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Articles

FOOD SAFETY AS A NEW SCIENCE DISCIPLINE

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Science is just one of many tools
invented by people
to deal with the surroundings
(P.K. Feyerabend, 1975)[1]

Abstract

The article is dedicated to the complex processes of science development, especially the separation of new disciplines and sub-disciplines of knowledge. Its main aim is showing the process and conditions of separation of a new science discipline, which is food safety. Food safety as a new discipline of science is separated on the basis of the subject, i.e. the status of food in the area of its health characteristics and quality standards and the goal of protecting the life and health of consumers and their economic interests. Food safety, using the terminology of Kuhn, is currently at the stage of the so-called pre-paradigmatic period. It is characterized by the diversity of approaches

[1] Polish edition: *Przeciw metodzie* (*Against Method*), Siedmiorόg, Wrocław 1996. For reasons unknown to me, Polish publisher omitted the second part of the title of work: *Outline of an Anarchist Theory of Knowledge*. This is inexplicable especially that epistemological anarchism is the essence of Feyerabend's theory.

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to food safety, the scope of research and the used terminology. It should be emphasized, however, that recent years have brought even greater compliance, both from the representatives of institutional and author mainstream on the identity of food security, as a (sub)discipline of science. This applies, first of all, to the research area, which increasingly includes both, health and economic safety of food.

Keywords: economic sciences, development of science, food, food safety, adulteration of food.

JEL codes: Q18, K22, A12.

Introductory remarks

Periods abounding in slumps, rapid changes or new social, economic and political phenomena have always resulted in an increased interest in science[2] and what it has to offer in such a situation. We have seen such an increased interest also in recent years. It refers to many fields of science, but one of those attracting more interest and expectations is economic sciences. There are several reasons for this, with the most important ones being probably:

– increasing social (income) inequalities in existing, old relations (rich countries versus poor countries) and new ones (between individual social groups in a single, also rich country),
– economic crises recurring more and more often[3], including the recent global crisis of the first decade of the 21st century,
– radicalisation of social views and reviving nationalism, leading to the inhibition of tendencies liberalising economic and trade relations in a global system (failure of the Doha Development Round, resistance to trade agreements similar to the TTIP or the CETA, inhibition of integration processes within the EU).

On the other hand, for some time (the last 10-20 years) the economic sciences have been undergoing transformation – deeper than in the vast majority of the second half of the twentieth century – and increasing complexity of individual theories, their multidirectional evolution, the renaissance of earlier views or attempts to adapt them to new challenges. Chronologically, firstly, this is the result of constantly increasing complexity of economic processes in consequence of progressing globalisation and, as a result, attempts of economic sciences to keep up with these processes. And secondly, this stems from the above-mentioned economic crisis of the first decade of the 21st century which definitely revealed the incompatibility of economic theories of the so-called mainstream with an increasingly complex and unpredictable reality.

[2] Naturally, this applies first and foremost to modern times. In earlier periods, in such "unnatural" moments, as a rule, interest in magic, religion or the opinion of the so-called social and political authorities, both formal and actual, increased.

[3] For example: the oil crisis (1973), the second oil crisis (1979-1982), Black Monday (1987), the Mexican crisis (1994), the Asian financial crisis (1997), the Russian financial crisis (1998), the Argentine crisis (1999).

As a consequence, this causes the emergence of more and more interdisciplinary research and, as a result, new, if not yet disciplines, subdisciplines. In other words, new areas of knowledge emerging "on the borderline" of existing disciplines/fields and using more and more often and to a greater extent the achievements of other disciplines/fields. This means that a significant feature of modern science is the multiplication of separate scientific disciplines at a relatively fast pace (Flejterski, 2018).

There are also opinions which emphasise the effort – usually of different schools within one discipline – to create a common trend, or a common paradigm. However, the scope of such a paradigm, created, for example, within the mainstream of economics, would still be limited for ideological and political reasons (Madej, 2011).

These trends lead directly to the development of science in the form of expansion of knowledge about the reality surrounding us, both by enriching existing theories, their modification, and finally their refutation (falsification). In the theory of development of science, philosophy of science and logic of scientific discovery, there is no agreement as to how science develops. One can distinguish many concepts and approaches, such as the critical rationalism (falsificationism) of K.R. Popper (1902-1994, Popper 2002), the theory of research programmes (hard core) of I. Lakatos (1922-1974, Lakatos, 1977), the theory of scientific revolutions of T.S. Kuhn (1922-1996, Kuhn, 2011), or epistemological anarchism of P.K. Feyerabend (1924-1994, Feyerabend, 1996) to focus only on approaches typical of the 20th-century science.

According to probably the most popular theory of development of knowledge created by T.S. Kuhn, research has basic importance in this process, which the scientific community *currently* accepts and treats as the foundation of its further practice. The results of this research should have two main features: (1) be original and attractive enough to divert the attention of a particular group of supporters of this "new" theory from competing theories, and (2) should be open enough to leave various problems to be solved by other researchers. Kuhn called scientific achievements characterised by these features paradigms. However, the achievement of a state of paradigmatic science, i.e. having its own paradigms, by a given discipline is not so simple. This requires time and above all research and results which are universally recognised by the scientific community, whereas the very development of science takes place through "inevitable and indelible" differences and collisions of paradigms, taking the form of scientific revolutions (Kuhn, 2011).

Analysing K. Popper's concepts, Feyerabend concludes that the nucleus of scientific research is the emergence of a problem. A problem which is a consequence of the discrepancy between an expectation and an observation determined by that expectation. Attempts to eliminate this discrepancy lead to the creation of a theory which proposes a specific solution to the problem (Feyerabend, 1996). The more proposals to solve a given problem, or the more theories, the better for science. Because theoretical uniformity weakens the critical power of science, consequently

leading to the threat of a free development of an individual. Objective knowledge requires a variety of opinions, whereas it is difficult to search for any permanent and universal rules for development or evolution, because science is essentially an anarchist undertaking.[4]

However, according to Popper himself, the correctness of the proposals, or in other words the objectivity of the theory, can be ensured only by the repeatability of events. It is only thanks to repetitions that we become convinced that we are not dealing with some isolated coincidence. Non-repeating, individual events have no meaning for science. In Popper's approach, as we know, this repetition is equivalent to the falsifiability of statements considered scientific. In his opinion, it is not important for the development of science to consider the probability of a given hypothesis, but to what extent it has proven its ability to survive, or to what extent it has been confirmed (*corroboration*) (Popper, 2002). Naturally, new experiments may be to an existing theory's disadvantage which is, however, a natural process of development of science.

Regardless of what concept or logic of scientific discovery we consider to be dominant or more accurately reflecting the essence of development of science in every discipline or field of science, we have periods of higher and lower dynamics of change. Using Kuhn's terminology, of less or more violent conflicts between existing and new paradigms.

There are many indications that this is the case in economics, and perhaps in the entire field of social sciences.[5] At this point, however, the author is only interested in economics as a science discipline.

Thus, what are the reasons for which today the dynamics of changes in economics is so high? According to K. Jajuga (2018), two essential factors are and will be responsible for this high dynamic of evolution both in recent years and in subsequent periods. First, economic problems and dilemmas which emerged in the last decade, i.e. mainly related to the global crisis of the first decade of the 21st century. Such dilemmas include: the future nature of economics: normative versus descriptive, the probability of a renaissance of empirical research, and finally the possible increase in the interest of economists in the achievements of sciences such as biology, sociology, psychology, ethics, etc. The second factor results from current processes taking place in the world, also at a faster and faster pace, and the economics must keep up with them.

Thus, what results from these new phenomena for science, including economics? There are many indications that, above all, growth of separate scientific (sub) disciplines at a rapid pace should be expected. The dynamics of civilisational changes, including economic ones, leading to an increase in the degree of com-

[4] Hence the famous phrase "anything goes" by Feyerabend.

[5] The author uses the concept of 'field of science' herein in the sense of a chosen scope of science, similar in terms of identity, and not an element of administrative classification of science, as abolished by the Regulation of the Minister of Science and Higher Education of 20 September 2018 on the fields of science and scientific disciplines.

plexity of the reality surrounding us on the one hand, and emerging new trends and researches and as a result the increase in the amount of research material on the other, lead to the emergence of new, separate specializations, subdisciplines, and finally disciplines. These new specializations and subdisciplines are increasingly overlapping with research fields, use the results of other disciplines, intermingle and integrate, which is why also demarcation lines between individual fields of science become more and more blurred (Flejterski, 2018). This leads to an increasingly widespread phenomenon of interdisciplinarity in economic sciences. Therefore, according to G.W. Kołodko, today economics ceased to be a discipline and became an interdiscipline.[6] And if so, nowadays we are dealing with multi-paradigm science. There is no economics based on one paradigm. If it is to be useful and satisfactorily explain individual fragments of reality, it must be eclectic and based on methodological pluralism (Flejterski, 2018). This multi-paradigmatic nature refers not only to economics as a whole but, as stated by M. Gorynia (2018), it is also related to subdisciplines, creating a kind of "market of paradigms."

Interdisciplinarity of sciences can be understood in various planes. For example, (i) studies conducted in a given discipline refer to research and findings of disciplines from other fields of science (e.g. references of economics to findings of agricultural sciences, (ii) to studies and findings of disciplines from the same field of science (e.g. references of economics to legal sciences), and finally (iii) studies conducted in a given subdiscipline refer to research and findings of other subdisciplines within a given discipline, which, however, is often called into question as a case of interdisciplinarity (Gorynia, 2018).

Nevertheless, regardless of the dimension in which we analyse interdisciplinarity, we notice greater and greater *fluidity* of divisions and the tendency to move the boundaries of individual disciplines and fields. As a result, new (sub)disciplines which several decades ago nobody would rather think about are formed, such as behavioural finance, econophysics, eco-finance, or neurolinguistics.[7] In any case, this blurring of differences and moving of research areas must not lead to the disappearance of the identity of individual disciplines and fields of science. Objective, methodological and linguistic differences are the essence which allows scientific knowledge to recognise its part identified with a specific discipline or field of science.

[6] Statement by G.W. Kołodko at a conference organised by the Polish Economic Society in cooperation with the Committee of Economic Sciences of the Polish Academy of Sciences on: *The evolution of economic sciences. Unity and diversity, relations to other sciences, classification problems*, Warsaw, 14 March 2018.

[7] Attempts to use the achievements of different but "distant" fields/disciplines in the form of new branches of knowledge sometimes arouse opposition of the scientific community, an example of which can be quantum psychology for which the key work is paper by R. A. Wilson: *Quantum Psychology*, New Falcon Publications 1990. Cf. P. Cieśliński, *Psychologia kwantowa, czyli bełkot naukowy na Uniwersytecie Warszawskim* (Quantum psychology, or scientific gibberish at the University of Warsaw), "wyborcza.pl," 8 September 2018. http://wyborcza.pl/7,75400,23896050,psychologia-kwantowa-czyli-pseudonauka-na-uniwersytecie-warszawskim.html. Access date: 17.09.2018.

These new (sub)disciplines are usually formed on the periphery or in areas remaining in a relationship of dependence to each other. For these reasons, they are usually of a multi-area, multi-paradigmatic and more fluid nature, cross-border in a sense, in relation to "old" fields and disciplines. Today, food safety is such a new emerging area of knowledge.

Food safety as a new science discipline

Food safety as a new science discipline is distinguished based on two main criteria: (1) the subject which is the status of food regarding its health features and compliance of the quality properties of food with the actual state (state of food adulteration), and (2) the purpose of the discipline which is to protect the life and health of the human (consumer) and his/her economic interests.

The objective criterion is identical with testing and assessing health properties and economic features of food. Firstly, it means examining the health condition of food, including its possible chemical, biological and mechanical contamination, and the nutritional value of food products, especially those intended for selected groups of consumers, such as children, pregnant women, the elderly, people using health products, etc. Secondly, it is related to testing compliance of the actual state of food (food product) in terms of organoleptic characteristics, physicochemical properties and correctness of labelling with applicable food law and the manufacturer's declaration. This is a consequence of deliberate lowering of quality as well as adulteration of food by some producers. The main reason for this is the desire to obtain additional economic benefits at the expense of consumers.

In turn, the second demarcation criterion for what we define as food safety illustrates the main goal of this new discipline. It is, firstly, the need for the state authorities to protect health and life of citizens as food consumers, which is an inalienable function and duty of the institution such as the state. Secondly, due to adulteration of food or deliberate lowering of its quality, which can be observed practically at any time and in any socio-political system, the need to protect the economic interests of citizens. Interests exposed to dishonest activity of some economic entities. Entities wishing to obtain additional, undue and unjustified economic benefits at the expense of citizens.

Both criteria constituting the new discipline are, naturally, interrelated. However, while the subject criterion is an answer to the question of *what is this new discipline researching, or what is it aiming at*, the objective criterion answers the question of *intention in which it does that*.

Isolation of food safety

Nowadays, the emergence of food safety as a new science discipline is taking place primarily through attempts to define it and to determine the objective and essence of this new area of knowledge. However, there is no one universally accepted and recognised definition of food safety in literature on the subject and in general use. This can even be a bit of a surprise, because despite the fact that in recent dec-

ades food safety and nutrition have been talked and written about a lot, which is particularly evident after numerous food scandals of the 1980s and 1990s, there are very few, if any, acceptable expressions of this issue.

According to R. (Skip) A. Seward II (2003), this is a consequence of the fact that the term "safe food" has different meanings for different recipients. Consumers associate food safety primarily with the practical properties of its use (consumption), such as preparation conditions, health status, nutritional values and the level of risk resulting from the consumption of a given food. Industry organisations and associations, as well as the companies themselves, usually raise the issue of microbiological and chemical hazards and the risk arising actually or potentially from new "improved" manufacturing technologies (GMOs, novel food). In turn, representatives of science in the field of food, belonging – of course – to the best-educated groups of consumers, which can also be considered obvious, formulate definitely an excessive number of questions and hypotheses, which inevitably result in an excessive number of variable views and as a result the inability to reach a consensus or develop and adopt a paradigm defined in this respect.

In relation to food safety, and more generally food security, two main trends of formation of views as well as practical and theoretical concepts coexist: (i) the trend represented by international institutions and national organisations involved in the food sector, herein referred to as the institutional trend[8], and (ii) the authors' trend which consists of the views of individuals, mainly from the world of science, obviously also associated with certain institutions (research centres) but presenting individual views (Kowalczyk, 2016).

As part of the institutional trend, representing mainly the operational and practical approach, food safety is defined at three levels: global, regional and national.

Arrangements on global food safety are included in the *Codex Alimentarius*. According to one of the oldest and best-known definitions of food safety included in the code document from 1969 devoted to the principles of food hygiene *General Principles of Food Hygiene CAC/RCP 1-1969, it means* "*assurance that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use*" (Codex Alimentarius 2009). This approach has been partially modified in the FAO/WHO Common Position from 2003 included in *Assuring Food Safety and Quality*, where food safety is understood as "*all those hazards, whether chronic or acute, that may make food injurious to the health of the consumer*" (FAO/WHO 2003).

For many years, food safety issues have been at the forefront of Community/EU legislation and activity, and therefore at the regional level. This is primarily a consequence of food incidents of the 1980s and early 1990s. This legislation, which can be considered surprising for some reasons, has not developed a common definition of food safety and what constitutes its essence. The main finding included in Regulation No 178/2002 recognises that food is deemed unsafe if it is considered to be: (a) injurious to health, (b) unfit for human consumption (Article

[8] The above term does not refer in any way to the research area and the identity of institutional economics.

14(2)) (Regulation..., 2002). It is, therefore, in a sense a negative (disqualifying) approach. An approach defining what should be considered unsafe food, not what food safety is. The EU approach, which should be assessed as positive, clearly outlines the area of interest of food safety. It includes the qualification of acts against which EU law is to protect consumers. Firstly, these are fraudulent or deceptive practices (Article 8(1)(a)), secondly, the adulteration of food (Article 8(1)(b)), and thirdly, any other practices which may mislead consumers (Article 8(1)(c)). The first area refers to a wide catalogue of acts which mislead consumers, mainly related to the threat to their health and life, i.e. health safety, the second include acts of adulteration of food, which form the economic safety of food[9]. Naturally, the safety from the point of view of the economic interests of consumers.

Food safety is formulated very differently in individual countries. Countries which have several different approaches to this issue are also not uncommon. An example of this is the USA.

Regulations regarding the most important American institution responsible for food safety – the U.S. Food and Drug Administration – state, in general terms, that food safety is a problem affecting all spheres from society, through government, industry to the academic community (FDA 2012). According to another American agency, the Food Safety and Inspections Service, "*Food safety are conditions and practices which protect food against contamination and food-borne diseases*" (FSIS 2018). In the report on the *National Agriculture and Food Defense Strategy* – 2015, which the US Ministry of Health and the Ministry of Agriculture presented to Congress, food safety is defined as "*the effort to prevent unintentional contamination of food products by hazards*" (Report..., 2015). In turn, already in 1990, the U.S. General Accounting Office adopted an approach assuming that measures in the field of food safety are aimed at ensuring that food is safe, clean, healthy and properly labelled (GAO 1990).

British Food *Safety Act 1990* (Chapter 16, part II (7)(1)) defines food safety by identifying prohibited operations which include: (i) adding any article or substance to the food, (ii) using any article or substance as an ingredient in the preparation of the food, (iii) abstracting any constituent from the food; and (iv) subjecting the food to any other process or treatment rendering food injurious to health. It is, therefore, an approach to food safety through defined prohibited acts which result in the loss of the status of safety by food products.

The Australia New Zealand Food Standards Code (Standard 3.1.1) assumes that food does not meet the safety condition, i.e. it is considered unsafe food, if it would be likely to cause physical harm to a person, assuming it was: (i) properly subjected to all processes that are relevant to its reasonable intended use, and (ii) consumed according to its reasonable intended use (Food Standards Australia..., 2016).

In Polish conditions, food safety means "*all the conditions that must be met, in particular regarding: (i) additives and flavours used, (ii) levels of contaminants,*

[9] Article 8(2)(c) of Regulation No 178/2002 is a "complement" to possible acts which do not qualify directly for the first two groups of food safety irregularities.

(iii) pesticide residues, (iv) food irradiation conditions, (v) organoleptic characteristics, and measures that must be taken at all stages of the production or marketing of food to ensure human health and life" (the Act of 2006, Article 3(1)(5), Announcement..., 2017).

The Association of State and Territorial Health Officials (ASTHO), which associates public health institutions and their employees in the USA, presents a classic approach to the area of food safety. According to the ASTHO (2018), food safety means a range of food-related activities from prevention and surveillance to detection and control.

The authors' trend naturally makes use of the achievements of the institutional trend, significantly enriching and developing a number of issues and problems related to food safety.

The authors' trend, of course, is much richer and more diverse than the institutional one, which should be attributed, as R. (Skip) A. Seward II cited above notes, to the excess of hypotheses and positions formulated. And even though it enriches the discussions and polemics revolving around food safety, unfortunately, it not always is an impulse for development of the discipline and its higher maturity in the advancement of its status as an area of science. Food safety in authors' research refers to, among others, issues such as:

- preventing food contamination,
- all conditions and practices which guarantee food free from contamination and pathogenic micro-organisms,
- ensuring that food is safe, clean, healthy and properly labelled,
- ensuring that food does not cause harm to consumers,
- all conditions and measures to be provided for food to be safe and healthy,
- all conditions which must be met and measures which must be taken to ensure human health and life,
- biological, chemical and physical hazards for food,
- part of the area of public health related to agriculture and other elements of the food chain,
- all properties of food products related to their ability to meet the needs of buyers and consumers.

Therefore, in the vast majority of approaches to food safety, the focal point of their considerations is the relation in the chain: food-consumption-effect. The main assumption of the concept of food safety boils down to the thesis that food (its consumption) cannot be the cause of harm or damage to the health of the consumer. However, individual concepts differ in aspects such as: (1) the scope of the hazards analysed (chemical, microbiological, material/physical, radiological), (2) completeness of the food chain (selected or all stages), (3) necessary measures and instruments to ensure food safety, (4) persons and authorities responsible for the state of food safety (government authorities, producers, consumers).

Therefore, as showed by this, by necessity, cursory analysis of approaches to the scope of food safety, three approaches are possible in the categorisation of this phenomenon:

- positive: consisting in the formulation of what is considered food safety (e.g. definition of FAO/WHO, FSIS, Polish Act of 2006),
- negative (falsifying): consisting in the quantification of events and processes which lead to the transition from the state of food safety to its loss, i.e. practically defining the concept of "unsafe food" (EU Regulation No. 178/2002, Australia New Zealand Food Standards Code),
- prohibitive: consisting in the recognition of certain acts and phenomena as prohibited by law, as they may lead to the loss of food safety (e.g. British Food Safety Act).

The vast majority of approaches to the issues which form food safety focus on its contamination and thus the so-called health security. That was the case at least until the end of the 20th century. Events which took place after that time, especially major scandals related to the adulteration of food, persuade an increasing number of researchers to expand the area of food safety by including economic issues, which determine the so-called economic food safety. According to K.H. Kuhne and K.J. Henning (2009), the primary goal of food safety, and thus protection of consumers, is protection of their health, protection against food fraud and provision of objective (reliable) information about food. The area of interest in food safety is presented similarly by P. Hariyadi (2014). According to this author, this includes: (i) protecting the health of consumers; and (ii) shaping the conditions for trade in the food sector.

It is worth emphasising that this dichotomous nature of food safety was noticed at virtually the same time by organisations such as the EU (2002, Regulation No. 178), the FAO and the WHO (2003). According to these organisations and institutions, the adulteration of food leads (may lead), firstly, to health risks and, secondly, to financial losses for consumers (FAO/WHO 2003).

Therefore, in general, food safety covers two aspects in its area of interest: (i) threats arising from the presence of foreign substances in food (contaminants, residues of pesticides and veterinary drugs, radioactive contamination), and thus health safety, and (ii) food counterfeiting, in particular the adulteration of food and its consequences, i.e. economic safety of food.

The diversity of approaches to the area of food safety represented by individual institutions and representatives of science proves that we are dealing with, using the terminology of T. Kuhn, the so-called pre-paradigmatic period in the development of science. A period so far without a common position based on paradigms and recognised research tradition, which is dominated by a multitude of research strands, approaches and hypotheses (Kuhn, 2011). After all, this is a situation typical for the initial stage of the separation of a new discipline, which in this case is food safety. However, it should be emphasised that recent years have brought greater and greater conformity, both on the part of representatives of the insti-

tutional trend and, although here with greater resistance, of the authors' trend, regarding the area of interest in food safety. The area which more and more often includes both health safety and economic security of consumers. The latter, first of all, following a growing wave of food adulterations revealed in virtually all countries and regions of the world.

The evolution of food safety

Food safety over the centuries

For centuries or even millennia, food production has always been the form of human activity which shaped interpersonal relations as well as social and economic bonds. For these reasons, from the earliest times, food has been the subject of interest of people and institutions involved in the practice of everyday life, as well as people associated with the intellectual and cultural sphere. That is why the first regulations of interpersonal relations known to us concern, among others, food, similarly to the first scientific and literary works.

The oldest regulations in the field of food safety refer primarily to the economic aspect, i.e. the adulteration of food. Adulteration or counterfeiting of food, because this practice is as old as the history of food itself, and certainly produced for commercial purposes. The Code of Hammurabi, which was created in the 18th century B.C. during the reign of Babylonian king, Hammurabi (1792--1750 B.C.), already includes a provision on how to pay for beer, specifying the punishment for the seller (innkeeper), among others, in the event of accepting an inflated payment for beer (Paragraph 108).

The Middle Ages are a period when attempts to counteract the adulteration of food are already becoming universal, also as a consequence of the widespread nature of these adulterations. The relevant decrees, royal/princely acts, and treatises constitute an important part of the activity of the then rulers. And this applies to virtually all monarchies, like England, France, Germany or Poland. These specific struggles generally go in two directions: (i) introducing uniform, mandatory measures and weights, and (ii) issuing "legal acts" specifying the quality parameters of selected food products and penalties for non-compliance.

One of the first decrees significant for development of trade relations was the English *Assize of Moneyers*, published in 1124 by King Henry I (1100-1135). This decree forbade the minting of inferior quality coins and introduced harsh, for those times, punishments for these offences. In turn, in the field of food production, one of the first and at the same time the most well-known, also nowadays, acts was the *Magna Charta Libertatum*, established on 15 June 1215 by King John of England. The Great Charter regulated many areas of political, social and economic life of England at that time. *Magna Charta* also set measures for the main food items on the market at the time, i.e. wine, beer and grain.

Other known and significant for development of activities in the field of "safety" of food production include: the Assize of Bread (Assisa Panis) issued in England

between 1266 and 1267, the ordinance issued on 25 November 1396 for Paris on the prohibition of colouring butter, the set of legal acts on the quality of beer: Augsburg (1156), Nuremberg (1290), Weimar (1348), Munich (1363, 1447), Landshut (Bavaria, 1409), Regensburg (1447, 1453), with the best-known German law on brewing issued by Duke William IV in 1516, *Reinheitsgebot*, the Olsztyn Bread Tariff prepared by N. Copernicus in 1531, and the Krakow Food Tariff of 1573 (Kowalczyk, 2017).

In the following centuries (sixteenth to eighteenth), the fight against food adulterations gradually moved to the level of collegial organs, which were gaining importance at that time (city councils, towns, local and national parliaments, assemblies). These bodies make law against the adulteration of food, establish more and more numerous control and inspection services, and enforce existing law.

The nineteenth century is a breakthrough in attempts to reduce food adulteration. A breakthrough for two main reasons: firstly, it is the beginning of the industrial era, a new structure of societies as well as professional and social groups. Anonymous food market is emerging, and this creates new temptations in terms of counterfeiting, lowering quality or even adulteration. There is a new type of defender in the battle for "clean food." It is a doctor, a pharmacist, first public officials, scientists and finally politicians. There is a stronger and stronger conviction that there is a need to introduce universally binding regulations in the field of food safety and quality. This is how the British Act of 1860 or the American Act of 1906 were passed – though after extremely long battles with opponents of such solutions, who were primarily food producers and politicians representing them.

Secondly, apart from the problem of food adulteration, the nineteenth century brings a new problem raised more and more strongly, which is health safety. The beginnings of mass production of food on the anonymous market cause larger and larger and more numerous threats to the health and life of consumers. While the sanitary conditions in which this production took place on a trade scale were under a certain "control" of consumers who, through daily contacts, signalled possible threats, with the mass production scale and anonymous market this consumer control disappears. This is because direct contact between the producer and the consumer disappears. An intermediate link – trader/seller – appears.

This, however, stimulates more and more research into the quality and safety of food, and the growing interest of the so-called public opinion in it. The nineteenth century, especially the second half of it, brings a real "avalanche" of scientific papers related to food quality and safety. Papers on the borderline of food technology, detection of its adulterations and diet health. A new ground for activity in this regard is emerging. This is no longer the interest of rulers in food typical for the Middle Ages, mainly due to the prevention of possible outbursts of dissatisfaction of subjects and possible acquisition of additional significant revenues to the treasury as a result of imposing financial penalties on food counterfeiters. This new, different ground for interest in food quality and safety is consumer interest. Health and economic interest.

The twentieth century, especially its second half and the modern period, after 2000, again brings increased interest in the problems of economic safety of food. This, in turn, is a consequence of the growing phenomenon of food adulteration. Out of 700 significant food incidents analysed by the author which took place in the world in 1828-2015, as many as 2/3 occurred between 2000 and 2015. This confirms the increase in the scale of food fraud over the last few decades. And even if we take into account the fact that in the nineteenth century the system recording food incidents was not as efficient as today, it is impossible to refer this remark to the entire second half of the twentieth century. This, in turn, justifies the conclusion that we are dealing with the so-called second wave of food adulteration in the world, after the first one which occurred in the nineteenth century, and mainly in the first half of this century (Kowalczyk, 2016). However, while the basic reason for the first wave was the industrial revolution, in the case of the second one this was globalisation and systematic extension of food supply chains. At the same time, it is worth emphasising that after centuries of antiquity and the Middle Ages of fight mainly for the economic safety of food, i.e. against its adulteration, in the nineteenth century there was an increased interest in both health and economic aspects, to give priority to economic safety (counteracting adulterations and lowering the quality of food) again in the second half of the twentieth century. It is also naturally a consequence of a significant reduction (although not elimination) of health threats as a result of improved sanitary conditions of food production in many regions of the world.

On the other hand, from the second area of human activity, i.e. scientific papers and literary works, one can also cite numerous examples devoted to food. For example, Plato (427-347 B.C.), in his famous work *Republic*, wrote "... no man desires drink only, but good drink, or food only, but good food. For good is the universal object of desire. And thirst being a desire, will necessarily be thirst after good drink," and continues "... if the badness of food communicates corruption to the body, then we should say that the body has been destroyed by a corruption of itself, which is disease, brought on by this" (Plato, 2003).

In the following centuries, there are naturally more and more examples of works devoted to food and its consumption, including those dedicated solely to issues of food quality and safety. Out of 150 publications on food and its quality analysed by the author which appeared between 1820 and 1920, more than 60% comes from 1850-1900, i.e. the initial period of increased interest in the issues of food safety and quality.

Food safety and quality in Poland

The issues of food safety and quality have been the subject of interest in Poland for many centuries. Admittedly, the first Polish codes, such as the Statutes of Casimir the Great (the Wiślica statute – before 1365, the Piotrków statute – 1356/7-1362), and the Krakow-Warta Statute of Władysław Jagiello (the Krakow statute – 1421, 1423), and the Statutes of Nieszawa of Casimir Jagiellon

(1454), did not refer to these issues. However, they formed the basis for such regulations, an example of which is the Krakow-Warta Statute of Wł. Jagiello. Article XXXI states, "for the Voivode and the Starost with other members of these Lands, each summer... measures of both rye and cloth, and other land things... and toll to establish, announce and bind... not to permit treachery on these measures and toll" (Helcel, 1856). Therefore, it is an unambiguous basis for issuing acts regarding prices, quality and conditions of sale of the most popular goods which were traded at that time, mainly food. These acts were the so-called Voivode Tariffs.[10]

An example of such an act is a tariff of Voivode of Krakow and Marshal of the Crown, Jan Firlej (1521-1574), who in 1573 issued an act regulating many areas of the then economy in the voivodship. This "Tariff of food and various things," as this act was described by J.U. Niemcewicz (1822), concerned, among others, matters such as: rights of guilds, measures and weights applied in the Krakow Voivodship, baking bread and brewing beer, meat trade, tanning leather, trade in wine and fish. In the area of quality and safety of food products, the Tariff provided, inter alia, that beer should be brewed only from "clean wheat," and a fine of 14 monetary units was imposed for the sale of underdone bread. Additionally, the Tariff of 1589 specified that 14 "czwiertnias[11] (of wheat) and not less" should be given for one batch[12] (Archive..., 1895).

The rules of beer production and trade were regulated much earlier – after other countries. Cities which received relevant provisions in this regard were, among others: Zawichost (1257), Krakow (1358), Halych (1408), Skaryszew (1473), Warka (before 1478), Leżajsk (1525), Sochaczew (before 1563) and Lublin (before 1570), and many other cities.

After regaining independence, the first act in the field of food safety was the Basic Sanitary Law of 19 July 1919 which provided, inter alia, that the authority of the Ministry of Public Health includes "sanitary supervision of foodstuffs" (Article 2(9)), and the authority of local government bodies includes cooperation with governmental authorities in this respect and "establishment and maintenance of slaughterhouses" (Article 3 (11) and (12)) (Basic..., 1919).

In turn, the first regulation dedicated exclusively to food matters was the Regulation of the President of the Republic of Poland of 22 March 1928 on the supervision of food products and objects of use (Regulation..., 1928). For those times, it was an extremely innovative law because it referred to and defined a full range of matters related to food safety, i.e. health safety and economic security. The Regulation included relevant definitions of a "spoiled" as

[10] The authorisation to issue tariffs included in the Krakow-Warta Statute was renewed in the Statutes of Nieszawa as well as the statutes of John I Albert of 1496. From the sixteenth century, these powers were gradually taken over by special committees appointed by the Sejm.

[11] *Czwiertnia* – unit of dry goods used in Krakow, equal to 30.75 litres.

[12] A batch is a unit of measure denoting a portion of beer obtained from one brewing, in other words obtained in one full production cycle.

well as "counterfeit", "adulterated" (adulterated by changing the composition of the product in question) and "falsely labelled" food product. The Regulation survived until 1970 when it was repealed by the Act on health conditions of food and nutrition of 1970 (the Act..., 1970). Moreover, this Act was to a certain extent a step backwards in relation to the 1928 Regulation; even though it specified that foodstuffs must not be "harmful to human health, spoiled or adulterated" (Article 3.1), in fact it was practically entirely devoted to the so-called health quality of foodstuffs. The fact that economic security was treated as a less important problem is also demonstrated by the level of penalties for individual irregularities: in the case of production and marketing of harmful foodstuffs, the penalty was up to 2 years of imprisonment, while for adulterated foodstuffs – up to 1 year.

Poland's accession to the EU in 2004 created a completely new situation in the field of food safety – the coexistence of EU and Polish solutions and regulations, whereas the latter, as we know, may not interfere with EU solutions.

Food safety in the EU

For several years of existence of the EEC, food safety has not been among the key problems in the functioning of this grouping. This happened quite rapidly which is why the Community/EU food safety system, as K. Kottenstede (2012) notes, "was born out of crisis". Crisis and in fact a whole series of crises, primarily of the 80s and 90s of the twentieth century. The turning point was 1978 and the discovery of mercury in Israeli oranges in the Dutch Maastricht and Haarlem (Shargil and Sedan, 1978) and the German Darmstadt (Doder, 1978). The Palestine Liberation Organisation claimed responsibility for this act of bioterrorism. A year later, on 13 February 1979, the Rapid Alert System for Food and Feed (RASFF) was launched. It was the first Community/EU system entirely dedicated to food safety of consumers of Member States.

Four basic periods can be distinguished in the activity of first Community and then EU bodies and implemented policies in the field of food safety:

– 1st period: until 1978,
– 2nd period: 1978-2002,
– 3rd period: 2002-2013,
– 4th period: after 2013.

In the first period, i.e. until 1978, the regulatory effort was directed towards two main issues, which were then: (i) creating the basis for financial support for agricultural holdings from the Community budget; and (ii) implementing legal and market solutions, including quality ones, for basic products and product groups, primarily agricultural, but also selected processed products. Thus, in this period, priority was given to quality, including standardisation of agricultural and food products. At the peak of the expansion of this scope of regulations, legal standards

covered 21 products and groups of agricultural and food products.[13] Food safety was not subject to separate regulations and measures taken.[14]

After the 1978 incident related to the contamination of Israeli oranges, the problem of danger to consumers resulting from the lack of regulations in the area of food safety was realised. As noted above, the RASFF was launched almost immediately to monitor food hazards. Food crises of the 1980s and 1990s deepened the belief in the need for further action. Extensive work was undertaken to create appropriate protection for the EU food market against the threat of further loss of its safety level. The Green Paper on food safety was published in April 1997 and Regulation No 178 laying down the principles and requirements of EU food law in 2002. This Regulation not only was and is a constitution in the field of food safety, but also created the institutional basis for the EU food safety system, establishing bodies such as: the European Food Safety Authority, the Standing Committee on the Food Chain and Animal Health, and formally – the Rapid Alert System for Food and Feed.[15] Therefore, the first elements of the EU food safety system were created.

The third period, i.e. 2002-2013, is a time of detailed specification and gradual development of the EU food safety system, primarily in the area of new solutions and regulations. In 2004, the set of legal acts provided for in Regulation No. 178/2002, regulating many areas of food safety, in particular the safety of animal production as well as food control and supervision processes in the Member States, came into force. The main weakness of this period is the "overvaluation" of the area of veterinary matters at the expense of projects integrating services responsible for food safety in individual Member States, as well as complete ignorance and, as a result, omission of the area of economic security (food adulteration) in measures taken. The end of this period was the eruption of the horsemeat scandal in 2013, associated with the discovery of mass food adulteration on the EU scale in this particular case of beef products with horse meat.

The fourth period starts with the so-called Coordinated Control Plan for a selected product group in all Member States, commissioned for the first time in the history of the EEC/EU by the European Commission. This group included products declared by producers as beef, and the controls were to exclude the use of horse meat for their production. The plan was implemented between March and April 2013. As shown by the controls, out of 27 Member States, the control services detected adulterated products in 22 countries, and after taking into account controls

[13] These regulations were repealed by Regulation No 1234/2007 of 22 October 2007 establishing a common organisation of agricultural markets and on specific provisions for certain agricultural products (Single CMO Regulation) (OJ EU L 299 of 16.11.2007).

[14] However, first initiatives in the field of general consumer protection were taken in this period. An example of such action is the Council Resolution of 14 April 1975 on a preliminary programme of the EEC for a consumer protection and information policy. It points to the need to protect the purchasers of goods or services from dangerous products, demands for payment for unsolicited goods and from high-pressure selling methods.

[15] Until 2002, formally the RASFF was operating without a legal basis.

commissioned by producers themselves, in 24 out of 27 controlled countries. Food adulteration has proved to be common and massive in the single market. As a result of the controls performed and in fact the results of these controls, a decision was made to launch an additional system for monitoring the economic security of food, i.e. food adulteration. The new system, namely the Administrative Assistance and Cooperation (AAC), was launched in mid-2013. The AAC contact points were also established in all Member States and a new unit responsible for economic food safety in DG SANCO (currently DG SANTE). Moreover, in 2018, the Knowledge Centre for Food Fraud and Quality was opened. This is how the EU food safety system, whose scope covers both health safety (RASFF) and economic security (AAC), was created and gradually developed.

Summary

Food safety as a new science discipline began to emerge, similarly to new disciplines in other domains and fields of science, under the influence of phenomena and problems which the existing disciplines could not effectively analyse or sufficiently explain. In general, this is how new disciplines – and nowadays, basically, interdisciplines – of science are created, as exemplified by behavioural finance, econophysics, biocybernetics, and also food safety. In addition, it is worth emphasising that often these new interdisciplines also emerge "under the pressure" of the needs of practice, economic, social and political reality. This was and is the case of food safety. In this particular case, this pressure was caused by phenomena related to the problems of food, hunger, food quality and, finally, threats to food safety in a rapidly globalising world. Phenomena and issues being the subject of meetings and discussions of bodies of international institutions, initiatives or agreements in many different areas, and in this particular case in the area of food, its quality and safety.

This widespread tendency of emergence of new (sub)disciplines of science is a process completely independent of political or administrative decisions regarding the categorisation of science, because it is a consequence of global economic, political and, more broadly, civilisational processes.[16] For these reasons, as noted by S. Flejsterski cited above, a significant feature of modern science is the emergence of separate scientific disciplines and subdisciplines at a relatively fast pace.

Due to a new, different dimension of contemporary challenges, only an approach using the existing achievements of other disciplines could analyse, explain and formulate rather acceptable canons, not to use the term "paradigms" at the initial stage of emergence of a new discipline. This way also gradually shaping the achievements of the new discipline. Food safety, as a new discipline, also uses such achievements. The achievements of at least disciplines such as: in the field of economic sciences: economics and commodity science, in the field of agricultural

[16] It is worth recalling here that the categorisation of only economic sciences adopted by the *Journal of Economic Literature* includes 20 disciplines and subdisciplines.

sciences: food and nutrition technology, and biotechnology, in the field of legal sciences: law (mainly food law, but also criminal law), in the field of social sciences: security studies, and sociology, and even disciplines such as: health sciences, family studies and medicine.[17]

As a science discipline, food safety has been growing more intensively since the 1980s and 1990s, although issues typical for it were obviously the subject of research and scientific and journalistic considerations much earlier, as the author wrote above. Academic fields of teaching, education and research teams related to the new discipline are created. So what was the impulse for such development? For the initiation of the process of the emergence of a new (sub)discipline of science and, consequently, new fields of teaching and education. The effects of globalisation in terms of food status should be considered the main one.

Globalisation brought many benefits for the global society and for individuals. These undoubtedly include increased flows of goods, freedom of migration, or new labour market opportunities. It also brought many unfavourable phenomena which include the increased rate of spread of zoonoses, food adulteration, understating the health status and the dominance of transnational food corporations and the economic degradation of small businesses, including traditional agricultural holdings. These phenomena dominated the global economy at the end of the 20th century. Attempts to counteract them at the forum of international organisations, i.e. the UN (FAO, WHO), with traditional methods, such as aid programmes, counselling as well as training and awareness-raising campaigns, have proven unsuccessful. A different approach was needed. Approach which would be more active, integrate different experiences and knowledge, coordinated at regional or global level, but with an active participation of individual countries, using new methods and means, including control, laboratory tests, and finally imposing and enforcing sanctions. This gave rise to the need for "intellectual support" from science. Science that would integrate research methods and achievements from many areas. Areas which give a chance to address not only the problem of food supply and access to it, but also the issue of its nutritional value, health values and its adulteration. Areas which propose solutions in this field but also in fields such as: the need to establish new control institutions, the conditions and scope of their cooperation, the tools and methods of control used, and finally the scale and severity of penalisation.

Food safety as a new emerging discipline of science faces serious challenges, such as developing own identity, including clear definition of the research field, research methods and own language. More and more opinions and positions indicate that this research field, or the scope of the studied reality, is: (i) health status of food; and (ii) economic status manifested in the scale of its "purity" and adulteration. Purity understood as compliance with the producer's declaration resulting from the applicable law, business ethics and rules of coexistence. Food safety as

[17] The cited division of sciences is in accordance with the Regulation of the Minister of Science and Higher Education of 8 August 2011.

an interdiscipline should be associated with a "multi-paradigmatic" nature rather than one generally accepted set of theoretical concepts and findings. Achieving a higher level of development requires dedication, work and open discussion on key aspects of representatives of science determined to engage in this new research area. The contemporary pre-paradigmatic period is, as T. Kuhn states, a time of "fundamental discussions on legitimate methods, problems and standards of solutions" (2018, p. 95). Only such a way guarantees development and maturation of a new discipline, and as a result its social and economic usefulness.

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BEZPIECZEŃSTWO ŻYWNOŚCI JAKO NOWA DYSCYPLINA NAUKI

Abstrakt

Artykuł poświęcony jest złożonym procesom rozwoju nauki, w tym zwłaszcza wyodrębniania się nowych dyscyplin i subdyscyplin wiedzy. Podstawowym jego celem jest ukazanie procesu oraz uwarunkowań wyodrębniania się nowej dyscypliny nauk, jaką jest bezpieczeństwo żywności. Bezpieczeństwo żywności jako nowa dyscyplina nauki zostaje wyodrębniona w oparciu o przedmiot, czyli status żywności w obszarze jej cech zdrowotnych i zgodności właściwości jakościowych żywności ze stanem faktycznym oraz celem, jakim jest ochrona życia i zdrowia konsumentów oraz ich interesów ekonomicznych. Bezpieczeństwo żywności, według terminologii Kuhna, znajduje się obecnie na etapie tzw. przedparadygmatycznego okresu rozwoju. Charakteryzuje go zróżnicowanie podejść do obszaru bezpieczeństwa żywności, zakresu badawczego oraz stosowanej terminologii. Należy jednak podkreślić, że ostatnie lata przyniosły coraz większą zgodność i to zarówno ze strony przedstawicieli „nurtu instytucjonalnego", jak i autorskiego w sprawie tożsamości bezpieczeństwa żywności jako (sub)dyscypliny nauki. Dotyczy to przede wszystkim obszaru badawczego, do którego coraz powszechniej zalicza się zarówno bezpieczeństwo zdrowotne, jak i bezpieczeństwo ekonomiczne żywności.

Słowa kluczowe: nauki ekonomiczne, rozwój nauki, żywność, bezpieczeństwo żywności, fałszowanie żywności.

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