Integrating Behavior Into Regional Resilience Concept for Sustainable Growth: An Example of Agricultural Sector

Integracja behawioru z koncepcją resilencji regionalnej na rzecz zrównoważonego wzrostu: przykład sektora rolnego

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Abstract

Regional economic resilience, which is a necessary and indispensable component for ensuring both regional and overall sustainability, is understood principally in relation to the system's structure and overall functioning ignoring human agency and its bounded rationality. This leads to missing important and potentially crucial elements fostering or hindering resilience, and consequently to designing resilience enhancing programs with low effectiveness. This paper argues that the focus of the resilience concept should shift from the system structure to the behavior of agents, since any outcome at the macro level is a product of the myriad of interacting behaviors. The structure of the system and all the context matters as the options for the behavior and which options are chosen depends on the internal factors of the decision maker. A framework, depicting the mechanism how the above mentioned factors interact and determine behavior thus consequently influencing resilience is proposed. An exemplary analysis of how to use the framework is also presented.

Key words: behavior, regional resilience, model, sustainability, risk management, agriculture

Streszczenie

Regionalna resilencja ekonomiczna rozważana jest przede wszystkim w odniesieniu do struktury systemu i ogólnego funkcjonowania, ignorując ludzkie działania i związaną z nimi racjonalność. Jest niezbędnym elementem zapewniającym regionalną i ogólną zrównoważoność, w szczególności w jej wymiarze ekonomicznym. Jednak wąskie podejście do niej w konsekwencji prowadzi do utraty ważnych, potencjalnie kluczowych elementów wspierających lub utrudniających resilencję, a zatem opracowywane tak programy mające zwiększać resilencję charakteryzuje niska skuteczność. W tym artykule sugeruje się, że celem koncepcji resilencji powinno być przesunięcie ze struktury systemu na behawior, ponieważ każdy wynik na poziomie makro jest wynikiem niezliczonych zachowań. Struktura systemu i cały kontekst ma znaczenie, ponieważ opcje zachowania i dokonany wybór zależą od wewnętrznych czynników decydenta. Zaproponowano ramy obrazujące mechanizm interakcji wyżej wymienionych czynników i determinujące zachowanie, a tym samym wpływające na resilencję. Przedstawiono także przykładową analizę korzystania z frameworka.

Słowa kluczowe: behawior, resilencja regionalna, modelowanie, zrównoważoność, zarządzanie ryzykiem, rolnictwo

Introduction

In the last decade the popularity of resilience has surged both within the various disciplines as well as among them. Politicians and various public bodies are actively adopting this concept too. This is no surprise, since resilience holds a large potential of securing viability of the relevant system in the

face of increasing pace of changes and uncertainty of the future, thus providing long-term sustainability. At the same time the practical application of the resilience concept is still in its infancy. The spread of usage is inhibited by several reasons. First of all, there is no consensus on what exactly resilience means, how it can be measured and even less in what determines resilience and how it can be increased. Without strong theoretical background it is hard to define practical guidelines. Second, the majority of resilience literature has focused on the structural aspects of the analyzed system without taking into account the bounded rationality of human agency which can significantly and unpredictably affect the resilience of the whole system. Implementation of any resilience-enhancing strategy inevitably involves changes of behavior of at least several agents (corporate or individual) therefore failing to consider potential behavioral aspects makes the effectiveness of those programs very low.

In this paper we focus on the latter notion – the necessity of integrating human agency into the resilience research with a special focus on the mechanisms of how resilience is influenced by behavior and how the latter is in turn determined by psychosocial factors.

First we give a short overview of resilience concept development in the regional economic literature. Then we provide basis for integrating human agency into regional economic resilience research followed by a model of behavior-resilience relationship. Finally we present a framework for practical implementation of a particular behavior-based resilience-increasing strategy together with an exemplary case study.

Ensuring sustainability through regional economic resilience

Resilience is broadly defined as the characteristic of a complex system to withstand external shocks, meanwhile sustainability (or sustainable development), although much harder to define, is usually described as *development that meets the needs of the present without compromising the ability of future generations to meet their own needs* (Brundtland Report, 1987). Sustainability starts with a functioning system, and then looks at how long that system can operate without wearing down. It also takes into consideration how a system's component functions can be improved so that the system can run continuously on its own. Resilience starts with a disaster, and then looks at how to clean up afterward. It then considers how to prevent or minimize a future disaster, or at least minimize the negative effects of the disaster. The end result may or may not be sustainable, although a sustainable outcome is ideal.

Speaking about resilience and sustainability means speaking about two highly abstract and multifarious concepts, each of which has a great variety of interpretations and definitions (Derissen et al, 2011). According to Derrissen et al. (2011) four relationships between resilience and sustainable development are distinguished: resilience of the system in a given regime is both necessary and sufficient for sustainable development, b) resilience of the system in a given regime is sufficient, but not necessary, c) resilience of the system in a given regime is necessary, but not sufficient, and d) resilience of the system in a given regime is neither necessary nor sufficient for sustainable development. Meanwhile, Lebel et al. (2006), Perrings (2006) strengthen, that resilience is seen as a necessary precondition for sustainability and sustainable development, economic activities and development strategy are sustainable only if the life-support ecosystems upon which they depend are resilient. All these provide an understanding, that resilience as a capacity to overcome unexpected problems, adapt to change, prepare for and survive catastrophes in its continuity becomes a basis for sustainability.

Within the literature on regional economic resilience three different uses of the term can be distinguished (Boschma, 2015). The first one comes from the physical sciences and is called engineering resilience. It focuses on the resilience as the ability of the system to quickly recover or bounce back from the shock to a pre-shock state or development path (Hill, Wial and Wolman, 2008). The second definition comes from the ecology field and defines resilience as system's ability to absorb shocks. It emphasizes stability of system structure, function and identity in the face of shocks (Martin and Sunley, 2015). The third concept is based on the adaptive capacity of the system, highlighting the need for adaptability and transformability in order to be resilient. First found in psychological sciences it was extended to organizational theory and theory of complex adaptive systems (CAS). This definition is preferred by evolutionary economic geographers since it parallels with the main ideas of the field, namely path dependency, non-equilibrium dynamics and constant change (Bristow and Healy, 2014). Finally, some authors integrate all three notions under one umbrella, suggesting that regional economic resilience is multidimensional, embracing resistance to shocks, and recovery from them as well as transformation leading to new growth paths (World Economic Forum, 2013).

Although quite different all these conceptualizations of resilience have common grounds. First, all of them define resilience in terms of the functioning of the regional economy as a system. Second, they all measure overall economic performance as a means to evaluate resilience. And finally, and most importantly, all of them focus on system structure features as the determinants of resilence (Bristow and Healy, 2014). For example, some researchers argue that inherited regional production structures determine how regions react to recessionary shocks and to what scope and how fast recover after

them (Hill et al., 2011). There is a lot of research dedicated to finding out if and what industrial structure leads to resilience (Desrochers and Leppala, 2011, Evans and Karecha, 2013, Doran and Fingleton, 2013).

Other researchers emphasize a plethora of inherent as well as nurtured factors influencing coping ability of a region. For example, Briguglio et al. (2006) hypothesize that resilience stems from macroeconomic stability, microeconomic market efficiency, good governance and social development. Wink et. al (2018) emphasize economic structure, community networks, skilled workforce and government policies. Still other focus on how system structures go through adaptive cycles of change and resilience depends on the phase of cycle the system is in (Simmie and Martin, 2010).

Consequently regional economic resilience, despite different perspectives, is understood principally in relation to the system's structure, performance and overall functioning (Bristow and Healy, 2014). Such structural point of view led to ignoring a potentially crucial component of resilience – namely human agency and its power and willingness to create and change or on the contrary – to keep the status quo locked in. Even when CAS perspective looking at regional economies as collections of myriad of interacting agents (workers, businesses, government, etc.) is being adopted, the incentive, motivation and proactive power of human agency if left somewhere behind.

Despite acknowledging the role of the behavior in resilience conceptual models, when planning for resilience, whatever the scientific approach, the behavior change of relevant actors is at least one of the targets. The behavior is then most often treated as some universal actions made by a more or less homogenous set of actors (de Bruijn et al., 2018, Mehmood, 2016, Resilience Alliance, 2010). Quite on the contrary to marketing professionals who perceive potential customers as a very varied set of individuals and perform an extensive research on their motivations, preferences, lifestyle and habits before suggesting them company's products or services. If a company doesn't know its customer, good sales are more of accidental nature than that of a planned one. However many governmental bodies and various public institutions still develop programs for others based on their own understanding of others' problems (World Bank, 2015). Consequently many of those programs fail or do not produce the expected results (ibid).

Integrating agency into regional economic resilience

Despite the focus on the structural components of the system many authors admit (Martin and Sunley, 2015, Briguglio et al., 2006, Hill et al., 2011) that resilience is nurtured and depends mainly on the actions of the myriad of economic agents. However these actions (or as we call it here – behavior) apart from being mentioned are not rendered with any further attention. Nevertheless we argue that exactly the behavior is at the core of the resilience.

The underpinning logic is straightforward. **First of all, all the developments at the macro level depend on the activities at the micro level**. Let it be industry structure, export concentration or supply chains – all and each of them depend on the choices and actions made by lots of entrepreneurs, company leaders and government. **Second, any outcome at the micro level depends on the human action** (or inaction, since inaction is also an action). Low interest rates or good equity market conditions just by themselves do not mean anything until human choice is made and an action towards exploiting or not exploiting these conditions is being done. Of course, it is not to be said that financial arrangements or other context do not matter – on the contrary, they do matter. But not by their mere existence – they matter as options of possible choices from which a human chooses the ones to exploit. Accordingly business structure, financial arrangements, labor market conditions in different countries or regions may present more or substantially less options to choose from, however the choice of one or the other option and the effectiveness of its implementation is contingent on the behavior of a human agent. A wide array of research (Obschonka et. al, 2016, Steel, Rinne & Fairweather, 2012) show that regions subject to the same macroeconomic forces and having similar economic structure perform very differently. It is because that with the same set of structural elements there is a huge set of possible choices. Which ones would be selected depend first of all on the human agency. **Third**, as it is widely acknowledged in psychology and behavioral economics, humans are not always rational. Moreover, they are more often irrational than rational (World Bank, 2015). Humans have a limited cognitive capacity and therefore use mental shortcuts and automatic models for filtering and interpreting information (ibid). This means that a human will never be able or even willing to identify, explore and evaluate all the available options. Instead he looks only at the most salient[1] options. The implications are that **it is not the real options that**

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[1] Saliency – aspect of a stimulus that, for any of many reasons, stands out from the rest. Salience may be the result of emotional, motivational or cognitive factors and is not necessarily associated with physical factors such as intensity, clarity or size (Wikipedia, 2020).

matter, it is the options that human agency conceives as possible that matter. An entrepreneur acting in the same context and with the same resources after a shock to the market can conceive several opportunities as available on the contrary to the conventional businessman who sees none. Or, if a small business owner holds a negative attitude towards borrowing and prefers better to work with an outdated machinery instead of investing in a new one and thus expanding business through taking a loan, even very good loan conditions and additional state support provided to subsidize loan interests may have no impact. In other words, although taking a loan is one of the options for the businessman to develop his business, it is not considered as a possible one.

Human behavior depends on a wide array of internal factors, including attitudes, beliefs, social norms, values, fears, trust, etc. Through modifying behavior they have a huge impact on economic performance. Rose et al. (2009) found that fear costed more than 85 billion US dollars for the US economy, due to a decline in airline travel and related tourism (even after adjusting for the downturn in both of these activities due to the pre-9/11 recession) (Rose, 2009). Human motivation and willingness to act and to adapt to changes was estimated to be a major prerequisite for business continuity with all its consequences for resilience (ibid). And Bristow and Healy (2017) make a conclusion that innovation (which is widely accepted as one of the main drivers of regional resilience) is a mindset and a capacity as much as an outcome. All these examples lead to a conclusion that internal human factors can't be ignored in researching resilience.

Summing it up, the regional or sectoral resilience is determined by the reciprocally interacting behaviors of the myriad of agents (workers, business, government, etc.) which are in turn determined by two blocks of factors: external (or the context), representing all the possibly available options, and internal, framing the *window* or lens through which these options are seen, evaluated, chosen and implemented (Figure 1). In the next section we discuss these factors and the whole model in detail.

Behavior based resilience model

The above model is based on ones of the most widely used theories for explaining human behavior and designing interventions for changing it, namely the Socio-ecological Model (Bronfenbrenner, 1989) emphasizing the different layers of influence (individual, community, organizational and political) on human behavior, Social Cognitive Theory (Bandura, 1986), explaining the reciprocity of relationships between personal factors, behavior and environment, and Theory of Planned Behavior (Ajzen, 1991), explaining how personal factors influence intention

and behavior. Since each theory analyzes human behavior from a different view-point, we integrate them to see the whole picture. According to these theories human behavior is influenced by internal (arising from within the human) and external (arising from outside the human) factors. Both sets of factors are discussed in detail below.

Internal factors. Standard economic theories most often assume that people are rational beings, who consider all possible options, evaluate their costs and benefits from a selfish perspective and according to the results make a decision. However people are nothing like that although many think of themselves as such. Rather, people are malleable and emotional actors whose decision making is influenced by contextual cues, local social networks and social norms, as well as shared mental models, which all play a role in determining what individuals perceive as desirable, possible, or even *thinkable* for their lives, what they pay attention to and how they evaluate possible options (World Bank, 2015). Many resilience researchers (Boschma, 2015) do mention institutions (formal and informal) as playing some role in shaping regions' or sectors' resilience; some (Martin and Sunley, 2015) go a bit deeper alluding to the role of attitudes and expectations. However, in most cases these factors are only mentioned, without going into any detail of how they really work and what is their effect. Thus important elements, hindering or fostering resilience are missed.

According to the Theory of Planned Behavior psychosocial factors comprise attitude towards a particular behavior (subjective value or evaluation of each outcome), social norms (perceived social pressure) and perceived behavioral control (the extent to which people believe that they can perform a given behavior) (Ajzen, 1991). In the extended models of TPB more factors are singled out as influencing behavior directly and indirectly (through the impact on the beliefs) – namely habit and trust (Giampietri et al., 2018, Leung and Chen, 2017, Hagger et al. 2002). Trust is one of the psychological constructs rendered significant attention in the resilience literature and widely acknowledged as an important factor leading to enhanced economic performance and greater resilience (Algan and Cahuc, 2010, Boschma, 2015). In economic literature trust is most often operated as a shared asset residing as social capital in various networks (Boschma, 2015, Aldrich, 2017). However each individual holds certain general and particular beliefs about if and whom to trust, therefore it is an individual factor as well.

Habit in contrast has received undeservedly very little attention. But research shows that habitual behavior is a very significant factor leading to behavior lock-ins and misses of occurring opportunities (Maréchal, 2010, Murray and Haeubl, 2007, Barnes et al., 2004). Therefore, it may be a strong inhibitor for resilience enhancing behaviors.
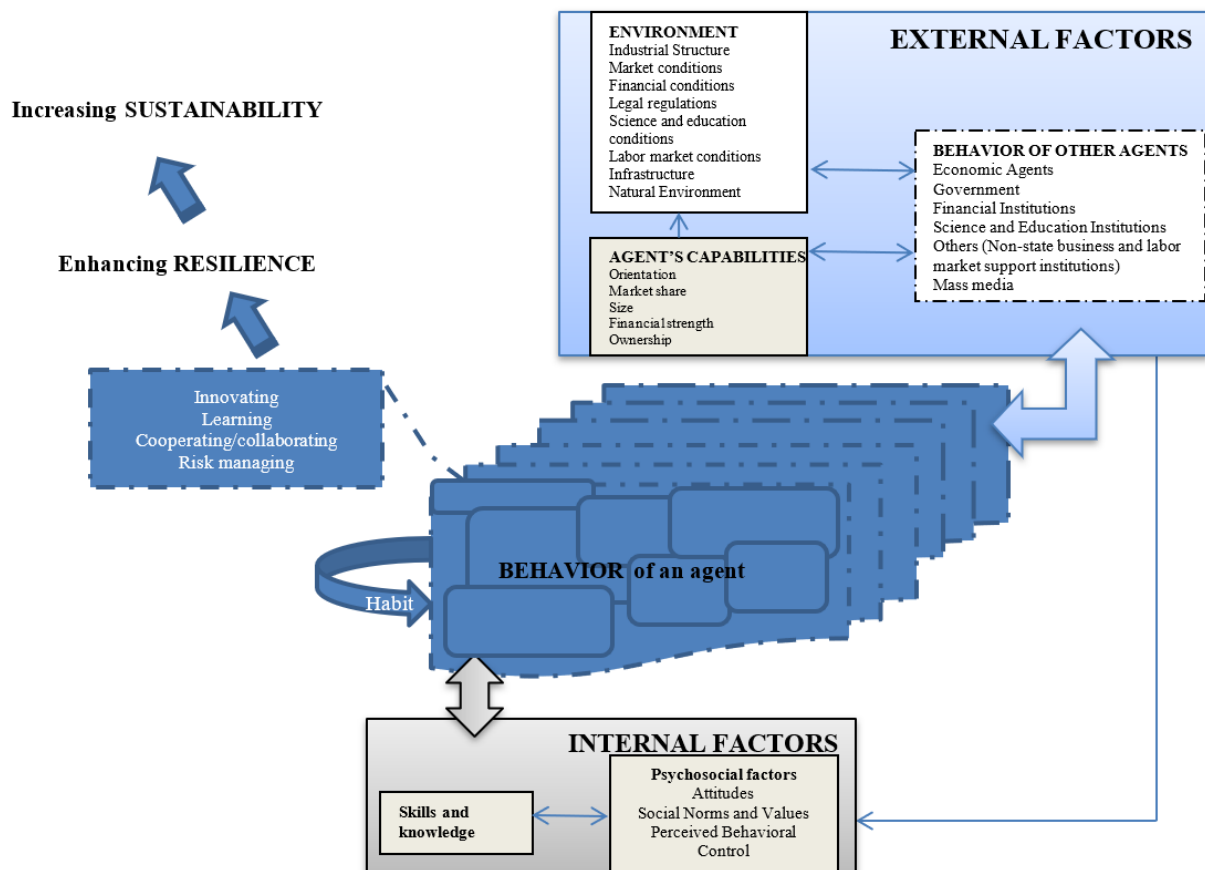
Figure 1. Behavior-based resilience model, source: compiled by authors, 2019

The other relevant group of internal factors is skills and knowledge. The importance of them as drivers of resilience is widely acknowledged. Human education and/or skills are integrated into the majority of resilience models (Hill et al., 2011, Martin and Sunley, 2015, Boschma, 2015), therefore the argumentation why it is important, will not be expanded here. Instead we argue that its influence on the resilience is not direct, but acts indirectly through influencing behavior. Its influence on the behavior is twofold: direct and indirect, through influencing psychosocial factors (attitudes, social norms and perceived behavioral control), which in turn influence skills and knowledge through feedback mechanisms (World Bank, 2015). In the model skills and knowledge are combined with psychosocial factors under internal factors block alluding to the idea that they are influencing human from within. These factors together form *a window* from which one perceives and evaluates the world (ibid) and makes a decision if, when and how to act.

The relationship between internal factors and behavior is reciprocal: not only internal factors influence behavior but they are influenced by the behavior as well (Bandura, 1986). When people for one or the other reason engage in a certain behavior their attitudes may change depending on the outcomes, making the behavior more or less probable in the future.

External factors represent the context or in other words, all the possibly available options for the agent. These options are defined by three main groups of external factors: environment, agent's capabilities, and the behavior of other agents.

Environment represents all the available options at some point in time. For example, the existence of supply of credits for start-ups provides a possibility (i.e. an option) for a company to apply for a credit. The company may or may not apply for it, however its existence makes one of the available options to act upon. The more the options, the more flexible the company's or individual's answer to the change may be. As flexibility (due to the diversity) is ubiquitously indicated as one of the main elements of adaptability, and adaptability – as one of the main capacities for resilience (Martin and Sunley, 2015, Resilience Alliance 2010, Carpenter et al, 2001), the breadth of choice is an important factor in increasing resilience.

Which elements of the environment are relevant for the issue at hand depends on the actor. For a private service company it may be legal regulations, interest

rates, labor market and natural resources, for a governmental body – international regulatory arrangements, tax revenues, external debt and budget deficit; and for a science institution – infrastructure, e.g. if there is no educational infrastructure to prepare high quality rocket engineers and it is costly to acquire, science and education institutions will most probably not offer a program for preparing rocket engineers.

Environment reflects the static state of the context, whereas the behavior of other agents represents its dynamics. The others' behavior may either directly limit/expand the available options for an agent or change the environment and thus indirectly change the availability of options. If one company breaches trust, the relationships between this company and its partner would either break off completely or have a long term negative effects (directly limited options of cooperation). If there is a research institute in an area and government starts an incentive to encourage business-science communication, a company may start a very productive relationship with that institute, which can boost company's performance and resilience in hard times (indirectly expanded options for cooperation). These relationships reflect the feedback mechanism between the behavior of other agents and the environment. The interaction is reciprocal, i.e. both sides directly influence each other. When government issues new waste management regulations (behavior), these regulations change the legal conditions and at the same time alter market conditions by imposing waste management taxes, which in turn directly influence how much tax revenue the government will get and will be able to act on.

Agent's capabilities may include its size, ownership, financial strength, network relationships, employees' skills, market share (for the private companies), etc. These capabilities are included in the external factors' block since they limit the amount and quality of possibly available options (or to be more exact the relevant environmental conditions) to act upon. A financially sound firm holds a much greater chance to get a credit (if applied), to get a larger one and with lower interest rate when a crisis hits than a company with a bad credit history.

What needs to be mentioned however is that the breadth of choice just by itself does not increase resilience. As it was argued before, an agent must consider these options as possible ones in order for them to have any impact. In other words, the internal factors limit the really available options for the entity to the options subjectively perceived as available.

External factors not only directly influence behavior through the availability of options, but they also have an indirect effect by impact on the internal factors. External factors may influence skills and knowledge as well as psychosocial factors, such as attitudes or perceived social norms (Bandura, 1986). For example, the rise of the shared economy has an impact on the attitudes towards sharing things (apartments, cars, etc.) and even if the initial attitudes were negative, the existence of the practice together with the observation of others doing it may alter the attitudes or directly encourage trying it out. Or if the government issues a new regulation for waste management identifying fines for not complying with it, economic agents' knowledge, beliefs and probably perceived social norms would change, influencing the change of behavior. What exactly the changes of the behavior would be (e.g. starting good practices or continuing with the bad ones, just hiding them) depends on the change of above mentioned personal factors.

The relationship between the behavior and external factors is reciprocal. As external factors mostly represent the options for behavior, they are also the outcomes of it. Inflation, industry structure, state of the environment – all of them are the results of the human actions.

Application of the model

The behavior based resilience model is best suited for resilience planning since it proposes a holistic view of the problem at hand and suggests its possible solutions. Integrating three levels – human internal factors, behavior and the context – it allows to identify the real causes of the problem, which otherwise could have been missed. Most of the governmental programs up to date focus mainly on external drivers of behavior and therefore the effectiveness of those programs is very low (World Bank, 2015). Many European countries offer significant subsidies to farmers for taking up crop or animal insurance. The risk of various perturbations in agriculture is increasing however the uptake of insurance is very low. One of the main reasons is supposed to be farmers' beliefs that in case of a climatic event their national government will grant some kind of *relief* payments anyway (OECD, 2011). There are also several other possible reasons identified, like the lack of trust, the lack of knowledge how to acquire insurance and risk perception (OECD, 2011, European Commision, 2017). All of those possible problems identified by various researchers represent the internal factors of the human agent. Failing to account for these factors makes the problem hard to solve.

Since this model accounts not only for internal but also for external factors, i.e. the context of the agent, it allows to identify causes of the problem related to external factors as well. For example, the cooperation of farmers in Lithuania is very limited (only 4% of farmers have joined cooperatives), although economic motives seem to be very clear: greater bargaining power leading to lesser input costs and better output prices, mutual help, knowledge sharing, etc. National support for cooperation although significant did not render effective.
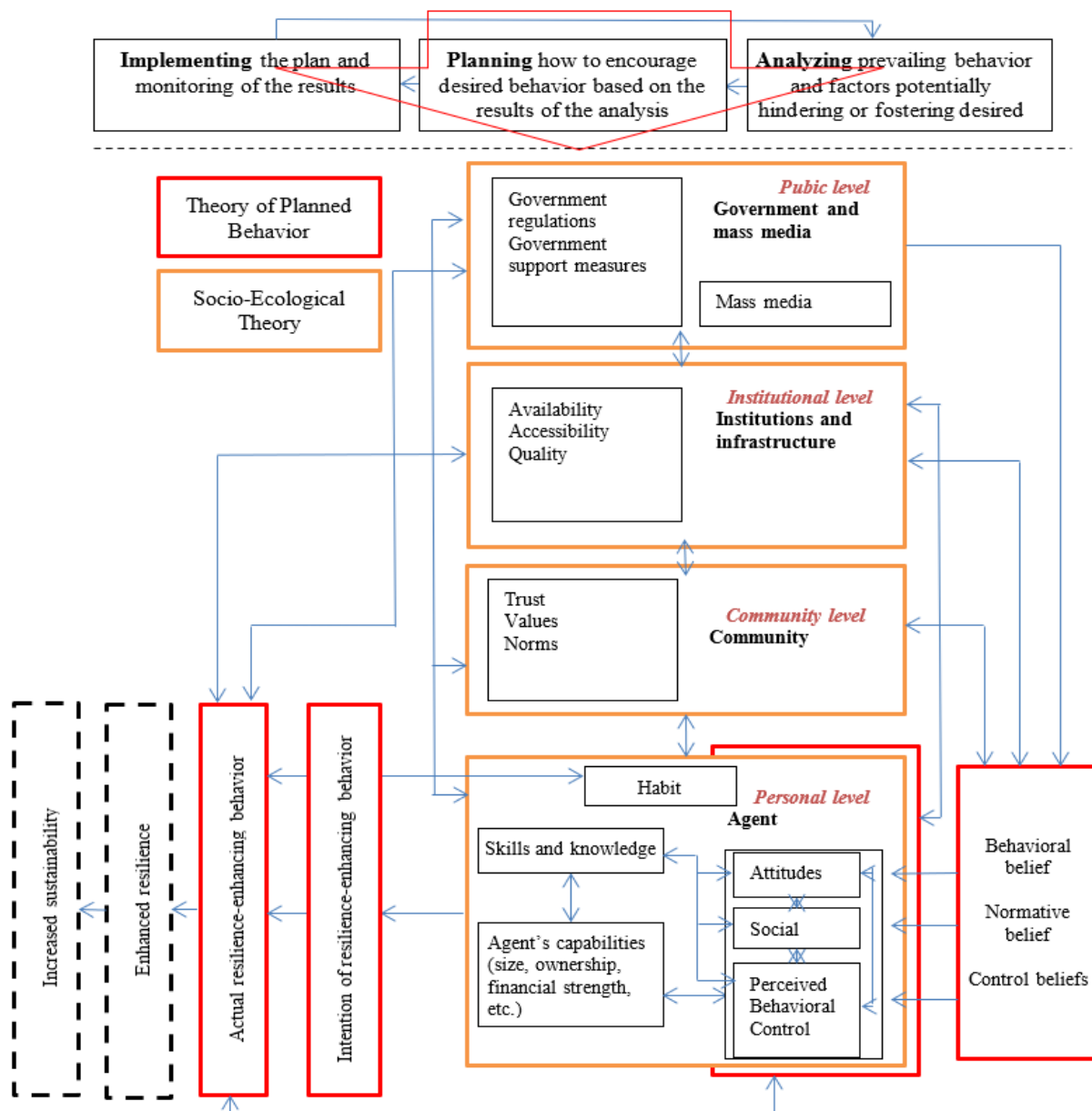
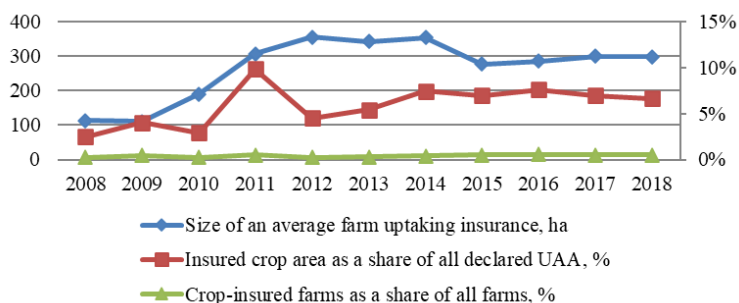Figure 2. Analytical framework, source: compiled by authors, 2019

Figure 3. A share of insured crop area, a share of farms holding crop insurance and the size of an average farm insuring crops in the period 2008-2017 in Lithuania, source: compiled by authors, based on data obtained from the Ministry of Agriculture of the Republic of Lithuania

results. Kuliesis and Pareigiene (2010) found that co-operation is hindered by several reasons, one of the most important being the lack of cooperatives in the area.

The feedback mechanism allows taking into consideration cross-scale effects and evaluating how the changes in one factor could impact others.

To make this conceptual model more user-friendly for resilience planners we propose an analytical framework (figure 2) and an example of its application (table 1).

Example case of behavior model application

Increasing resilience is at the focus of lots of researchers. There is no consensus on what are the main drivers of resilience, and researchers lately tend to agree that resilience is context specific (Martin et al., 2016) so consequently there is no recipe for resilience that could fit all. Different agents with different belief/value/norm systems acting in different contexts create unique systems with unique interrelationships, therefore a resilient agent or system in one context will not necessarily be resilient in the other context. However, most of researchers coming from various fields tend to mention several behavior patterns that lead to resilience in multiple contexts, namely: creating and absorbing innovations (Wink et al., 2018, Bristow and Healy, 2017, Martin and Sunley, 2015), increasing qualifications (education) and improving skills (Obschonka et al., 2016, Martin and Sunley, 2015), collaborating and cooperating (Wink et al., 2018, Boschma, 2015) and managing risks (Linkov et al., 2014, Mitchell and Harris, 2012). Although recently there has been a shift from the traditional, vulnerability-driven risk management approach to resilience (Simonovic, 2016) risk management is still a very important part of ensuring resilience of a system. Lately, as Aven (2016) notices in his review of recent advances in risk management, integrative thinking, incorporating traditional risk analysis, resilience and antifragility, leading to broader risk management frameworks, is starting to emerge.

A case study of risk management in Lithuania's agricultural sector is presented below, providing an example of why the behavior analysis is necessary and how to use the above presented model in order to increase risk management at the farm level thus seeking to enhance resilience of the whole agricultural sector.

One of the main risk management tools for crop producers is crop insurance. It allows producers to stabilize income in the face of increasing frequency and severity of harsh weather events. The conditions for taking up insurance in Lithuania are very favorable: state has been subsidizing up to 65% of insurance premiums (which by themselves are reasonable charged) for a number of years. However, the uptake of insurance, although gradually increasing, is low (figure 3). And the absolute majority of farms insuring crops are large or very large (>150 ha). The rest of the farms (accounting to more than 95%) do not insure their risks despite very favorable insurance conditions and constant state propagation of insurance schemes.

Here comes the necessity for behavior analysis: why different farmers act in different ways; what stops them from acting in a resilience enhancing way and what would motivate them to act differently? Deeper analysis may reveal quite shocking results. For example, one of the main issues that may be stopping farmers from taking up insurance is high share of direct payments and other subsidies in their net incomes (figure 4). Other studies (Finger and Lehmann, 2012) support the hypothesis that smaller farms rely more on subsidies than on their agricultural business therefore the incentive to insure crops is quite low. The other possible explanation is that existence of *ad hoc* payments (which are paid after in the case of a disastrous event) do not motivate farmers to uptake insurance since they expect the state to take care in the case of severe event. If these hypotheses are true they hold very important implications for politicians, who aiming to make agriculture more resilient actually are encouraging quite the opposite.
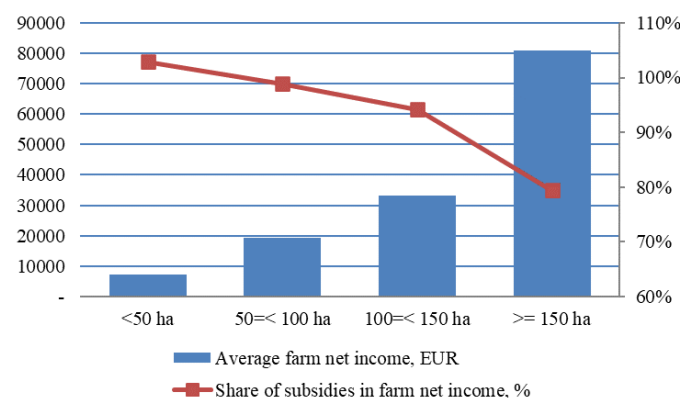

Figure 4. Average annual farm net income and share of subsidies in it according to farm size in the period 2010-2017 in Lithuania, source: compiled by authors, based on FADN and Statistics Lithuania data

Although these hypotheses are quite convincing there may be other important factors hindering insurance behavior. What's also important is that different groups of farmers are driven by different motives; they are by no means a homogenous group, therefore efforts to change their behavior in a more resilient way have to be based on the motives relevant for each particular group. Since insurance is a part of the risk management behavior the holistic approach is necessary. In the table below (table 1) we present an example of how risk management behavior could be analyzed according to the behavior model.

Managing risks starts at the farm level, where farmers have a large variety of options to choose from in order to reduce their exposure to risks, mitigate the potential effects of the risk or cope with the actual perturbations. That involves l) knowing how to (i.e. learning/getting information about potential risks, available risk management tools and their application), 2) actively engaging in risk management (pre-

Table 1. Example of application of behavior based analytical framework to farmers' risk management behavior analysis, source: compiled by authors, 2019

Level	Dimension	Factors potentially fostering behavior	Factors potentially hindering behavior

Personal	Skills and knowledge	Sufficiency of knowledge and/or skills on:
		  1. Potential risks (economic and price-related risks, climatic, environmental, pests and diseases, etc.).
		  2. Management of those risks:
		• Possible tools: e.g. diversification (that can occur in many forms and over different scales; crop/animal/income insurance; use of improved crop or animal varieties; early warning systems, etc.
		• How to apply them (*ex-ante* and *ex-post*).
		• Where to start when the adverse event happens?
		  3. Farming (improved livestock management practices, soil and water conservation, crop rotations, hygiene standards, etc.) and farm management (finance, marketing (e.g. how to create more value added products), etc.).
		  4. Available support measures for:
		• Farm modernization.
		• Risk management.
		• Increase of the competitiveness of the agricultural sector.
		• Diversification of rural businesses.
		• Innovations.
		
		The up-to-datedness of the above knowledge.
		
		Skills of coping with stress.
			Lack of knowledge and/or skills on:
			  1. Potential risks.
			  2. Management of those risks.
			  3. Farming and farm management.
			Obsolescence of knowledge
			Use of obsolete methods
			Misunderstanding of information
			Erroneous use of information/methods

	Attitude toward the behavior	Positive farmers' attitude towards necessity and effectiveness of risk management. Attitude towards risk taking (willing to take risks or risk aversive). Positive attitude (expectations) towards farming in general.	Satisfaction with status quo. Perception of farm risk management as a shared responsibility as opposed to farmer's own responsibility. Exaggerated farmers' reliance on state support means in case of the perturbation.
	Behavioral beliefs	Farmers' beliefs on benefits of preparations for risks ex-ante. Farmers' beliefs on potential gains of learning/getting information about possible risk management tools and their application. Farmers' beliefs on the necessity and efficiency of available risk management tools (separately for each one). Farmers' beliefs on the availability/accessibility of various tools. Farmers' beliefs on the severity of various risks.	Farmers' beliefs on costs related to risk management (financial, time, technological, etc.). Distrust in *new* risk management tools. Absence of perception of benefits of *ex-ante* preparations/learning. Negative farmers' beliefs towards the effectiveness of available tools. Farmers beliefs that state support is the main and sufficient means for farm risk management.
	Subjective norm	Perception of important others (close relatives, neighbors, friends) as highly encouraging for risk management.	Perception of important others as highly discouraging of risk management
	Normative beliefs	Beliefs on important others' approval of various risk management tools Beliefs on important others' approval of learning, changes and innovations.	Beliefs on important others' disapproval of various risk management tools. Beliefs on important others' disapproval of learning, changes and innovations.
	Perceived behavioral control	Farmers' perception that farm risk management depends only on them. Farmers' perception that they can control various risks (by preparing or managing them on spot).	Farmers' perception that farm risk management is theirs as well as others responsibility. Farmers' perception on how difficult it is to manage risk.

	Control beliefs	Farmers' beliefs on the sufficiency of the available resources (knowledge and skills, financial, technological, etc.) to manage risk (in general and separately for each risk management tool).	Farmers' disbelief of the effectiveness of risk management on the whole (Fatal thinking *Whatever I do, it won't change anything*). Farmers' belief of insufficiency of the available resources (knowledge and skills, financial, technological, etc.) to manage risk. Farmers' beliefs on the necessity of governmental support in case of: • catastrophic events (large negative impact, very rare) • mild to medium perturbations (price decrease, crop damage due to wild animals, pest damage, frequent rains).
	Farm capabilities	Sufficiency of farm resources for risk management: • financial capital, • land characteristics, • seed/animal species, • machinery, • access to internet, • other relevant resources.	Full or partial insufficiency of farm resources.
Community	Cultural values	Activities, perceived as valuable: • individual incentive; • learning/knowledge acquisition; • knowledge sharing.	General envy for success of others. Perception of individual incentive as a break out. Denial of the importance of learning/permanent knowledge updating. Perception of those who learn as showing off.
	Norms	Existence of a tradition of consultations, knowledge and best practice sharing. Existence of a tradition of mutual help. Generally accepted norms of individual responsibility for one's own farm (business).	Norms of waiting for someone's help, denying one's own responsibility. Alcohol or substance abuse, leading to neglecting, poor efficiency and fatal thinking.
	Trust	Trust in other farmers in general.	General distrust.
Organizational	Availability, accessibility and quality of products, services, institutions	Availability, accessibility, reputation and quality of: • Consultation services. • Financial services (general attitudes towards lending to farmers, interest rates, loan terms and conditions, fees and charges, collateral requirements, repayment flexibility, alternative sources of finance, guarantee funds, forward contracts, etc.). • Insurance services. • Supply of new, better quality, risk-resistant plant and animal varieties, technological solutions, etc.	Lack of availability, accessibility or efficiency (quality) of relevant products, services and/or institutions. Negative farmers' attitude towards borrowing in general. Distrust in relevant service providers.
		Availability, accessibility and good quality of non-governmental farmer and rural people support institutions.	
	Availability, accessibility and quality of infrastructure	Early warning systems. Irrigation and/or drainage systems. Internet.	Lack of availability, accessibility or quality of infrastructure.
Public	Governmental regulations	Sufficiency and efficiency of local and national legal regulations and requirements in the relevant fields (e.g. the time needed for new seed variety certification in a country, environmental requirements for	Insufficiency and/or inefficiency of local and national legal regulations.

Level	Dimension	Factors potentially fostering behavior	Factors potentially hindering behavior
		farm management, legal regulation for insurance service providers, regulations for credit providers, etc.).	Redundancy of requirements posing limits on relevant actions.

Redundancy of inspections, large fines for minor misdemeanors. |
| | Government agricultural and rural policies and support measures | Availability of national and local support measures (for: farm modernization, risk management and *ad hoc* disaster aid, increase of the competitiveness of the agricultural sector, diversification of rural businesses, innovations, cooperation, learning, etc.; direct payments; special treatment on taxation, credit subsidies etc.)

Is support easily accessible and timely? Co-financing costs?

Does support come with necessary consultations to ensure benefiters know how to acquired machinery, technologies, etc.? | Redundancy of state risk and farm support measures (crowding out personal risk management) |
| | Mass media coverage | The sufficiency and positivity on how risk management in general and different risk management tools are presented on mass media. | The negativity of mass media coverage towards risk management in general and different risk management tools. |

paring for those risks, coping with the effects of actual perturbations using various tools) and 3) learning from the experience and using these lessons to increase farm resilience in the future. But first and foremost farmers have to accept and internalize the idea that they themselves are responsible and best equipped for managing risks on their own farm. In each and every step mentioned above the beliefs, attitudes and other tacit factors play a very important role, determining if and how well the risks would be managed.

The analysis of relevant behavior is done similarly to customer research in the field of marketing. The relevant *customers* (agents whose behavior is sought to be changed) are grouped into segments and the picked out agents from those segments are studied. The intervention measures/programs based on the results are being prepared. The implementation of these measures should be done according to the adaptive management principles, i.e. implement – monitor – learn – change the measure if needed (Carpenter at al., 2001).

The advantages and limitations of behavior based resilience model

Since resilience is context specific and dynamic (Pendall et. al, 2010, Martin et al., 2016) and the future is very uncertain, nobody knows what systems will be resilient in the future. However, most of researchers tend to agree that in order to be resilient a system (individual, corporation, sector or region) must be able either to adapt to and take opportunity of the changes whatever are brought by or to transform in order to stay viable and preferably better off (Martin and Sunley, 2015, Boshma, 2015, Martin-Breen and Anderies, 2011). In any case at least some kind of activity must be done in order to adapt or

transform. Therefore behavior should be at the core of the resilience research.

The main advantage of our behavior based resilience model is its holistic view at the problem in hand, depicting all the relevant structural elements as well as the causal relationships between them. It allows to identify drivers fostering resilience increasing behaviors, but also the ones hindering such behaviors. Therefore strategies based on these results could be much more effective.

This resilience model is highly flexible and can be applied to a range of systems across various scales, ranging from individuals to communities and regions, since it takes into consideration the unique context where it is applied at. The model itself does not provide any universal *cures* but allows identifying the most effective ones for the particular issue at hand.

It also allows understanding and monitoring processes and dynamics within people, between them and their environment, which is necessary in order to understand resilience.

As with any theoretical model, the strengths of this resilience concept come with some limitations. First of all, this model is best suited to analyze and foster or inhibit some particular behaviors that are known beforehand. For example, most of the researchers agree that innovation creation and absorption activity is one of the most important determinants of resilience. So this model is particularly useful in planning how to increase innovation behavior. However it lacks analytical power to determine which exactly behavioral patterns lead to resilience.

Using this model it is hard to compare the resilience among regions, however it allows being very context specific and efficiently improving resilience by working on region specific weaknesses and strengths.

Conclusions

Resilience has been increasingly considered as a necessary precondition for sustainability and sustainable development. Ensuring the continuity of the system it becomes a basis for sustainability. The concept of regional economic resilience itself, due to the adopted perspective, varies from the ability of the system to absorb shocks to the ability to quickly recover from them and to the ability to transform itself and start new development paths. Despite different viewpoints resilience is understood principally in relation to the system's structure and overall functioning, ignoring the human agency and its bounded rationality. However people are malleable and emotional actors whose decision making is often influenced by lots of factors others than rational calculations, such as their attitudes, contextual cues and social norms, which all play a role in determining what is perceived as desirable or possible, what the attention is paid to and how the possible options are evaluated. Thus not including human agency into resilience research leads to missing important elements, hindering or fostering resilience. Consequently the effectiveness of resilience enhancing strategies is quite poor.

In this paper, it is argued that human behavior should be at the core of the resilience concept, since whatever the shock, its potential impact will mostly depend on the (ex-ante and ex-post) behavior (of a myriad of reciprocally interacting agents). The behavior is in turn determined by two blocks of factors: external (or the context), representing all the possibly available options for an action, and internal framing the *window* or lens through which these options are seen, evaluated, chosen and implemented. External factors encompass environment, agent's capabilities and the behavior of other agents, while internal factors comprise psychosocial factors (beliefs, attitudes, social norms, self-efficacy) and skills and knowledge.

The framework, grounded on psychological theories, reveals the mechanism how the above mentioned factors interact and determine behavior thus consequently influencing resilience. Integrating three levels – human internal factors, behavior and the context – it offers its users a holistic view of a certain resilience enhancing strategy. An exemplary analysis of enhancing risk management behavior at the farm level is provided as a sample of how to use this framework.

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