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ENVIRONMENTAL INSURANCE AND ISO 14001 ENVIRONMENTAL MANAGEMENT SYSTEMS – ANALYSIS OF THE WILLINGNESS TO IMPLEMENT SYSTEMIC SOLUTIONS RELEVANT TO INSURANCE

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ABSTRACT: The first purpose of the research was to assess the dependence between the organisational decision-makers willingness to implement systemic solutions relevant to insurance (RSSs) and the attributes (systemic, awareness-related and organisational) of an organisation managed in accordance with ISO 14001. Another purpose was to identify the motivators that drive entities to implement additional system elements.
Earlier studies suggest that the structures of currently implemented ISO 14001 EMSs should be modified in order to increase their utility for the process of insurance provision.
The research problem was solved based on data obtained through an online survey among organisations implementing and certified ISO 14001 EMSs in Poland. Depending on the type of variables, the independence chi-square test, U-Mann-Whitney test, and the test of Spearman's rank correlation, among others, were used for analysis.
The results of the study may help build integrated environmental risk management tools. They indicate the legitimacy of using non-insurance motivators (e.g. reduction of environmental fees) to achieve the desired EMS structure in the organisation from the insurers' point of view. At the same time, they emphasise the need to build environmental risk awareness (including, among other things, the risk of liability for environmental damage and its severity) to achieve the above.

KEYWORDS: environmental insurance, environmental management system ISO 14001

Introduction

For over five decades, mankind has been dynamically engaged in building up the tools for managing environmental risk, unfortunately being somewhat uncoordinated and inharmonious in their actions (Lisowska, 2014). As a result, it is often impossible to benefit from the full potential of the proposed instruments. The article refers to the potential integration of two tools for environmental risk management: environmental insurance and environmental management systems according to the ISO 14001 standard (ISO 14001 EMSs).

In 2004, the EU implemented the directive on the environmental liability with regard to the prevention and remedying of environmental damage (ELD) (Directive 2004/35/CE). Article 14 of the Act urges the member states to encourage the development of financial security instruments to enable operators to use financial guarantees to cover their responsibilities under this Directive. The regular reviews of the Directive identify the ongoing problems relating to environmental insurance market development and indicate their potential solutions. In the most recent documents pertaining to this area, the European Commission has tackled the issue of the importance of the voluntary environmental risk management systems for the development of the financial security instruments market (European Commission, 2016; European Commission, 2017). The above assertion is the prime justification for the commencement of research devoted to the relation between environmental insurance and ISO 14001 EMSs.

ISO management standards (including the ISO 14001:2015 standard) are just a flexible framework for organisations' systems whose structures are contingent on decision-makers (Yin & Schmeidler, 2009). Consequently, ISO systems can be implemented in a way which takes into account the interests of environmental insurers. The decisions referring to this aspect are solely within the authority of the organisation's decision-makers.

The purpose of the research is the assessment of the dependence between the organisational decision-makers willingness to implement systemic solutions relevant to insurance (RSSs) and the attributes (systemic, awareness-related and organisational) of an organisation managed in accordance with ISO 14001:2015. Another purpose is the identification of the motivators (potential benefits that are recognised as motivating) for implementing the additional system elements.

The analysis was based on data obtained through an online survey among organisations that have implemented and certified ISO 14001 EMSs in Poland. Depending on the type of variables, the independence chi-square test, U-Mann-Whitney test, and the test of Spearman's rank correlation, among others, were used for analysis.

DOI: 10.34659/eis.2022.81.2.452

Literature review

The relation between environmental insurance and environmental management systems in compliance with ISO 14001 standard has been analysed by scholars for over two decades. Soon after the publication of the ISO 14001 standard, its potential utility for the process of insurance provision was detected (Swiss Re, 1998; Environmental Protection Agency, 2006), and scientists initiated studies of the possible applications of ISO 14001 EMSs in the course of providing insurance services (Minoli & Bell, 2002a; Minoli & Bell, 2002b; Minoli & Bell, 2003). Nevertheless, despite the initially strong interest in the integration of the analysed environmental risk management tools, it was never completed in practice. According to the insurance sector representatives, a lack of uniform interpretations of the standard and divergent and unsatisfactory implementations of the systemic solutions in organisations constitute the essential barriers to applying ISO 14001 EMSs in the process of insurance provision (Lemkowska, 2020b).

Parallel to the insurance-related scientific approach to the systems managed according to the ISO 14001 standard, analysis was undertaken of the motivators of systems implementation in organisations, pointing to those involving expectations of reduced insurance premium (Sorooshian, Qi, & Fei, 2018; Zutshi, & Sohal, 2004; Jovanovic & Janjiz, 2018; Hajduk-Stelmachowicz, 2013; Matuszak-Flejszman, 2010). The research, however, was only limited to identifying the motivators for system implementation. The decision-making process was neither examined in the context of the factors determining such decisions nor in the light of economic theories concerning decision-making. The causative relations were only analysed in the context of the already reached outcomes of systemic management.

It is tough to anchor a decision-making process to implement an ISO 14001-based system within decision-making economic theories. The variety of motivators (extrinsic/intrinsic; economic/environmental), flexibility in the construction of the system framework, and the simultaneous difficulty in predicting the outcome of system implementation – all the above elements make the decision-making process barely susceptible to formalisation or modelling.

Limiting the analysed objects to the motivators for implementing only the selected system elements (as opposed to a decision to implement the system itself) may partly reduce the research difficulties. The flexibility of the structure of ISO 14001 – compliant systems enables them to perform a wide range of functions. The selected system elements can be therefore connected with a limited set of expectations because of which they have been implemented. The statement above explains the choice of the research subject area.

DOI: 10.34659/eis.2022.81.2.452

The research to date proves that ISO 14001 EMSs implementation in any form does not by itself contribute to its utility for the insurance provision process. At the same time, however, a modification of the already implemented system (by complementing it with additional structural elements) may increase this utility (Lemkowska, 2020c). Therefore, the subject of this study is the willingness of decision-makers to implement the additional system elements.

However, within the present economic circumstances, the decision-making process that results in implementing these elements is burdened with various limitations (Hansson, 1994). Decision-makers do not know whether any desirable consequences will be brought about by the modification of ISO 14001 EMSs and what their nature will be; they have no guidelines as for how the environmental management system should be modified, and, finally, they are faced with a conflict of interests of the organisation's internal clients who pursue various goals due to ISO 14001 EMSs implementation. The above state of affairs renders the neo-classical theories of choice useless for the examined decision-making process. Expected utility rules were introduced as early as in the 18th century by D. Bernoulli (Makuch, 2012) and elaborated on in the mid-twentieth century by J. von Neumann and O. Morgenstern within the so-called normative theory of choice (Solek, 2010), propose an array of assumptions (Kotlarek, 2014) which are inadequate with regard to the situation in which the decision-makers have to make their choices in an ISO 14001 standard-managed organisation.

However, studies of the willingness to implement ISO 14001 EMS solutions relevant to the insurance process merge with behavioural theories of decision-making. They assume the existence of a rich, heterogeneous, individualised bundle of decision-making factors. Behavioural theories question the assumptions referring to decision-makers access to complete information and their full capability to interpret it, their unchangeable preferences[1], or sufficient numeracy to select the best option (Simon, 1955). Behaviourists also reject the assumption of the decision-makers substantive rationality, which means the assumption that subjects always have a pre-defined goal (e.g. maximisation of utility or profit) and pursue it rationally. Conversely, in behaviourists' opinion, a decision stems from complex thought algorithms which reflect the elaborate bundle of preferences instead of a limited set of mathematical decision axioms, the application of which guarantees maximisation of the expected utility (Simon, 1976)[2]. It is also counterfactual – according to behavioural theories – to claim that a decision-maker always

1 Assumption invalidated by Maurice Allais in 1953 in his experiment (Zaleśkiewicz, 2011).

2 Neoclassicists assume the rationality of market entities, whereas the market does not have the tools to generate the rationality of its entities (Mullainathan & Thaler, 2000).

DOI: 10.34659/eis.2022.81.2.452

aims to maximise numerically designated benefits. Observations lead to a conclusion that entities make satisfying decisions which do not necessarily maximise benefits (so-called satisficing theory) (Hansson, 1994).

The neo-classical theories treated making non-optimum decisions as a marginal phenomenon; they are diversions from the model, but within the market *en masse,* they cancel one another out (Fama, 1998). The neo-classicists did not research the premises for making non-optimum decisions. Nevertheless, they constitute the prime area of interest of behavioural economics. According to assumptions of behavioural economics, among other factors, are the cognitive capabilities, emotions, thinking patterns, habits, timing, situational context and social mechanisms (Śliwowski, & Wincewicz-Price, 2019), which create a broadly understood decision-making environment (decision-making architecture) (Thaler, Sunstein, & Balz, 2013).

Mullainathan and Thaler (2000) point to three essential traits of a decision-maker in the behavioural approach: bounded rationality, bounded willpower (the entities make decisions which are not suitable for them in the long term) and bounded self-interest (the entities take decisions that benefit others). The bounded rationality concept was created in 1955 by Simon (1955), although the term itself was only used explicitly two years later (Barros, 2010). It means that the entities pursue rationality, but they are limited by cognitive, emotional and situational capabilities (e.g. attempting to achieve contradictory goals). Thaler (1994) uses the term "mental accounting" to refer to complex mental acts attempted by decision-makers which lead to arrangements, assessment and analysis of the decision-making situation. In the course of the evolution of behavioural theories, a range of heuristics was identified (simplified mental rules) (Kaczała, 2019), which led to the occurrence of cognitive bias (Makuch, 2012; Solek, 2010) and caused diversions from optimum choices derived from the neo-classical approach (Cossette, 2014).

The catalogue of heuristics and the resulting cognitive biases is not complete. In its primary form, Tversky and Kahneman (1974) identified three heuristics (representativeness heuristic, availability heuristic, anchoring-and-adjustment heuristic) to which they matched thirteen cognitive biases (Tversky, & Kahneman, 1974). The following studies within behavioural economics have led and are still leading to the extension of the above catalogue[3].

The assumptions of behavioural economics are used in the analyses of the risk management process. Heuristics and cognitive biases, which are derived from the attributes of the risk subject, are indicated in numerous

3 Selection of the most often analysed heuristics (Kaczała, 2019); overview of studies on that area (Cossette, 2014); a record-breaking number of researched heuristics may be attributed to Manimal's work (1992). He studied more than 600 heuristics, which he next reduced to 186 grouped into 57 sets.

DOI: 10.34659/eis.2022.81.2.452

studies as a determinant of risk perception and risk control decisions (e.g. Slovic, Fischhoff & Lichtenstein, 1980; Janmaimool & Watanabe, 2014; Kaczała, 2019; Lemkowska, 2021) (Figure 1).

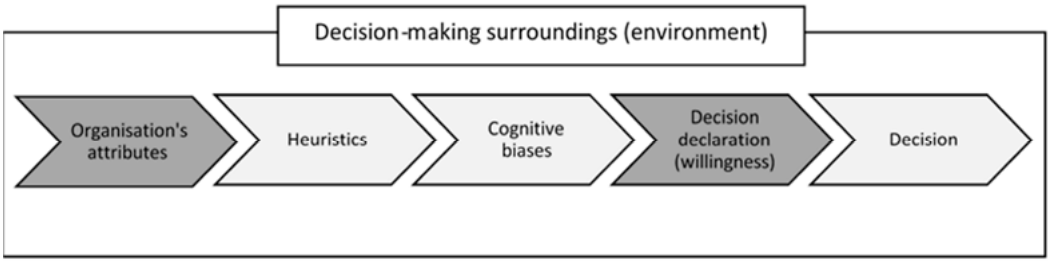

Figure 1. Elements of the decision-making process

Source: authors' work.

Behavioural economics helps explain anomalies which have remained beyond neo-classicists analysis (Solek, 2010) and have defied the mathematical tools which are unsuitable for a description of the full array of decision-makers' behaviours (Beed, & Kane, 1991). Behaviourists increase the realism of assumptions made for the sake of economic theories (Solek, 2010). Their assumptions are the fruit of observations of reality, and they do not result from the attempts to create simple mathematical models. Thanks to them, it is possible to break through the neo-classicists narrowness, rigidity and mechanical character (Tomer, 2007) and broaden the horizons of the analysis through the integration of economists' works with the accomplishments of psychologists[4], sociologists, anthropologists, cognitive scientists or even neurobiologists (Mruk, 2018). Another reason for the continuation of studies in the area of behavioural economics and compounding them with the analysis of the relationship between environmental insurance and ISO 14001 EMSs is that assumptions of behavioural economics were not created by the 20th-century economists. Their sources should be found amongst the classics of economics, i.e. in Smith's Theory of moral sentiments, in Bentham's works where the term of homo oeconomicus was created, or in Mill's paradigm of *homo economics* (Bogdanowicz, 2014; Solek, 2010; Camerer, & Loewenstein, 2004)[5]. Mathematisation has been dominating economics over the past decades, especially in the wake of V. Pareto's and his successors' accom-

4 The founders of behavioural economics are believed to be the psychology professors: Daniel Kahneman and Amos Tversky.

5 Some detect the sources of behavioural economics as early as in Xenophon's works (5th – 4th century BC), where he uses the term 'economics' while integrating within it the elements which today are attributed to psychological sciences (Bogdanowicz, 2014).

DOI: 10.34659/eis.2022.81.2.452

plishments (e.g. J.R. Hicks', R.G.D. Allen's, P.A. Samuelson's), has to be accepted as one of the many in the history of economic thought, albeit neither the dominating nor the only correct way of explaining economic phenomena.

Research methods

To denote the objective scope of the research and identify the barriers to the decision-making process, it is essential to demarcate the stages of taking the decisions in the organisation.

The process studied here refers to the form of environmental management system in accordance with the ISO 14001 standard. The standard itself determines the form. However, due to its flexibility, it remains individualised depending on the organisation's boundary conditions (e.g. the applied technologies, identified relations with the elements of the environment), as well as implementation motivators[6]. The catalogue of systemic solutions (the form of ISO 14001 EMSs) is not circumscribed. The limitations in attempting to demarcate the studied decision-making problem amount to, among other things, an undefined list of alternatives in the decision-making process (there is no catalogue of systemic solutions which would be considered by the insurance sector to be helpful for the decision-making process), an undefined record of motivators (the decision-maker does not know what effect will be derived from the implementation of particular systemic solutions), an undefined decision time horizon (which changes, in particular in the area of the environment, along with the changing regulatory conditions about sustainable development).

Research to date has shown that the structure of the currently implemented ISO 14001 systems in Poland only scarcely reflects the insurer's requirements (Lemkowska, 2020a). Hence, insurance companies hardly ever consider systemic management when assessing the potential insured's risks. At the same time, theoretical analyses imply quite a large potential utility of these systems for insurance purposes and their relatively straightforward

6 Research shows that the impact of EMSs implementation remains significantly dependent on the system implementation motivators. Environmental impact is inferior when obligatory extrinsic motivators dominate (Gavronski, Paiva, Teixeira, & de Andrade, 2013; Castka & Prajogo, 2013; Prajogo, Tang, & Lai, 2012). The obligation can be classified according to various criteria: according to the factual condition that it refers to, according to its origin, as well as the consequences of the lack of its realisation. The obligation can be realised concerning two factual conditions: ISO 14001 EMS implementation and certification itself or implementation of particular system elements. It may have an economic or legal dimension. In the first case, the source of obligation is legal regulations which provide for the consequences of the lack of ISO 14001 EMS implementation (e.g. more frequent inspections, obligation to obtain insurance for more significant sums of money). In the other case, the debt is created by the relations conceived within the economy. Modification of these relations is the sanction for failure to comply with this obligation (e.g. lack of permission to participate in a tender, potential lack of or inferior terms of insurance cover).

DOI: 10.34659/eis.2022.81.2.452

adaptability to the insurance sector expectations. There are hardly any incentives for such an adaptation in the present situation.

The choice of systemic solutions is part of the environmental risk management process. The research assumes a particular decision-making scheme in the risk management process (Figure 1). The subject analysed is merely a fragment of the elements which build up this scheme. The present study encompasses the analysis of the correlation between the organisation's attributes, the types of motivators (incentives, potential benefits) and willingness to implementation of additional system elements. The set of motivators drives the decision-making environment of the organisation.

There are seventeen variables describing the organisation's attributes, divided into systemic, awareness-related and organisational variables (Table 1). The index of independent variables was created based on research results regarding the identity of the factors which lead to a positive environmental impact (such as reducing harmful emissions and lowering consumption of natural resources). Although the past twenty years of the history of ISO 14001 environmental management systems have seen numerous studies of their functioning in the economic reality (Lemkowska & Wiśniewska, 2021), the subject of the relation between the positive environmental impact and the attributes of an organisation managed according to ISO 14001 standards has hardly been analysed.

The limited number of studies which concerned the above were devoted to the assessment of the relation between positive environmental impact and the attributes such as the size of the organisation, its ownership (private/public), sector (manufacturing/service), stability/changeability of the applied technologies, amount of time for which the system has been in operation in a given organisation, possession of quality management system in conformity with ISO 9001, or finally, the external/internal motivation for the system implementation (Matuszak-Flejszman, 2010; Prajogo, Tang & Lai, 2012; Boiral & Henri, 2012; Christmann & Taylor, 2006; Fura, 2013; Castka & Prajogo, 2013; Gavronski et al., 2013).

Based on the above, a catalogue of features and independent variables was divided into systemic features, awareness-related features, and organisational features. The independent variables are presented in Table 1.

DOI: 10.34659/eis.2022.81.2.452

Table 1. The catalogue of independent variables

Variables		Description	Measurement method/ categories
Systemic features			
I		Time span of systemic management	Qualitative variable, in ordinal scale Categories: 1) shorter than 5 years 2) 6-10 years 3) over 10 years
II	a b c d	Motivator for implementation of EMS Linked to environmental insurance risk Linked to other environmental aspects Financial Extrinsic	Four binary variables, meaning that a given motivator has been indicated (1 – if indicated; 0 – if not indicated)
Awareness-related features			
III		Subjective evaluation of organisation's exposure to environmental risk	Ranked variable, in the 5-level Likert scale, where: 1 – definitely not exposed to risk 5 – definitely exposed to risk
IV	a b c d e f	Subjective evaluation of the likelihood of damage occurrence Loss catalogue: Group A in surface waters, in groundwater in land in protected species Group B emissions of substances into the air energy emissions	Six ranked variables, in the 7-level Likert scale, where: 1 – causing this damage is entirely unlikely 4 – it is hard to say 7 – causing this damage is extremely likely
V	a b c d e f	Loss experience (particular damage was caused in the past) Loss catalogue: as above	Six qualitative variables, in nominal scale. Categories: No, such damage was never caused I do not know if a given damage was caused in the past Yes, such damage was caused in the past
VI	a … f	Loss experience (payment of compensations to third parties experienced in the past as a result of causing particular damage) Loss catalogue: as above	Six binary variables, where: 1 – compensation was paid, 0 – compensation was not paid
VII	a … f	Loss experience (environmental damage remediation costs incurred in the past) Loss catalogue: as above	Binary variables, where: 1 – costs were incurred; 0 – costs were not incurred

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Variables		Description	Measurement method/ categories
VIII		Subjective evaluation of likelihood of bearing the particular consequences resulting from damage occurrence	
	a	Catalogue of consequences:	
	b	Claims due to damage to property caused by emission	Ranked variables, in the 7-level Likert scale, where:
	c	Claims due to damage to person caused by emission	1 – entirely unlikely
	d	Environmental organisations claiming infringement of	4 – it is hard to say
	e	the environment as a common good	7 – extremely likely
	f	Obligation to remedy environmental damage in water according to ELA (…)	
		Obligation to remedy land damage according to ELA (…)	
		Obligation to remedy environmental damage in protected species and habitats according to ELA (…)	
IX		Subjective evaluation of severity of the particular consequences resulting from damage occurrence	
	a	Catalogue of consequences:	
	b	Cost of conducting remediation (cr) in water	
	c	Costs of cr in land	
	d	Costs of cr in protected species (…)	
	e	Volume of compensations paid on account of damaged property due to emissions	Ranked variables, in the 7-level Likert scale, where:
	f	Volume of compensations paid on account of damage done to person due to emissions	1 – Minor and entirely not severe
	g	Volume of compensations paid in response to environmental organisations' claims	4 – it is hard to say
	h	Loss of revenue due to breaks in operations	7 – Major and extremely severe
	i	Loss of reputation	
	j	Legal costs	
		Loss of permissions to conduct operations	
		Loss of competitive advantage	
		Loss of customers	
X	a		Ranked variables, in the 7-level Likert scale, where:
	…	Impact of legal acts on operations	1 – entirely no impact
	j	Catalogue of legal acts included 10 items	4 – it is hard to say
			7 – extreme impact
XI		Impact of regulations on operations	
	a	Catalogue of regulations:	
	b	Regulations on environmental permits	Ranked variables, in the 7-level Likert scale, where:
	c	Regulations on emission caps	1 – entirely no impact
	d	Regulations on civil liability for consequences of environmental damage (…)	4 – it is hard to say
	e	Regulations on obligation to remediate environmental damage	7 – extreme impact
		Regulations on disclosure of environmental information	

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Variables	Description	Measurement method/ categories
XII	Insurance against environmental risk	Qualitative variable, in nominal scale Categories: Organisation has civil liability insurance with an environmental clause or another specialised contract Respondent does not know if the organisation has this type of insurance Organisation does not have this type of insurance
Organisational features		
XIII	Number of employees	Qualitative variable, in ordinal scale Categories: Fewer than 10 workers 11-50 workers 51-250 workers 251-1000 workers More than 1000 workers
XIV	Type of operations	Qualitative variable, in nominal scale Categories: Operations in a single location Operations in several particular locations Services provided in various locations
XV	EPL classification (the organisation has been classified as prone to large or increased risk of a serious industrial failure)	Binary variable (1 – yes, 0 – no)
XVI	ELA classification (the organisation has been classified as a user of the environment, running operations which create a risk of environmental damage)	Binary variable (1 – yes, 0 – no)
XVII A / B	Environmental permits	Two measurement methods: Binary variable, meaning: organisation requires at least one environmental permit (1 – yes, 0 – no) Quantitative variable – the number of required permits

Source: authors' work.

Because of the barriers to decision-making identified above, the respondents[7] were asked about their willingness to implement "additional system elements" without their further specification. However, the motivators for the elements' implementation were indeed specified. Therefore, the respondents were asked if the organisation was willing to introduce an additional system element to achieve a particular goal. The willingness referred to seven types of motivators[8]:

7 Persons responsible for ISO 14001 EMS in an organisation.

8 Respondent also had the opportunity to indicate additional motivators which would persuade them to modify EMS. There were the following indications: "meeting the contractors' expectations" (1 response) and "obtaining state support" (1 response).

DOI: 10.34659/eis.2022.81.2.452

- group A consists of four non-insurance-related motivators (improvement of the organisation's image; reduction in environmental fees; obtaining tax reliefs; lowering other operating costs);
- group B consists of three insurance-related motivators (reduced insurance premium; increasing the scope of insurance cover; obtaining insurance premium subsidy).

First of all, the analysis was conducted about the correlation between the willingness to implement additional system elements and the organisation's attributes. To that end, willingness was described by two variables: (1) qualitative binary variable, denoting indication of at least one benefit from groups A or B, which encourages implementation of an additional EMS element – in brief, „WILLINGNESS"; (2) quantitative variable meaning the number of indicated motivators from groups A or B, further on denoted as "NUMBER OF MOTIVATORS".

The literature divides the motives for implementing EMS ISO 14001 into internal and external (Matuszak-Flejszman, 2007; Prajogo, Tang, & Lai, 2012; Boiral & Henri, 2012; Christmann & Taylor, 2006). Internal motives result from the organisation's own need to manage environmental aspects derived from environmental awareness, including awareness of environmental risks. External motives are, in turn, generated by various forms of coercion. Studies have shown that internal motives for implementing the ISO 14001 EMS were the most important determinant of achieving beneficial environmental effects (Gavronski, Paiva, Teixeira, & de Andrade, 2013; Prajogo, Tang, & Lai, 2012). Thus, they were the basis for the actual (material) rather than the formal implementation of the ISO 14001 EMS. The above leads us to assume that also internal (awareness) factors will be the main motivators for the implementation of additional system elements.

This hypothesis is also supported by studies from the area of risk perception determinants (not only the environmental one) and their influence on taking control actions in the risk management process (Slovic, Fischhoff & Lichtenstein, 1980; Breweret al., 2007; Kaczała, 2019; Toma & Mathijs, 2007).

Both research areas indicated above justify the formulation of the following hypothesis:

H1: Higher awareness of environmental risk (operationalised by awareness attributes of the organisation) increases the propensity to implement additional elements of the ISO 14001 EMS

Amongst the motives for implementing an ISO 14001 EMS, the literature identifies economic factors (e.g. reduction in environmental charges, taxes, waste management costs), contractual factors (e.g. ensuring the ability to deliver services/goods to the contractor) or legal factors (e.g. exemption from compulsory insurance, reduced frequency of inspections). The cata-

DOI: 10.34659/eis.2022.81.2.452

logue of motives is also fed by insurance factors (i.e. reduction of the insurance premium or increased coverage). The order of their indication in the motives' studies is significantly later, and their frequency substantially lower than other factors (Environmental Protection Agency, 2006; Sorooshian & Fei, 2018; Zutshi & Sohal, 2004; Jovanovic & Janjiz, 2018; Hajduk-Stelmachowicz, 2013; Santos et al., 2016). At the same time, studies conducted on the Polish market show that insurance is still of little importance in environmental risk management (Hęćka, 2017). The above leads us to assume that also the propensity to implement additional elements of the ISO 14001 EMS will be more often motivated by non-insurance factors, which justifies the formulation of hypothesis 2.

H2: Non-insurance motivators are more likely to positively determine an organisation's propensity to implement additional elements of an ISO 14001 EMS

The type of statistical features, the number of observations and the distribution of responses became the significant criteria of choice for statistical tests and inference methods about the dependence (or correlation) between them. Therefore, in the case of a binary and qualitative dependent variable, "WILLINGNESS":

- the independence chi-squared test was applied whenever the independent variable was also qualitative and nominal scaled or was an ordinal variable but with a relatively low number of possible variants;
- U-Mann-Whitney test was applied in the case of qualitative but ranked independent variables with a relatively high number of variants (e.g. 1-entirely unlikely, ... 7 – very likely), as it was impossible to conduct an independence chi-squared test because of too small expected frequencies in some cells of a cross table.

In the case of quantitative dependent variable "NUMBER OF MOTIVATORS":

- U-Mann-Whitney test was used for dichotomous independent variables and the Kruskal-Wallis test if the qualitative organisation attribute had more than two variants. The choice of the nonparametric test was caused by a distinct asymmetry of the quantitative variable distribution;
- the test of Spearman's rank correlation was applied in the case when the independent variable was quantitative or qualitative but ordinal one (with a relatively high number of variants); this choice was determined by the rank character of organisation attributes and also by the distribution of the variables (it wasn't normal).

What is more, whenever drawing conclusions concerning the features' correlation required multiple testing in pairs, the Bonferroni correction was applied. In all the cases, the correlation (or dependence) was considered sig-

DOI: 10.34659/eis.2022.81.2.452

nificant when the p-value of a given test did not exceed the statistical significance level of 0.05.

The other stage of the analysis was focused on particular types of motivators. At this point, it was investigated which potential benefits turned out to be motivating enough for an organisation to declare willingness to implement additional elements of EMS. Significantly, the frequency of indication of particular motivators was examined. Establishing sub-groups in the sample made it possible to verify whether the proportion of respondents willing to implement additional EMS features depends on the motivator type (therefore, the test of equality of proportions was carried out for each pair of motivators). Due to multiple pair comparisons, Bonferroni's correction was applied.

The analysis of the indicated motivators also let to find out how many of the motivators were selected by particular organisations and which motivators were connected to each other. The connection between motivators was reflected by the fact that they were chosen simultaneously as motivating to implement additional EMS elements. In order to evaluate the dependence between the motivating factors, for all the possible pairs of „potential motivators", values of conditional probability were estimated, i.e. a chance that a given „benefit" would be considered to be motivating to implement an additional EMS element on condition that the respondent thought another "benefit" as inspiring. The probabilities were estimated as fractions inappropriately defined sub-samples.

The data for the analysis was obtained using an online survey (October 2018 – May 2019). The invitations to participate in the survey were sent to 1612 organisations which had been certified for ISO 14001:2015 EMSs in Poland. 121 complete responses were returned. Enterprises employing from 251 to 1000 employees (33.06%) and from 51 to 250 employees (28.1%) were the most numerous groups in the sample. Only 7.5% of the surveyed organisations belonged to the category of "prone to large or increased risk of a serious industrial failure" (classification according to Environmental Protection Law), and 15.7% constituted an organisation classified as a "user of the environment, running operations which create a risk of environmental damage" (classification of the Environmental Liability Act).

DOI: 10.34659/eis.2022.81.2.452

Results

The results of tests regarding dependence between the willingness and organisation's attributes have been presented in Table 2; detailed findings (including the p-value given in brackets) were only mentioned if the dependence (correlation) could be considered statistically significant. The analysis discovered only a few statistically significant dependences between the organisation's attributes and the „WILLINGNESS" variable. The scarcity of these dependencies may result from the fact that most respondents (79.2%) declared thus measured willingness to implement additional system elements for at least one motivator.

Far more statistical dependencies (and correlations) were found when the research pertained to the correlation between "NUMBER OF MOTIVATORS" and the organisation's attributes. The detailed findings (Table 2) show that the correlation coefficients are positive. This means that the higher the rank attributed to the likelihood of loss occurrence as well as the level of the particular impact and loss severity, along with the highly ranked influence of legal acts and regulations concerning environmental liability, the more frequently the organisations declared willingness to implement additional system elements in order to obtain a given benefit (the number of motivators increases). At the same time, the values of correlation coefficients are not very high, which means that even though the correlations are statistically significant, they are not strong.

It should be added here that although being insured against environmental risk did not affect either the „WILLINGNESS" or „NUMBER OF MOTIVATORS", organisations which have acquired this kind of insurance declared with significantly greater frequency than others that they were willing to implement an additional EMS element to obtain an insurance benefit (73% cases vs 27% cases). Organisations in possession of environmental insurance, at the same time, indicated a more significant number of insurance-related motivators (on average, 2 out of 3 motivators in group B) than organisations which did not have this kind of insurance (the average amounted to 0.6).

It also turned out that the "NUMBER OF MOTIVATORS" was additionally contingent on the motivators which drove the implementation of the system. The increase in the value of this variable was affected by the fact that EMS was introduced for reasons related to environmental insurance risk, other environmental aspects as well as financial issues. Moreover, the number of indicated motivators was significantly higher when the organisation needed to obtain a permit to conduct its activities. However, the number of tickets itself did not affect the number of motivators.

DOI: 10.34659/eis.2022.81.2.452

Table 2. Dependences between willingness to implement additional system elements and organisation's attributes (the table omits the variables for which no statistically significant correlations were detected)

		Are they willing (indication of at least one motivator)? *	For how many motivators are they willing?*
I		Lack of dependence (I/d)	Lack of correlation(I/c)
II	a	(I/d)	Significant dependence (0.028)
	b	(I/d)	Significant dependence (0.048)
	c	(I/d)	Significant dependence (0.048)
	d	(I/d)	(I/c)
III		(I/d)	rS: -0.2 (0.025)
IV	a	(I/d)	rS: 0.197 (0.031)
	b	(I/d)	(I/c)
	c	(I/d)	(I/c)
	d	(I/d)	rS: 0.185 (0.043)
	e	(I/d)	(I/c)
	f	(I/d)	rS: 0.237 (0.009)
VIII	a	(I/d)	rS: 0.242 (0.008)
	b	(I/d)	rS:: 0.269 (0.003)
	c	(I/d)	rS: 0.192 (0.035)
	d	(I/d)	rS: 0.247 (0.007)
	e	(I/d)	rS: 0.228 (0.018)
	f	(I/d)	(I/c)
IX	a	(I/d)	rS: 0.208 (0.023)
	b	(I/d)	(I/c)
	c	(I/d)	(I/c)
	d	(I/d)	rS: 0.244 (0.008)
	e	(I/d)	rS: 0.191 (0.037)
	f	(I/d)	rS: 0.192 (0.036)
	g	Significant dependence (0.001)	rS: 0.360 (0.000)
	h	Significant dependence (0.002)	rS: 0.328 (0.000)
	i	Significant dependence (0.012)	rS: 0.353 (0.000)
	j	Significant dependence (0.029)	rS: 0.305 (0.001)
	k	Significant dependence (0.001)	rS: 0.362 (0.000)
	l	Significant dependence (0.002)	rS: 0.357 (0.000)
X	a	(I/d)	(I/c)
	b	(I/d)	rS: 0.183 (0.046)
	c	(I/d)	(I/c)
	d	(I/d)	rS: 0.193 (0.035)
	e	(I/d)	rS: 0.202 (0.027)
	f	Significant dependence (0.036)	rS: 0.181 (0.048)
	g	(I/d)	(I/c)
	h	(I/d)	rS: 0.19 (0.038)
	i	(I/d)	(I/c)
	j	(I/d)	(I/c)
XI	a	(I/d)	(I/c)
	b	(I/d)	(I/c)
	c	(I/d)	rS: 0.206 (0.024)
	d	(I/d)	(I/c)
	e	(I/d)	rS: 0.196 (0.033)

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		Are they willing (indication of at least one motivator)? *	For how many motivators are they willing?*
XII		(I/d) Significant dependence in group B (0.010)**	(I/c) Significant dependence in group B (0.005)**
XIII		(I/d) (not enough observations)	Significant dependence (0.027) – the largest numbers of motivators were indicated by organisations 51 – 250 and 250 – 1000
XVII	A	(I/d)	A: Significant dependence (0.019)
	B	(I/d)	B: Lack of correlation between the number of permits and the number of motivators.

*in brackets the p-values are given unless they exceed 0.05; r_S – the values of Spearman's rank correlation coefficient (displayed if significant)
** the analysis limited to group B motivators

Source: authors' work.

Further analyses proved that seven potential motivators were relatively frequently considered to be convincing to implement an additional EMS element (24.2% cases). Such a situation was more common than when no motivator was indicated (Figure 2).

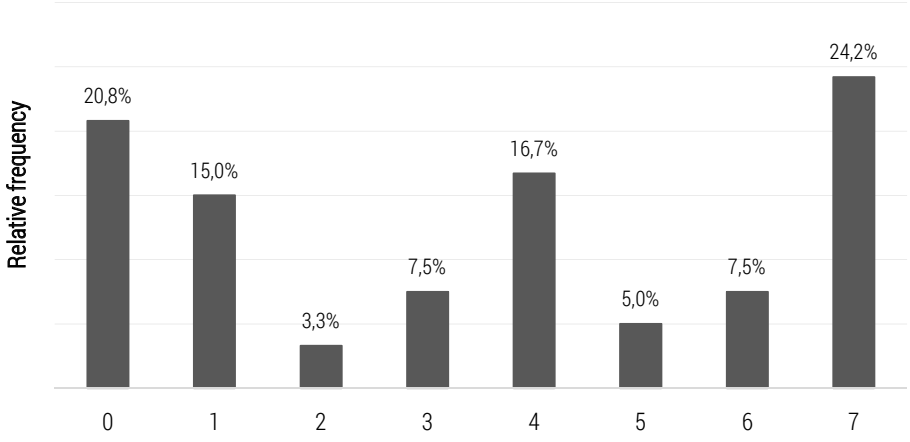

Figure 2. Distribution of the number of indicated motivators for implementation of additional system elements

Source: authors' work.

It should be emphasised that the overall percentage of indications for a particular motivator was not always similar (Table 3). The largest group – as many as 68.5% of the respondents were willing to implement an additional EMS element in order to enhance the organisation's image. Many organisations (65.8%) would like to reduce operating costs in this way. It is

DOI: 10.34659/eis.2022.81.2.452

meaningful that insurance-related motivators (group B) were indicated relatively more seldom; in this group, the most frequently selected motivator was the reduced insurance premium.

Differences in frequency of indications of particular motivators suggest a hypothesis that the declared willingness to implement an additional EMS element is contingent on the given motivator. This hypothesis concerning the correlation between willingness and the motivator type was corroborated by means of the equality of two proportion test. In Table 3, the highlighted boxes mark the cases where the proportions of those willing to implement additional EMS elements are significantly different. The results once more point to the disparity between group A (motivators unrelated to insurance) and group B (insurance-related motivators).

Table 3. The percentage frequencies of particular motivator indications and p-values for the equality of two proportion test

Motivators	non-insurance motivators				B – insurance motivators			Sample proportions
	a	b	c	d	e	f	g	
a	1.0000	0.0460	0.0178	0.6816	0.0001	0.0000	0.0000	68.3%
b	0.0460	1.0000	0.6985	0.1142	0.0402	0.0001	0.0005	55.8%
c	0.0178	0.6985	1.0000	0.0050	0.0968	0.0005	0.0019	53.3%
d	0.6816	0.1142	0.0050	1.0000	0.0004	0.0000	0.0000	65.8%
e	0.0001	0.0402	0.0968	0.0004	1.0000	0.0622	0.1452	42.5%
f	0.0000	0.0001	0.0005	0.0000	0.0622	1.0000	0.6907	30.8%
g	0.0000	0.0005	0.0019	0.0000	0.1452	0.6907	1.0000	33.3%

Source: authors' work.

As it has already been said, organisations often indicate a few potential motivators. The estimated conditional probabilities that particular motivators were indicated, presented in Table 4, show that there are correlations between the motivators: if one of the potential benefits appears to motivate the organisation, it increases the likelihood of another benefit also becoming a motivator for implementation of an additional EMS element. The strength of this correlation, once again, depends on the motivator type. The lowest conditional probability values were obtained in the case of benefits marked e, f and g (group B of motivators). Consequently, if the organisation was willing to implement an additional element for reasons unrelated to "insurance" (e.g. in order to gain a tax relief or to enhance the company image), it does not imply a substantial likelihood of recognising the insurance-related motivator (e, f or g) as convincing. Hence, group A of motivators (a-d) does not remark-

DOI: 10.34659/eis.2022.81.2.452

ably affect group B motivators' choice. There is, however, an inverse correlation: the selection of a motivator in group B implies that all the other potential benefits (both from group A and B) are highly probable to be recognised as motivating.

Particularly high values of conditional probability for group B motivators were obtained in columns f and g, which means that there are strong correlations in the group of insurance-related motivators; e.g. if it is known that benefits f and g are motivating for the organisation (i.e. an increase in the scope of insurance or obtaining an insurance premium subsidy), it is practically certain that a reduced premium will also turn out to be motivating. (Table 4).

Table 4. Estimates of conditional probability values for pairs of potential motivators

Estimate of the conditional probability that the motivator will turn out to be:	if it is known that the motivator is also…							Overall fraction of cases when a benefit was recognized as motivating
	a	b	c	d	e	f	g	
a – enhancement of company image	1.00	0.91	0.91	0.86	0.90	0.95	0.93	0.68333
b – reduced environmental fees	0.74	1.00	0.89	0.84	0.86	0.89	0.85	0.55833
c – obtaining a tax relief	0.71	0.85	1.00	0.80	0.92	0.92	0.90	0.53333
d – reduced operating costs	0.83	0.99	0.98	1.00	0.98	0.97	0.98	0.65833
e – reduced insurance premium	0.56	0.66	0.73	0.63	1.00	1.00	0.98	0.42500
f – increased scope of insurance	0.43	0.49	0.53	0.46	0.73	1.00	0.88	0.30833
g – obtaining an insurance premium subsidy	0.45	0.51	0.56	0.49	0.76	0.95	1.00	0.33333

Source: authors' work.

A similar situation can be seen in the case of group A motivators (a-d). Suppose it is known that any of the group A motivators was considered convincing. In that case, the likelihood of another group A motivator being convincing is very high – it often reaches beyond 0.9. The weakest influence on the selection of other motivators can be noticed in the case of motivator a, which refers to the enhancement of the company image.

Conclusions

Information about the willingness to implement additional elements of ISO 14001 EMS and its determinants make it possible to model the decision-making process in organisations managed in compliance with ISO 14001 standard. Planned system restructuring can directly facilitate the

DOI: 10.34659/eis.2022.81.2.452

increase in ISO 14001 EMS utility for the process of providing insurance cover (i.a., through the supply of the indispensable information for risk assessment or through physical control of risk). On the other hand, it may indirectly translate into the fulfilment of the demand relating to article 14 of ELD, which urges the EU member states to create the conditions for the development of financial instruments which may constitute a safety mechanism for remediation commitments, implied by the directive, concerning the damaged elements of the environment. In this context, restructuring the EMS according to ISO 14001 facilitates environmental risk management, which is one of the duties on the agenda for sustainable development within the EU.

The interested parties in the studied decision-making process may become its architects. The identified correlations point to the areas which are particularly relevant to the opportunity for deliberate modification of ISO 14001 EMS. The results of the study confirmed both previously stated hypotheses.

Firstly, a more frequent impact of non-insurance motivators was discovered on the declared willingness to implement additional elements of EMS. This means that the direction of change in the structure of environmental management, even if it is aimed at an increase in system utility for the process of insurance provision, should be stimulated not only by insurance-related motivators but also by motivators which appear to be more discernible for the organisation decision-makers (e.g. tax reliefs, reduced environmental fees or other factors which lower the costs and enhance the organisation's image at the same time). Insurance-related motivators present themselves as relevant, but it is true only for the group of organisations which have already signed environmental insurance contracts. They constitute a meagre percentage of the studied entities (15.3%). The survey did not produce results which would imply that the lack of insurance can stem from the lack of exposure to environmental risk or it is related to limited legal and insurance awareness. Nevertheless, considering the conclusions of previous studies, which point to the low understanding of the demand side as the prime barrier to the development of the insurance market (European Commission, 2016; Hećka, 2017), one can assume that some of the researched organisations most probably did not sign an insurance contract despite the exposure to environmental risk. Exclusive use of insurance-related motivators for planned restructuring of ISO 14001 EMS might, in fact, preserve the "lack of awareness" trap, as it would be effective only with regard to entities which have – thanks to signing the insurance contract – actually proved such awareness. On the other hand, creating a system of non-insurance incentives is rather complex, as it requires commitment not only from the insurance sector but also from the owners of the motivating instruments (including the

DOI: 10.34659/eis.2022.81.2.452

state in particular, but also environmental organisations which support the company image).

The research findings clearly suggest that except for the development of an effective motivator system, what strengthens the willingness for ISO 14001 EMS transformation of the organisation is the awareness-related attributes of the organisation. Organisations which ranked highly the subjective evaluation of the likelihood of damage occurrence (a, d, f), subjective evaluation of the likelihood of bearing particular consequences of the damage (a-e) or those which ranked highly the subjective evaluation of the severity of these consequences indicated more motivators which potentially could persuade them to implement additional ISO 14001 EMS elements. Also, more motivators were indicated by organisations which highly ranked the impact of most of the environmental legal acts on their operations, the impact of the regulations pertaining to civil liability for the consequences of environmental damage, as well as the legislation referring to obligatory disclosure of environmental information.

It is worth stating that the rare significant statistical correlations for the variable (1) describing the willingness to implement additional EMS elements (indication of at least one motivator) were identified in the area of variables describing awareness-related attributes of organisations. The sentence above refers to variants g-l of the variable "subjective evaluation of the severity of the particular consequences resulting from damage occurrence" and the variant f (act on environmental damage prevention and remediation) of the "impact of legal acts on operations" variable. Out of all the legal actions mentioned in the research, it is the latter that most remarkably determines the scope of insurance cover. High evaluation of its effect on the organisation's activities coupled with greater willingness to implement additional system elements emphasises how important it is for the process of integration between environmental insurance and ISO 14001 EMSs to develop legal awareness.

What is quite astonishing, though, is the outcome of the analysis of the correlations in the area of the "subjective evaluation of the severity of the particular consequences" variable. Significant correlations with the variable (1) of willingness were mainly discovered in those of its variants which do not pertain to the scope of insurance in the currently offered environmental insurance products (i.e. loss of reputation, loss of permissions to conduct operations, loss of competitive advantage or loss of customers). The variants „loss of revenue due to breaks in operations" and "legal costs" are the only ones which are found within the scope of insurance and, at the same time, in significant statistical correlation with the variable (1) of willingness. Focussing on the development of awareness regarding these two types of consequences of environmental damage may therefore lead to an increase in

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organisations' flexibility towards adapting their systems for insurance protection purposes.

The range of correlations described above leads to a multifaceted perception of the issue concerning the integration of the studied environmental risk management instruments. On the one hand, the addition of the insurance-related motivators to the array of incentives will be possible if the ecological awareness increases and leads to a greater frequency of finalising environmental insurance contracts. On the other hand, emphasis placed on the consequences of ecological damage not directly covered by insurance results in organisations' greater willingness to implement additional ISO 14001 EMS elements. Therefore it seems to make perfect sense – in the process of awareness development – to point at the indirect importance of insurance for minimisation of such consequences of damage as loss of customers, loss of competitive advantage, reputation or permissions to conduct operations.

As both the current study and previous analyses show, integration of ISO 14001 EMSs and environmental insurance seems to only be attainable in the long-term perspective (Lemkowska, 2020a; Lemkowska, 2020b) once multiple groups of stakeholders (insurance companies, the state, environmental organisations) have been involved in the process. Their commitment should be aimed at fostering organisations' insurance awareness and making the conditions of the decision-making process that will take place there increasingly accurate and precise. It is essential both to indicate the expected systemic solutions which will facilitate providing insurance cover and to build up a catalogue of motivators for implementing thereof. In view of the very meagre interest expressed by insurers themselves (Lemkowska, 2020b) due to i.e. the relatively small size of the environmental insurance market in Poland, the dominant role should be played by the public institutions. The fact that the EU agenda mentions environmental damage issues within the realm of sustainable development makes one anticipate an increase in the activism of various stakeholder groups in this area in the near future. The research findings suggest, at the same time, the validity of initiating integration measures in companies employing between 50 and 1000 workers in the first place. It was these organisations that indicated the largest numbers of motivators for which they were willing to implement the additional ISO 14001 EMS elements. The same is true for the entities which named among the incentives for system implementation the motivators connected with environmental insurance risk.

Further research should first of all be aimed at a precise description of the environment of the decision-making process studied here (the systemic elements applicable in the course of providing insurance cover; the willingness of the stakeholders to generate motivators for the decision-making process). The subjective scope of such studies should encompass the architects

DOI: 10.34659/eis.2022.81.2.452

of decision-making, i.e. stakeholder groups which represent the insurance sector as well as public institutions. Secondly, the economic efficiency and environmental effectiveness of the suggested ISO 14001 EMSs modifications should also be subject to analysis.

Acknowledgements

This research was undertaken as part of the project: Private insurance and environmental management systems complying with ISO 14001 as tools of environmental risk management – analysis of relations and were funded by a grant of the National Science Centre, Poland (2016/23/D/HS4/02654).

The contribution of the authors

Lemkowska M. developed the concept and assumptions of the research and conducted the online survey, which was the source of data analysed.

Wiśniewska D. worked out the statistical methods used to analyse the data.

Both authors prepared the conclusions part of the article.

References

Act of 13 April 2007 on environmental damage prevention and remediation (consolidated text: Journal of Laws of the Republic of Poland 2020, item 2187), Environmental Liability Act – ELA.

Barros, G. (2010). Herbert A. Simon and the Concept of Rationality: Boundaries and Procedures. Brazilian Journal of Political Economy, 30(3), 455–472. https://doi.org/10.1590/s0101-31572010000300006

Beed, C., & Kane, O. (1991). What is the Critique of the Matematization of Economics? Kyklos, 44 (4), 581–612. https://doi.org/10.1111/j.1467-6435.1991.tb01798.x

Bogdanowicz, B. (2014). Ekonomia behawioralna a klasyczny paradygmat ekonomii. Folia Pomeranae Universitatis Technologiae Stetinensis. Oeconomica, 313(76)3, 23–32.

Boiral, O., & Henri, J. F. (2012). Modelling the impact of ISO 14001 on environmental performance: A comparative approach. Journal of Environmental Management, 99, 84–97. https://doi.org/10.1016/j.jenvman.2012.01.007

Brewer, N. T., Chapman, G. B., Gerrard, M., Gibbons, F. X., McCaul, K. D., & Weinstein, N. D. (2007). Meta-analysis of the relationship between risk perception and health behaviour: the example of vaccination. Health Psychology, 26(2), 136–145. https://doi.org/10.1037/0278-6133.26.2.13

Camerer, C. F., & Loewenstein, G. (2004). Behavioural Economics: Past, Present, Future. In C. F. Camerer, G. Loewenstein & M. Rabin (Eds.), *Advances in Behavioral Economics* (pp. 3–52). New York: Princeton University Press. https://doi.org/10.1515/9781400829118-004

Castka, P., & Prajogo, D. (2013). The effect on pressure from secondary stakeholders on the internalization of ISO 14001. Journal of Cleaner Production, 47, 245–252. https://doi.org/10.1016/j.jclepro.2012.12.034

Christmann, P., & Taylor, G. (2006). Firm self-regulation through international certifiable standards: determinants of symbolic versus substantive implementation. Journal of International Business Studies, 37, 863–878. https://doi.org/10.1057/palgrave.jibs.8400231

Cossette, P. (2014). Heuristics and cognitive biases in entrepreneurs: a review of the research. Journal of Small Business & Entrepreneurship, 27(5), 471–496. https://doi.org/10.1080/08276331.2015.1105732

Directive 2004/35/CE of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage, Pub. L. No. 32004L0035, 143/56 OJ L (2004).

Environmental Protection Agency. (2006). *Financial Incentives from Environmental Management Systems (EMSs), Project Findings from Phase I*. Washington: Environmental Protection Agency. https://nepis.epa.gov

Environmental Protection Law of 27 April 2001 (consolidated text: Journal of Laws of the Republic of Poland 2019, item 1396), EPL.

European Commission. (2016). *REFIT Evaluation of the Environmental Liability Directive (Commission Staff Working Document)*. Brussels: European Commission. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52016SC0121

European Commission. (2017). *Multi-annual ELD Work Programme (MAWP) for the period 2017–2020: "making the Environmental Liability Directive more fit for purpose*. Brussels: European Commission. https://ec.europa.eu/info/sites/info/files/mawp_2017_2020_1_en_0.pdf

European Commission. (2018). Communication from the Commission to the European Parliament, the European Council, the Council, the European Central Bank, the European Economic and Social Committee and the Committee of the Regions Action Plan: Financing Sustainable Growth (COM(2018) 97 final). https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52018DC0097

Fama, E. F. (1998). Market Efficiency, Long-Term Returns and Behavioral Finance. Journal of Financial Economics, 49, 283–306. https://doi.org/10.1016/s0304-405x(98)00026-9

Fura, B. (2013). Improving ISO 14001 Environmental Management Systems. Polish Journal of Environmental Studies, 22(6), 1711–1721.

Gavronski, I., Paiva, E. L., Teixeira, R., & de Andrade, M. C. F. (2013). ISO 14001 certified plants in Brazil – taxonomy and practices. Journal of Cleaner Production, 39, 32–41. https://doi.org/10.1016/j.jclepro.2012.08.025

Hajduk-Stelmachowicz, M. (2013). Environmental Management System According to ISO 14001 as a Source of Eco-Innovations in Enterprises – A Case of Podkarpackie Voivodeship. International Journal of Economics and Management Engineering, 7(3), 650–655.

Hansson, S. O. (1994). *Decision Theory. A Brief Introduction*. Stockholm: Royal Institute of Technology.

Hęćka, A. (2017). Świadomość ubezpieczeniowa przedsiębiorców polskich w zakresie ryzyka środowiskowego – wyniki badań. Wiadomości Ubezpieczeniowe, 4, 41–51. https://doi.org/10.33995/wu2017.4.3

International Organization for Standardization. (2015). Environmental management systems – Requirements with guidance for use (ISO Standard No. 14001:2015). https://www.iso.org/standard/60857.html

DOI: 10.34659/eis.2022.81.2.452

Janmaimool, P., & Watanabe, T. (2014). Evaluating determinants of environmental risk perception for risk management in contaminated sites. International Journal of Environmental Research and Public Health, 11(6), 6291–6313. https://doi.org/10.3390/ijerph110606291

Jovanovic, D., & Janjiz, V. (2018). Motives for, Benefits from and Accounting Support to the ISO 14001 Standard Implementation. Economic Horizons, 20(1), 24–41. https://doi.org/10.5937/ekonhor1801027j

Kaczała, M. (2019). *Systemowe ryzyko suszy rolniczej a ubezpieczenia. Zadania dla państwa*. Poznań: Wydawnictwo UEP.

Kotlarek, P. (2014). Racjonalność w ujęciu ekonomii behawioralnej. Studia Ekonomiczne – Uniwersytet Ekonomiczny w Katowicach, 180, 106–116.

Lemkowska, M., & Wiśniewska, D. (2021). Elements of environmental management systems according to ISO 14001 relevant from the point of view of an insurance company – the results of empirical research. Argumenta Oeconomica, 2(47), 271 – 306. https://doi.org/10.15611/aoe.2021.2.12

Lemkowska, M. (2020a). *Systemy zarządzania środowiskowego zgodne z wymaganiami normy ISO 14001 na tle wybranych determinant rozwoju rynku ubezpieczeń środowiskowych*. Toruń: Wydawnictwo Adam Marszałek.

Lemkowska, M. (2020b). The use of ISO 14001 environmental management systems in the process of preparation and provision of environmental insurance. Acta Universitatis Lodziensis. Folia Oeconomica, 1(346), 63–83. https://doi.org/10.18778/0208-6018.346.04

Lemkowska, M. (2020c). ISO 14001 Environmental Management Systems Assessment From the Insurers' Point of View: Methodical Approach. In U. Akkucuk (Ed.) *Handbook of Research on Creating Sustainable Value in the Global Economy* (pp. 393-408). Hershey, PA: IGI Global.

Lemkowska, M. (2021). Perception of environmental insurance risk vs. implementation of control measures in organizations managed according to ISO 14001:2015 in Poland. Ruch Prawniczy, Ekonomiczny i Socjologiczny, 83(4), 187-203. https://doi.org/10.14746/rpeis.2021.83.4.13

Lisowska, A. (2014). Ochrona środowiska. In A. Florczak & A. Lisowska (Eds.) *Organizacje międzynarodowe w działaniu* (pp. 143–176). Wrocław: Agencja Reklamowa OTO.

Makuch, M. A. (2012). Decyzje podmiotów gospodarczych w ujęciu ekonomii behawioralnej. Zeszyty Naukowe Uniwersytetu Szczecińskiego. Studia i Prace Wydziału Nauk Ekonomicznych i Zarządzania, (27), 125–148.

Manimala, M. J. (1992). Entrepreneurial Heuristics: A Comparison Between High PI (Pioneering – Innovative) and Low PI Ventures. Journal of Business Venturing, 7(6), 477-504. https://doi.org/10.1016/0883-9026(92)90021-i

Matuszak-Flejszman, A. (2007). *System zarządzania środowiskowego w organizacji*. Poznań: Wydawnictwo Akademii Ekonomicznej.

Matuszak-Flejszman, A. (2010). *Determinanty doskonalenia system zarządzania środowiskowego zgodnego z wymaganiami normy ISO 14001*. Poznań: Wydawnictwo Uniwersytetu Ekonomicznego.

Minoli, D. M., & Bell, J. N. B. (2002a). Composite insurer consideration and attitudes on environmental management systems concerning public liability policies for pollution risks. Journal of Environmental Assessment Policy and Management, 4(3), 329-347. https://doi.org/10.1142/s1464333202001042

DOI: 10.34659/eis.2022.81.2.452

Minoli, D. M., & Bell, J. N. B. (2002b). Insurer perception of environmental management systems regarding insurance for pollution. Journal of Environmental Assessment Policy and Management, 4(3), 349–366. https://doi.org/10.1142/s1464333202001078

Minoli, D. M., & Bell, J. N. B. (2003). Reinsurers Opinions of Environmental Management Systems Concerning Insurance for Pollution. Journal of Environmental Planning and Management. 46(5), 771–780. https://doi.org/10.1080/0964056032000138490

Mruk, H. (2018). Ekonomia behawioralna a skuteczność zarządzania. Studia i Prace Kolegium Zarządzania i Finansów. Zeszyty Naukowe Szkoły Głównej Handlowej w Warszawie, 167, 9-19.

Mullainathan, S. & Thaler, R.H. (2000). *Behavioral Economics*. Cambridge: NBER Working Paper Series. https://doi.org/10.3386/w7948

Prajogo, D., Tang, A. K. Y., & Lai, K. (2012). Do firms get what they want from ISO 14001 adoption?: an Australian perspective. Journal of Cleaner Production, 33, 117–126. https://doi.org/10.1016/j.jclepro.2012.04.019

Santos, G., Rebelo, M., Lopes, N., Alves, M. R., & Silva, R. (2016). Implementing and certifying ISO 14001 in Portugal: motives, difficulties and benefits after ISO 9001 certification. Total Quality Management, 27(11), 1211–1223. https://doi.org/10.1080/14783363.2015.1065176

Simon, H. A. (1955). A Behavioral Model of Rational Choice. The Quarterly Journal of Economics, 69(1), 99-118. https://doi.org/10.2307/1884852

Simon, H. A. (1976). From Substantive to Procedural Rationality. In S. J. Latsis (Ed.) *Methods and Appraisal in Economics* (pp. 129-148). Cambridge: Cambridge University Press. https://doi.org/10.1017/cbo9780511572203.006

Śliwowski, P., & Wincewicz-Price, A. (2019). *Prościej, taniej i skutecznie, czyli jak ekonomia behawioralna wspiera polityki publiczne w Polsce.* Warszawa: Polski Instytut Ekonomiczny.

Slovic, P., Fischhoff, B., & Lichtenstein, S. (1980). Facts and fears: understanding perceived risk In R. C. Schwing & W. A. Albers (Eds.), *Societal Risk Assessment: How Safe Is Safe Enough?* (pp. 181–214). New York: Plenum Press. https://doi.org/10.1007/978-1-4899-0445-4_9

Solek, A. (2010). Ekonomia behawioralna a ekonomia neoklasyczna. Zeszyty Naukowe Polskiego Towarzystwa Ekonomicznego, 8, 21–34.

Sorooshian, S., Qi, L. C., & Fei, L. L. (2018). Characterization of ISO 14001 implementation. Environmental Quality Management, 27, 97–105. https://doi.org/10.1002/tqem.21532

Swiss Re. (1998). *Environmental management systems and environmental impairment liability insurance. Two areas in strained relations or in harmony?* Zurich: Swiss Re.

Thaler, R. (1994). *The Winner's Curse: Paradoxes and Anomalies of Economic Life.* Princeton: Princeton University Press.

Thaler, R. H., Sunstein, C. R., & Balz, J. P. (2013). Choice architecture. In E. Shafir (Ed.) *The behavioral foundations of public policy* (pp. 428–439). Princeton: Princeton University Press.

Toma, L., & Mathijs, E. (2007). Environmental risk perception, environmental concern and propensity to participate in organic farming programmes. Journal of Environmental Management, 83, 145–157. https://doi.org/10.1016/j.jenvman.2006.02.004

DOI: 10.34659/eis.2022.81.2.452

Tomer, J. F. (2007). What is Behavioral Economics? The Journal of Socio-Economics, 36(3), 463–479. https://doi.org/10.1016/j.socec.2006.12.007

Tversky, A. & Kahneman, D. (1974). Judgment Under Uncertainty: Heuristics and Biases. Science, 185(4157), 1124–1131. https://doi.org/10.1126/science.185.4157.1124

Yin, H., & Schmeidler, P. J. (2009). Why do Standardized ISO 14001 Environmental Management Systems Lead to Heterogeneous Environmental Outcomes? Business Strategy and the Environment, 18(7), 469–486. https://doi.org/10.1002/bse.629

Zaleśkiewicz, T. (2011). *Psychologia Ekonomiczna.* Warszawa: Wydawnictwo Naukowe PWN.

Zutshi, A. & Sohal, A. (2004). Environmental management system adoption by Australasian organisations: part 1: reasons, benefits and impediments. Technovation, 24, 335–357. https://doi.org/10.1016/s0166-4972(02)00053-6

DOI: 10.34659/eis.2022.81.2.452