14, Q17

1 Introduction

Pesticides refer to a wide variety of substances, such as fungicides, herbicides, insecticides, rodenticides, nematicides, molluscicides, plant growth regulators, and others. Organochlorine (OC) pesticides, which had previously been used successfully to manage a variety of illnesses, including malaria and the disease typhus, were prohibited or limited in most technologically advanced nations in the 1960s. Other synthetic pesticides, such as organophosphate (OP) insecticide in the 1960s, carbamates in the 1970s, and pyrethroids in the 1980s, as well as herbicides and fungicides, introduced in the 1970s-1980s, made significant contributions to insect management and productivity in farming. Ideally, a pesticide should be fatal to the intended pests but harmless to other organisms, including humans. However, this is not the scenario, and the issue of pesticide usage and misuse has resurfaced. The common usage of these substances under the premise that "if something is beneficial, significantly more will be better" has wreaked havoc on humans and other living forms (Szpyrka et al., 2016).

The key benefits are the consequences of the pesticides' actions or the immediate improvements anticipated from their usage. For example, eradicating caterpillars that feed on crops has the main advantage of increasing yields and improving vegetable quality. The three significant impacts result in 26 key advantages, which range from recreation grass preservation to human life savings. Secondary advantages follow the primary advantages but are less quick or visible. They can be invisible, more instantly visible, or long-term (Toan et al., 2021). As a result, secondary advantages are more challenging in demonstrating the relationship between cause and effect, but they can still be compelling arguments for

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pesticide usage. For example, increased cabbage output may generate more excellent cash for schooling for kids or health services, resulting in a healthier, more educated society. Secondary advantages have been reported, from improved physical fitness to biodiversity conservation (Rother, 2016).

Pesticide usage has resulted in enormous gains in forest products, public health, and the home realm - as well as the agricultural sector, which is critical to the Indian economy. Food grain output, at 50 million tons in 1948-49, had nearly quadrupled to 198 million tonnes by the last harvest of 1996-97 on approximately 169 million hectares of regularly planted land. This outcome was obtained by using productive seed types, modern irrigation techniques, and pesticides for agriculture. Similarly, outputs and productivity have grown considerably in most nations, such as the yields of wheat in the Kingdom of England and maize yields in the United States. Productivity increases have been attributed to a variety of variables, including the use of fertilizer, improved cultivars, and the use of technology (Sălceanu et al., 2023). Pesticides have become an essential component of the process, decreasing losses due to weeds, illnesses, and pest insects, which may significantly limit the quantity of harvestable products. Sánchez-Bayo (2021) also highlighted the dramatic gains in yields of crops in the US over the twentieth century. Szpyrka et al. (2016) said that "considerable economic losses" would occur if pesticides were not used, and they calculated the significant gains in production and economic margins that arise from pesticide usage. Furthermore, in the environment, the majority of pesticides undergo photochemical change, yielding metabolites that are largely non-toxic to both humans and the surrounding ecosystem.

The European pesticide business is dynamic to the region's agricultural sector. The primary goal of pesticide application is to protect crops from numerous hazards. These dangers include pests, illnesses, and weeds, which can injure or damage crops. As a result, this sector is critical in maintaining good health and producing the region's farming products. In 2021, Europe utilized 505.16 thousand metric tons of pesticides, representing 14.3% of total agricultural pesticide usage globally (Alix & Capri, 2018).

Although there is substantial debate over agriculture's environmental responsibility, the average usage of pesticides in Europe has not decreased in recent years. In reality, the detrimental impact is growing, as many recently released synthetic pesticides may be used in small amounts yet are more harmful. Between 2011 and 2020, pesticide revenues in the EU were relatively consistent, at roughly 350,000 tons per year. In 2022, a little reduction was observed, although this is not yet a pattern. The great majority is utilized in the agriculture industry. Since 2011, the European Union (EU) has provided EU pesticide sales figures and an overview from the European Environment Agency (Böcker & Finger, 2017). The publication on the usage of pesticides, which might begin providing data regarding pesticide use in various agriculture uses, is still in the works. Remarkably, the EU is unable to gather and publish these figures, given that EU Regulation No 1107/2009 on the licensing of crop protection goods states in subsection 67 that each farmer must register crops and use pesticides and retain these records. Regulation No 183/2005 on feed personal hygiene specifies in its Annex I, section II, (2) (a) that "feed providers must, in particular, maintain documentation on any utilization of plant protection goods and pesticides" (Brankov et al., 2021).

According to the European Commission's 2017 pesticide data, "Pesticides are a source of contamination and directly impact the preservation of biodiversity, aquatic ecosystems, and landscapes. To guarantee that these consequences are addressed correctly, authorities must be able to assess the danger and extent of pesticide contamination. This would also help to improve the application of current environmental policy instruments and identify any outstanding policy gaps for dealing with pesticide-induced environmental pressures (Falcó et al., 2012).

Because these are unintended effects that society and ecosystems face in addition to the direct producer or consumer of the pesticide, the use of pesticides has long-term negative effects on non-target animals and the environment. These consequences are referred to as external costs, external effects, or externalities. Because producers and consumers do not consider these external influences when making decisions, externalities lead to inefficient market outcomes. Therefore, in order to keep an eye on and control pesticide use and the associated risks, regulatory limitations are needed. To measure and track the risk associated with pesticides, the European Commission use two Harmonized Danger Indicators. Adjuvants and active compounds are frequently found in pesticides (Street, 2023). Adjuvants improve a product's performance or usage, while active compounds control the pest. The weighting of the annual sales volumes of all active substances on the market is based on the active substance's classification into one of four risk categories, and this computation yields the Harmonized Risk Indicator 1. By raising the total number of emergency authorizations granted for active compounds by the same precise weighting as previously and then combining these findings with the total number of active chemicals on the market, the Harmonized Risk Indicator 2 is produced. The Harmonized Risk Indicator 1 decreased by 38% between 2011 and 2013 and by 6% from 2020 to 2021. Nonetheless, metrics that track pesticide sales, such as the Harmonized Risk Indicator 1, can encourage the use of more dangerous pesticides at lower conventional application rates. Studies show that more complex risk indicators do not correlate well with quantity-based metrics (Scown et al., 2022).

Conventional agricultural techniques rely heavily on chemical pesticides to ensure crop output consistency and quantity while maintaining food safety. Pesticides are also employed in non-agricultural environments, such as forest products, on highways and railroads, and in urban areas, including public parks, playgrounds, and gardens. Some of these sites, particularly green spaces in cities, are often visited by the general public, especially youngsters and older people, whose wellness is more susceptible to pesticides. Pesticides' hazards to both people and the environment are determined not only by the inherent features of their components (e.g., active chemicals, co-formulants, additives) but also by how they are utilized, which includes application rate, amount, and manner, as well as the soil and crop type (Gamage et al., 2022).

Pesticide usage data are currently unavailable at the EU level but will be required beginning in 2028 under the Data on Farming Inputs and Output regulations. Simultaneously, since 2011, the EU has collected harmonized yearly pesticide sales statistics. Pesticide sales in the EU-27 were generally steady between 2011 and 2020, totalling roughly 350,000 tons annually. Sales fell in 11-member nations, with Czechia, Portugal, and Denmark seeing the worst declines. While Latvia and Austria had the fastest gains in pesticide sales, Germany and France saw the greatest total boosts in volume sold. These two nations, alongside Italy and Spain, account for the majority of active substance sales across most groupings, and they are also the EU's top four agricultural producers (Garcia-Caro, 2023).

Pesticide usage and danger in Europe are affected by broader global trends. Climate change affects pest dispersal, which may lead to higher pesticide use. Simultaneously, pesticide pollution diminishes organic pest management and promotes organisms to develop pesticide resistance, creating a vicious circle of greater pesticide use. In terms of politics, the cost increases caused by the Ukraine conflict are unlikely to influence pesticide sales significantly. This shows that policy initiatives are more important than pricing in lowering pesticide use. Finally, in our linked global food chain, pesticides prohibited in the EU continue to be sold to non-EU nations. This raises the possibility that livestock and food imports may be polluted with pesticide residues that are forbidden within the union (Paul Hay, 2018).

2 Literature Review

Pesticides, often known as plant protection goods or biocidal compounds, are chemicals that reduce, eliminate, or prevent the action of hazardous organisms. Pesticide usage significantly contributes to crop productivity, both in terms of quantity and quality. However, certain members of society are critical of these items and refuse to utilize them. Reasons for this rejection include potential health concerns for the population, negative environmental consequences, and difficulties in risk assessment. Furthermore, customers may dispute the professionalism with which pesticides are applied and the compliance with the legal rules (Moysiadis et al., 2021). Pesticide approval and usage laws across the EU contribute to the reduction of possible dangers. Plant protection products are marketed in the European Union following Regulation (EC) No. 1107/2009. The EU Directive 2009/128/EC offers an integrated structure for the long-term utilization of pesticides; its implementation is dependent on member states' national action plans. Different federal states may have varied standards for adopting national action plans based on legislative restrictions in EU member states. In Austria, for example, federal legislation governs the approval of plant protection products, but state rules govern their application and storage (Böcker & Finger, 2017).

In the EU, evidence of competence is necessary for professional pesticide usage in agriculture (Directive 2009/128/EC). This is to guarantee that the individual using the product has the knowledge and skills required to apply pesticides with chemicals correctly and in accordance with all applicable legislation. The particular qualifications for this competency document are determined by national and state-specific rules (Delahay et al., 2023). However, only competent individuals may carry out plant protection measures, and pesticides with authorized, active components (Regulation (EC) No. 1107/2009) may be employed in specific EU member nations following an exhaustive examination procedure. Furthermore, many instructions stated in the authorization process must be observed while administering pesticides, including the administration rate, the application techniques, and any waiting times (Leach & Mumford, 2011).

Pesticide sales in the EU fell dramatically in 2022, mainly owing to price increases. Pesticide sales in 2022 were around 322,000 tons, a 10% decrease from the previous year. Pesticides are marketed in the EU in three categories: "fungicides and bactericides" (43% of the total sales in 2022), "herbicides, haulm destroyers and moss killers" (35%), and "insecticides and pesticides" (14%). In 2022, France (21%), Spain (18%), Germany (15%), and Italy (14%) sold the most pesticides in the EU. These four countries are the EU's leading agricultural producers. During 2011 and 2022, several EU nations experienced considerable reductions in pesticide sales. Italy (-37%), Portugal (-36%), and Greece (-33%) had the most significant reductions (Garazha et al., 2023).

In 2013, pesticide sales were about 360,000 tons. Spain (19.5%), France (18.7%), Italy (13.8%), Germany (12.3%), and Poland (6.2%) were the countries in the European Union with the largest pesticide sales, accounting for 70.5% of the EU-28 total. Fungicides and bactericides remained the most popular pesticides, accounting for 42% of total sales, followed by herbicides, haulm destroyers, and moss killers (35%). Together with the group 'Other plant protection products' (13%), the three groups accounted for 91% of pesticides marketed in the EU-28 in 2013 (Alonso González et al., 2021). Insecticides and acaricides accounted for 5% of overall pesticide sales, followed by plant growth regulators at 3% and molluscicides 1%. They considered that specific member states of the EU, Spain, France, Italy, and Germany, are at the top of the list regarding pesticide sales by group and overall pesticide sales. Spain had the largest market for insecticides and acaricides (6.7 thousand tonnes) as well as other plant protection goods (17.3 thousand tonnes). Italy had the highest volume of sales of fungicides and bactericides at 32.9 thousand tonnes, while France placed first in herbicides, haulm destroyers, and moss killers with 27.8 thousand tonnes, as well as molluscicides with 1.1 thousand tonnes. Germany sold the most plant growth regulators in 2013, accounting for 2.9 thousand tons (Atwood & Paisley-Jones, 2017). The top four nations' trends did not always hold true. In Poland, for example, 12.5 thousand tonnes of herbicides, weed destroyers, and moss killers, 1.3 thousand tonnes of insecticides and acaricides, and 1.5 thousand tonnes of plant growth regulators were supplied. The United Kingdom was likewise in the top four for molluscicide and plant growth regulator sales (0.1 thousand tonnes), with the Netherlands coming in fourth with 3.0 thousand tonnes (Umetsu & Shirai, 2020).

The amount of pesticides sold each year can be linked to other data directly connected to the consumption of pesticides. Compares the amounts of pesticides sold for every country's utilization of agricultural land, and the nations that are members are ranked based on the number of pesticides (kilograms) per hectare UAA. Bulgarian had the smallest share of pesticide sales per hectare, at 0.24 kg/ha. Pesticides sold in Estonia, Ireland, Latvia, Sweden, Romania, Lithuania, and the United Kingdom totalled less than one kilogram. Only Italy ranks among the top four for pesticide sales per hectare, at 4.01 kg/ha. Malta had the most excellent pesticide use per hectare, with a figure of 13.59 kg. Sulfur is the most significant active chemical marketed and used in Malta, accounting for around 65% of the total sales and over 90% of all active compounds utilized. Netherlands, Belgium, Italy, Spain, Portugal, Greece, Germany, and France sold more pesticides per hectare than 2 kg/ha (Goffart et al., 2022).

Since the European Parliament passed the EU Directive (EC) No 128/2009 (SUD), a general framework for ensuring sustainable utilization of pesticides has been established, and European Union (EU) Member States have created National Action Plans in compliance with this Directive. Pesticides, goals, and quantitative objectives were explicitly developed for EU member states. As a result, the EU Commission created a risk assessment technique based on two harmonized risk indicators: HRI-1 and HRI-2 (Marchand & Robin, 2019) . The present research focuses on HRI-1, which can be adopted nationally. Each EU Member State submits yearly harmonized risk indicators to the European Commission based on computations with their data and findings. However, only the EU Commission can determine this HRI-1 (concatenated) indication at the EU level. As a result, the current study seeks to shed light on the methodology utilized by the EU Commission to produce this HRI-1 and explain these figures. Data from 27 European Member States were examined. These figures have been correlated to data released on the EU Commission's website. Virtual advancements are planned, such as the shift in and development of active substance statuses (Bregaglio et al., 2022).

Pesticides are used in every aspect of the agricultural industry in European countries, from farms to marketing networks. Following 1945, the goal of boosting agricultural output resulted in an intensification of farming that heavily relied on machinery, fertilizers, and pesticides. The growth of agricultural methods based on sowing a less diversified variety of crops at higher densities was made possible by high-yielding cultivars, fertilizers, and pesticides. However, this sometimes increased pests (hereafter referred to as unwanted insects, fungi, weeds, and diseases). Pesticides provided reasonable crop pest control in the environment, which helped transform the agricultural system. Agricultural intensification, which has increased production per hectare and worker while expanding farm size at the price of biodiversity, has been made possible by pesticides, fertilizers, and technology (Tang et al., 2021). Farming systems have grown more specialized and streamlined, resulting in fewer natural restrictions and more pesticide use to manage pests. As a result, these systems have become increasingly dependent on chemical inputs. The widespread application of permanent and comprehensive pesticides is currently one of the primary causes of a decline in ecological functions and natural pest control, encouraging the use of further pesticides. In parallel, the appearance of pesticide resistance due to their widespread usage has resulted in a rise in their use. These two developments have led to the growth of a "pesticide treadmill". Pesticides are presently the primary technique used to reduce the risk of crop losses as agricultural systems become more simplified. Furthermore, the growth in farm size and decline in the proportional share of family ownership regarding capital and land has persisted throughout the previous few decades, resulting in an increased reliance on foreign labour (Alvarez et al., 2023).

The low percentage of family members in the total labour force and the utilization of contract employment are frequently associated with increased pesticide use. The goal of maximizing output, which is not necessarily driven by economic logic, might contribute to excessive pesticide use. Furthermore, peer assessment, viewed as the norm, has an impact since farmers' reductions in pesticide use tend to be heavily impacted by whether other farms likewise drop. Upstream and downstream industries have been arranged to assist and benefit from agricultural intensification, resulting in a technical lock-in to pesticide usage (Helepciuc & Todor, 2021).

Agricultural machinery manufacturers and plant breeding farms have concentrated their efforts on technology and species appropriate for intensive farming practices. The types chosen and marketed are those whose traits allow for the optimization of processing technology without regard for disease susceptibility. Pesticide corporations often promote pesticide usage in their promotional and marketing techniques, as they are the primary counsellors to farmers. Furthermore, extension services continue to be dominated by ways geared at finding only one answer to each problem, with little focus on systemic methods that address a group of problems or suggest improvements in many areas at once (Bub et al., 2023). Furthermore, the absence of value chains for novel crops that might aid crop diversification is frequently cited as a significant impediment to agroecological transformation and pesticide reductions. Aside from this issue, the inability to generate more value throughout all sectors is the most significant barrier to pesticide-free practice implementation. Farmers have little motivation to employ these procedures since the goods they produce do not command more excellent prices than traditional ones. Implementing pesticide-free techniques in specific industries (e.g., vegetables and fruits) may also be hampered by market needs for undamaged products. The market seldom considers pesticides' influence on individuals or the environment (Sarkar et al., 2021).

3 Materials and Methods

Total pesticide sales and potential risks for pesticide business in EU-27 were evaluated by observing harmonized risk indicators. This study utilized analytical methods based on the secondary data from Eurostat on pesticide sales in the European Union, and data was gathered from 2011 to 2022. For potential risks for pesticide business in EU-27, - a harmonized risk indicator was observed for each chemical used as a pesticide from 2011 to 2022; the parameters were included: 1) pesticides - harmonized risk indicator 1 (all active substances), 2) low-risk active substances 3) low-risk microorganisms, 4) low-risk chemical active substances, 5) active substances, 6) microorganisms, 7) chemical active substances, 8) active substances candidates for substitution, 9) active substances for substitution not classified as non-carcinogenic, 10) active substances candidates for substitution classified as carcinogenic, and 11) non-approved active substances. This indicator, presented as an indicator relative to a 2011-2013 baseline set to 100, helps measure progress toward pesticide risk reduction. The keywords used for the paper as a whole.were pesticide sale, agri-businesses, agricultural growth, EU-27 pesticide business, total pesticide sales in the EU, chemical pesticides, Harmonized risk indicator, and pesticide active substances. Research engines used in this study were Google Scholar, Scopus, and other worldwide and regional information sources.

Formula of harmonized risk indicators for agricultural pesticide:

$$HRI = \frac{\text{Active Ingredient Usage} \times \text{Hazard Classification}}{\text{Baseline Year Risk Indicator}}$$

where
Active Ingredient Usage: The amount of pesticide used.
Hazard Classification: Based on categories like carcinogenicity or acute toxicity.

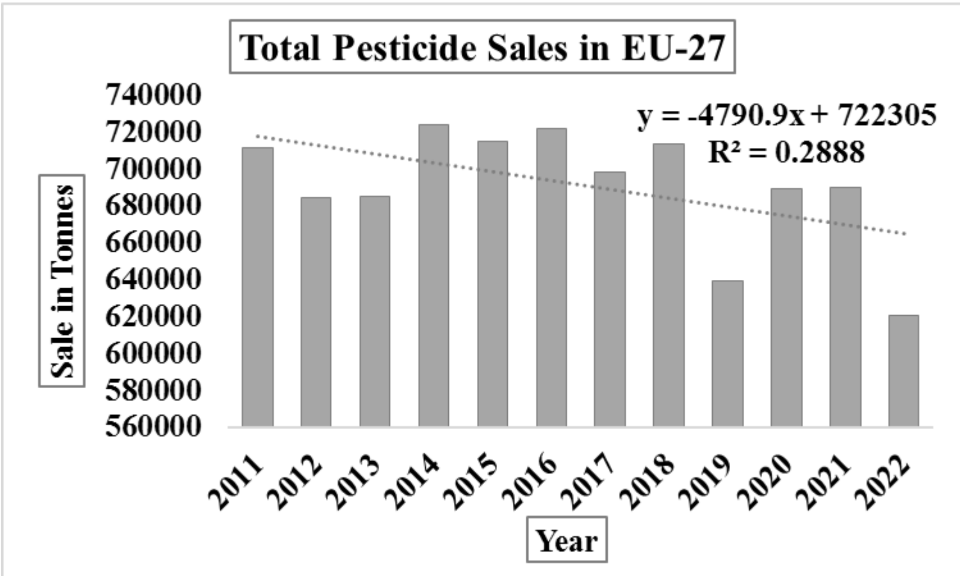
Baseline Year Risk Indicator: Standard value for historical comparison.

MS Excel analyzed data and outcomes and presented them in a classified manner using graphical representations and heat maps.

4 Results and Discussions

The pesticide market in EU-27 had grown significantly in previous years; recently, the trend has been observed toward declining. Figure 1 depicts the total pesticide sales in the EU-27 from 2011 to 2022. Overall pesticide sales were more significant in 2014, 2016, and 2018, at around 723806.8, 721990.3, and 713734.8 Tonnes, respectively. Pesticide sales in EU-27 increased in 2011 and decreased between 2012 and 2103. However, from 2014 to 2018, an increase was observed in sales, while in 2019, sales saw a drastic decline (639269 Tonnes). It could be the consequences of the COVID-19 pandemic, and mobility was suspended due to the lockdown. From 2020 to 2021, sales rose, but in 2022, a remarkable decline (620400.3 Tonnes) was observed in the pesticide business in EU-27. Several interconnected elements, such as agricultural practices, regulatory frameworks, and economic situations, impact the rise of overall pesticide sales in the EU-27. Despite legislative attempts by the EU to lessen dependency on pesticides, the need for increased agricultural yields encourages the usage of pesticides. More pesticide use is required due to increased pest damage brought on by climate change and intensified agriculture. Pesticide use is correlated with higher GDP per capita because wealthier areas often invest more in agricultural inputs. Higher sales are also a result of favourable pesticide selling prices and increased real income. Though designed for safety, the EU's strict regulations may unintentionally prevent using biopesticides, increasing the need for conventional pesticides.

Figure 1 Total Pesticide Sales in EU-27



Source: Own processing

There are serious health and environmental issues raised by the EU-27's growing overall sales of pesticides. This tendency has a wide range of effects on human health, agricultural sustainability, and ecosystems. The Harmonized Risk Indicator for Pesticides is a comprehensive method for evaluating and estimating the potential risks associated with pesticide use in Eu-27. This indicator provides essential information on the total risk level induced by pesticides in Europe, considering factors including toxicity, exposure, and environmental consequences. In this regard, data was collected from the Eurostat database and analyzed for Harmonised Risk Indicator for pesticide use in the EU-27 from 2011 to 2021, as represented in Figure 2. In 2011, Pesticides - harmonized risk indicator 1 (all active substances) was recorded at 108 indexes and in 2021, the reduction index was 62, which showed that the use of all active substances pesticides has declined in EU-27. In 2011, the use of low-risk active substances and low-risk microorganisms was recorded as 75 and 121index, respectively and in 2021, the reduction index was high (547 and 593, respectively) because EU-27 countries started to use these substances in high amounts as pesticides as they are less toxic to the environment. The annual reduction index for low-risk chemical active substances was 62 in 2011, but it drastically increased (534 indexes) til 2021, which showed that EU-27 started to use low-risk chemical active substances pesticides for agricultural activity as a good indication to prevent future risk. The annual use of active substances was recorded at 102 indexes in 2011, but it increased (118 indexes) until 2021, which showed that EU-27 started using active pesticides for agricultural activity. The use of microorganisms as pesticides was 87 index in 2011, and it gradually increased to 297 index in 202. The potential risk of chemically active substances was 102 index, and for active substances, candidates for substitution were 101 index in 2011 and 118 and 98 index, respectively, in 2021. The active substances for substitution were not classified as non-carcinogenic and had a 100 index in 2011 and 97 index in 2021, whereas active substances candidates for substitution classified as carcinogenic was106 in 2011 and101 index in 2021. The non-approved active substances index was 115 in 2011, whereas the 19 index was 202. The risk reduction index based on the type of pesticide used was also covered in this study. Analysis of the harmonized risk indicator revealed that the EU-27 has been focusing on lowering the risk of pesticide-related health and environmental harm since 2011 and has switched from using toxic and active chemicals to combat pests with low-risk active substances and microorganisms.

Figure 2 Harmonised risk indicator 1 for pesticides use (Unit 100 index)

Annual	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Pesticides - harmonised risk indicator 1 (all active substances)	108	98	93	97	99	94	86	86	79	68	62
Low-risk active substances	75	108	117	178	250	311	271	230	246	394	547
Low-risk micro-organisms	121	92	88	145	126	162	158	227	421	699	593
Low-risk chemical active substances	62	113	125	187	285	354	303	231	196	306	534
Active substances	102	99	100	106	104	108	107	110	100	117	118
Micro-organisms	87	102	111	107	113	129	156	195	234	477	297
Chemical active substances	102	99	100	106	104	108	107	110	100	116	118
Active substances candidates for substitution	101	97	102	106	108	112	106	110	97	91	98
Active substances for substitution classified as non-carcinogenic	100	97	103	105	107	112	104	107	94	89	97
Active substances for substitution classified as carcinogenic	106	95	99	118	121	112	138	144	130	120	101
Non-approved active substances	115	98	87	90	93	81	67	65	62	31	19

100 200 300 400 500 600 700

Source: Own processing

5 Conclusion

The study of harmonized risk indicators for the pesticide business in the EU-27 reveals significant insights into potential risks and regulatory challenges. The assessment of harmonized risk indicators for the pesticide business in the EU-27 reveals significant challenges and opportunities for improving environmental and health safety. In the EU-27, overall sale had noticabl;e up and down. The risk reduction index based on the type of pesticide used was also covered in this study. Analysis of the harmonized risk indicator revealed that the EU-27 has been focusing on lowering the risk of pesticide-related health and environmental harm since 2011 and has switched from using toxic and active chemicals to combat pests with low-risk active substances and microorganisms.

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