**Czech farmers’ perception of and adaptation to climate change risks**

Zuzana Martínková (Faculty of Humanities, Charles University),

Milan Ščasný (The Charles University Environment Center)

**Overview**

Since farming activities depend on climatic conditions the agriculture is one of the sectors mostly affected by climate change, even in Europe (European Environment Agency, 2015). Impacts of climate change on agricultural production could be mitigated by adaptation measures implemented by farmers and coping behaviour is influenced by many factors including risk perception and adaptation appraisal (e.g. Grothmann & Patt, 2005).

The objective of our case study was to find out if and how climate change risks are perceived, whether adaptation behaviour is occurring, what measures to mitigate the effects of drought, rain and other weather extremes are implemented by Czech smallholder farmers and what factors are influencing their adaptation decisions.

The most interesting results are related to different types of adaptation appraisal (after and before the implementation) and influence of financial supports (especially single payments) and compensations.

Results show that Czech farmers perceive changes in weather patterns and perceive many climate change risks, especially droughts and rainfall variability. Farmers implement many adaptation measures to avoid damages. There are many reasons why farmers are implementing adaptation measures. It seems the risk perception plays a crucial role: in many cases the main purpose of implementation the measure is to reduce adverse impacts of weather and therefor to reduce the risks and to increase or prevent reduction of yields and income. However, other factors could trigger the adaptation (e.g. financial supports).

**Introduction**

Research aiming at farmer’s risk perception and their adaptation behaviour is huge, however most studies have been conducted mostly in developing countries, i.e. in vulnerable areas with specific climatic, economic and political conditions. Only few studies (16 from 145 reviewed)[[1]](#footnote-1) were conducted in Europe (e.g. Adelle, 2015; Battaglini, Barbeau, Bindi & Badeck, 2009; Bonzanigo, Bojovic, Maziotis, & Giupponi, 2016; Comoé, Finger & Barjolle, 2014; Nguyen et al. 2016). European farmers’ adaptation capacity is supposed to be higher due to less constraints, i.e. physical (e.g. the distribution and abundance of water, water and soil quality), governance and institutional (agricultural policies and supports), human capacity and socio-cultural constraints (education, awareness, access to information and technology) and especially economic and financial constraints (e.g. access to resources) (IPCC, 2014).

Most often quantitative research methods have been used in recent studies on farmer adaptive behaviour, we however contribute to qualitative research by providing a more detailed and comprehensive view on this problem. A theoretical model of private proactive adaptation (Grothmann & Patt, 2005) was used as a base for categories identification and development.

**Methods**

*Design*

Qualitative research method was used to gather opinions and perceptions of individuals from their own perspectives. In-depth interviews were used for collecting data on individuals’ personal histories, perspectives, and experiences. Fourteen interviews were conducted with farmers from different production and climatic areas in the Czech Republic. Our interviews were focused on farming practice and farm characteristics, weather perception, perception of weather impacts on farmers’ practice and yields, farmers’ own adaptation behaviour and reasons for (not) implementing adaptation measures, perception of general adaptation measures, opinions on climate change and agricultural policy.

To ensure the authenticity of respondents answers regarding their perceptions and adaptation behaviour a few methods were combined including in-depth interviews, promise of anonymity and the use of other sources of information, such as personal observation.

*Sampling*

Theoretical sampling (Strauss & Corbin, 1999; Miovský, 2006) which means that sampling during data collection depends on the results of the data analysis was applied. It implies that respondents who may provide information relating to the research questions are being chosen (Auerbach, 2003). Following this strategy, we searched for farmers who used irrigation. We also searched for typical and extreme cases, e.g. farmers planning to finish their activities due to weather. A purposive sampling and snowball sampling methods were further used. Participants were chosen according to preselected criteria relevant to a particular research questions. The goal was to cover the variation of the phenomenon. Therefore, to include as much different climate related risks as possible, one of the criteria for the selection of respondents was a region where they are farming. For a homogeneity of the sample a size (small scale) and type of production (crop) were chosen as another criteria.

A few methods of finding and contacting participants were applied. First, gatekeepers from particular farming and climatic areas and from the Association of Private Farming of the Czech Republic helped to identify appropriate participants and provided contacts. Second, based on the database of the Ministry of agriculture a number of individuals farming at vulnerable areas were identified and their contact details via internet were gathered. Also contact details and information about farming practice were gathered via internet from the PRO-BIO Association. Third, participants helped to identify and contact other people who could participate at the research.

*Data collection and data analysis*

Data cleaning and analysis were done in conjunction with data collection so further topics were included into later interviews (e.g. difference in valuation of adaptation efficacy before and after the implementation of the measure). Data analysis was based on grounded theory and analysed in ATLAS.ti. Based on transcribed interviews data were conceptualised: during the open coding the codes, concepts and categories were selected. Categories are basic units of the qualitative analysis representing similar meanings. Categories are used to organize and group codes into meaningful clusters (Patton, 2002). Hundreds of codes emerged in this phase and categories from the model of individual proactive adaptation (risk perception, perceived adaptation efficacy, perceived self-efficacy, perceived adaptation costs) from Grothmann and Patt (2005) as well as own categories were developed and defined. In the second stage during the axial coding the connections between categories were made to identify how they influence each other. A different types of adaptation behaviour were identified and factors influencing these behaviour types were searched for and stories were constructed.

**Data and preliminary results.**

*Categories*

As stated above, preliminary categories were based on a theoretical model of private proactive adaptation (Grothmann & Patt, 2005). Categories used in this model and included into our analysis are: risk perception appraisal (perceived probability, perceived severity), adaptation appraisal (perceived adaptation efficacy, perceived self-efficacy, perceived adaptation costs), avoidant maladaptation (fatalism, denial, wishful thinking) and adaptation incentives. The goal was to extend the model – in consequent quantitative research – and add another categories and to develop current categories in more detail. Therefore, the adaptation appraisal characteristics and types (after the implementation, before the implementation, benefits, costs) were added and special attention was payed to subsidies as a type of adaptation incentives. Main categories emerged based on our data: climate change (weather) effects; weather impacts; weather effects / impacts appraisal; motivations to implement measures; barriers to implement measures; adaptation measure; farming practice changes; type of adaptation measures.

*Adaptation to climate change impacts*

Farmers are already adapting to weather extremes although not always intentionally. This means, farmers sometimes implement some measures mitigating climate change impacts because of other reasons but adaptation (e.g. economic benefits, beauty or tradition). Adaptation measures could be divided into several categories according to the time of their implementation: a) preventive/anticipatory and b) reactive adaptation, or according to their financing: a) own financing and b) financing from subsidies and supports, according to their length of functioning: a) long term and b) a “one-time”, and according to their target: a) particular risk or b) different kinds of risks.

Adaptation measures implemented by farmers are usually reactive (done after, and as a response to, climate change, Smith, 1997) and include: farming practice changes (diversification of crops, crop varieties, sowing times, activities and income), agronomic practice changes (stubble, intercropping, dense crop, trying different types of crops), changes in dates or time of some activities (earlier fertilization, planting, harvest, mowing, grazing cattle at night, hiding during the day), changes in a type of production (e.g. from conventional to organic farming scheme), changes in the extent of production (crop cultivated area reduction or termination of crop production), technical equipment and machinery (e.g. more harvesters, importing/abstraction of water, irrigation, disobedience of a ban on water abstraction, drainage systems, driers), natural measures (e.g. ponds, afforestation, grassing, grassy strips) and soft measures (e.g. insurance).

*Factors*

Factors influencing adaptation could be divided into two main categories: supporting and undermining (or motivations and barriers). Risk perception is definitely very important factor but our research suggests that perceiving climate change risks and impacts do not necessarily lead to an intention to adapt (supported by e.g. Burnham & Ma, 2016) and on the other side the risk perception is not necessary for adaptation implementation. The risk must have specific characteristics and more factors are needed to implement the adaptation measure. Different factors also apply to a different extent to a different kind of adaptation (anticipatory and reactive adaptation). Preventive adaptation measures are connected to anticipated impacts and to expected weather patterns. Reactive adaptation measures are more related to experience.

*Weather / climate change impacts / risk perception*

Czech farmers are perceiving changes in weather patterns in last decades. All of our respondents are aware of changes but some of them ascribe them to natural variability, temporary and short term fluctuations. We can divide farmers into two main groups regarding their views on the weather: one group think the weather extremes are occurring more often, are worse and will get worse in the future. The other group think the weather extremes occur but these changes are only temporary and these extremes occurred in the past as well. Even when farmers think the weather is the same as before they admit that the extremes (drought) occurs in a different way and time.

Although farmers do not speak about climate change, they perceive changes in precipitation patterns and weather variability and are aware of extreme weather, its impacts and manifestations like droughts and heat waves, heavy precipitation, floods, windstorms or frosts. Farmers complain that due to water scarcity, pests, erosion, waterlogged soil associated with those impacts their agricultural yields and income are reduced. Nevertheless, some farmers reported no adverse effects of drought on yields, but only in case the drought occurs in usual time of the year (spring). Drought is considered as worse than heavy precipitation in regards to yields. Farmers expect occurrence of droughts rather than floods or waterlogged soil in the near future.

*Risk perception and adaptation*

Weather is definitely perceived as a main factor influencing yields (not income) and farming activities. As a greater problem farmers perceived climate variability and the uncertainty of weather extremes which complicates their strategies how to prepare for the extremes. Depending on the risk perception the most appropriate measure is chosen.

Farmers are checking weather forecast but only in short term and are adjusting their actual activities according to it. Therefore, they are able to adjust their activities to actual conditions and implement some kind of reactive short term adaptation measure (e.g. irrigation, harvesting).

Some weather impacts are occurring more often and farmers are expecting them and are able to prepare for them and can implement measures to mitigate these particular risks. These long term adaptation measures are targeted to a specific risk (e.g. drainage systems or special equipment and machinery) and if the risk doesn’t occur the measure would not be utilised which is perceived very negatively since the measure implementation could be very costly (e.g. irrigation system, dryers) or could even reduce the yields (e.g. special drought resistant crop varieties). This means some adaptation measures would be effective only in some cases and it is risky to implement them.

Weather forecast for a longer periods are not perceived as reliable and farmers speak about impossibility to forecast weather for a longer period. Especially the weather variability is perceived as a main factor complicating decision making and planning. Extremes are changing from year to year and one strategy could be effective for drought but not wet. In this case farmers implement such a strategies and measures which are effective in mitigating both extremes, drought and too much rain. Strategies like diversification of crops, planting time, income or some natural measures for water retention are implemented.

Sometimes the risk perception act as a barrier for the adaptation. To undermine the adaptation intention the weather extremes are perceived only as temporary fluctuations, the weather extremes occurrence is perceived as uncertain (no one knows exactly what comes, what will be successful) and not frequent in the future.

Other risks are also perceived, e.g. price volatility or changes in political situation, support schemes and duties (also Špička, 2009).

*Adaptation appraisal*

Factors undermining the adaptation relate mainly to adaptation appraisal. Adaptation measure is appraised before and even after it is implemented which influence its future implementation. Experience and ex post assessment complicate future decision making as the farmer must wait a long time to see if the adaptation implementation was a right decision and consequences and situation could be different next time.

Adaptation is undermined if the adaptation measure is perceived as ineffective or with a low effectivity, if costs exceed benefits (implementation doesn’t pay off, no/low production, no own profit, high costs), if the measure could be effectively used only in a specific situation and is targeted to a specific risk (e.g. irrigation is effective to cope with drought but not wet), if the measure somehow complicates the activities (harvesting, farming). Feasibility of the measure is also important factor (e.g. irrigation is not a solution when water is not available due to bans on water abstraction). Lack of land or property rights could also complicate implementation of the measure. Negative experience also undermine implementation in the future (when preventive adaptation did not work). Unfortunately, the positive experience doesn’t mean the measure will be implemented again.

Positive assessment of measures implemented by farmers related to private benefits like, satisfaction with the implemented measures, increased revenues, or public benefits like positive environmental effects, nature quality, beauty, biodiversity increase.

*Role of support and subsidies*

Subsidies and other governmental support were identified as one of the most influential factors. They could encourage the implementation of the adaptation measures but could also undermine the motivation for adaptation behaviour. In some cases could be the main reason for the implementation of the adaptation measure since they act as the main source of income (e.g. organic or extensive farming).

Subsidies, especially single payments, are guaranteeing farmer’s income. This supports their activities even when yields are low but also undermine the motivation to prevent losses. Although most of the farmers admit that without subsidies they would not be able to manage the farm, on the other side they criticise the subsidies because they distort the free market and there is low distinction between measures, areas and conditions where the money should be invested.

Motivations

However, some measures mitigating climate change risks are implemented due to other functions and reasons, e.g. beauty, enjoy, aesthetics, commitment to future generations, responsibility for future, safety (e.g. pond as fire protection water reservoir) or revenues (fish production). These factors could support the implementation of adaptation measure.

*Barriers*

Other barriers identified in our research were related to fatalism (farmers think they can’t do anything about it, e.g. when extremes are too extreme, they feel the inability to influence the weather, helplessness, believe that yields will be anyway), frustration (receiving revenues only in a particular period or the year and many costs and payments). Other important factor is knowledge and social capital. Farmer are missing a uniform procedure, they think everybody has a different approach, different methods, conditions. Although they think something should be done they complain they don’t know how, what to do, they miss reliable information. The main sources of information are private companies advertising their products, associations and their materials and bulletins and official administrations and offices. Offices are often criticised due to providing insufficient information and focusing only on demands and duties and not on helping. Another source are media but information from media are perceived as inconsistent.

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1. Our review addressed farmers’ climate change risk perception and adaptation. [↑](#footnote-ref-1)