Eidgenössische Technische Hochschule Zürich
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Visualization of the Resilience of Regional Food Systems in Switzerland

Bachelor Thesis

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Abstract

This bachelor thesis outlines the process of creating an interactive map which displays various indicators of the resilience of Swiss food systems. The goal of the project was to create a publicly available tool, which would calculate these indicators and present them in an intuitive way, in order for researchers, policy makers and other stakeholders to have easy access to regional data concerning the resilience of food systems.

The website is available here.

Contents

Chapter 1

Introduction

1.1 Motivation

1.1.1 Resilience

According to Holling [1] resilience 'determines the persistence of relationships within a system and is a measure of the ability of these systems to absorb changes of state variables, driving variables, and parameters, and still persist.' For a food system, this is 'its ability to ensure the provision of the system functions in the face of increasingly complex and accumulating economic, social, environmental and institutional shocks and stresses, through capacities of robustness, adaptability and transformability.', as defined by Meuwissen [2]. How a food system reacts to perturbations in environmental, political, economical and social variables (global warming, rising gas prices, COVID-19 etc) is of great interest when viewed against the backdrop of climate change and increasing stress on habitats. Assessing resilience is important in being able to prevent and revert undesirable changes in our agricultural sector. It is essential to preserve and enhance resilience in systems which are in a desirable state and by analyzing resilience, we gain knowledge on how much stress an ecological community can handle before unwelcome changes occur.

1.1.2 Resilience Indicators

Resilience indicators are variables which aim to quantify the above mentioned capacity to resist and adapt to variations and transform the state of a system [3]. The indicators aim to be measurable and correlate with the stability of a system.

An example of an indicator for the resilience of food systems is the Primary Production Flexibility Index (PPFI) developed by the Food and Agriculture Organization of the United Nations [4]. It is comprised of two parts: how diverse the produced commodities are and how much access to the markets of these commodities the producer has. The PPFI aims to quantify the level of diversification of a farm, both in its production and in its target market, which is an important factor of the resilience of agricultural operations [5]. A diversified production makes the system less vulnerable to diseases or pests and other environmental factors such as extreme weather because only some crops may be affected. [6] A diversified market on the other hand, could potentially mitigate the risk of market shifts decimating sales.

Another important way to assess the resilience of a food system is to look into its economics: A system is more resilient if it has implemented a financial buffer to cope with economic turmoil [7]. We could therefore use the savings a farm has as an indicator, to determine if it is aptly prepared for financial stress.

One could also look at soil quality as an indicator of adaptability. It has been shown that farms which have a higher soil quality are more resilient to climate change [8]. Looking at the amount of soil organic carbon and nutrients present in the soil might give us another factor of how well equipped a food system is to withstand change, serving as a measure of its resilience [9].

It is important to note that food system resilience is more of 'a paradigm rather than a testable body of theory' as noted by Tendall [10] Resilience is a complex phenomenon which arises through the interplay of various variables and we can only estimate it through a thorough analysis of said factors.

1.1.3 Relevance

This project aims to construct resilience indicators with publicly available data, sourced from the Swiss Federal Statistical Office (FSO) and to display said indicators in an accessible tool for policymakers, farmers and other stakeholders. We want to make this data accessible to anyone, regardless of technological proficiency or other resources. Therefore, it is essential for the website we created to work in the simplest, most intuitive way possible, while relaying all relevant information. It is of utmost importance that the worldwide food systems, including the Swiss agricultural sector, become more resilient in the face of climate change and the environmental but also sociopolitical challenges that come with it and we hope that this work will contribute in communicating the relevant facts. Summarizing, the goal of this project is to make data on the resilience of Swiss food systems more readily available enabling people to educate themselves on the current state of Swiss regions with regards to food system resilience.

1.2 Related Work

There are some projects in different locations aiming to achieve a similar goal:

1.2.1 Résilience Paysanne

This project was jointly initiated by the Swiss canton of Vaud and ETH Zürich. It aims to be a toolbox with which farmers can assess the resilience of their farms and brave environmental, political and socioeconomic challenges. This bachelor thesis is part of the Résilience Paysanne initiative [11] and will help give context by showing what the indicator values for the region they are located in are like and how these compare to the national average.

1.2.2 CEReAl

CEReAI (Calculateur de l'Etat de Résilience Alimentaire) [12] is a Belgian initiative started by the association Objectif Résilience Alimentaire [13] in May 2021. Its goal is similar: to help people evaluate the resilience of different regions of Belgium. However, they do not include a personal analysis tool like Résilience Paysanne does. Many of the indicators of the CEReAI project served as a base for indicators of our resilience map. This was done to be able to compare the regions internationally.

1.2.3 CRATer

CRATer (Calculateur pour la Résilience Alimentaire des Territoires) [14] is a website developed by the french association Les Greniers d'Abondance [15] which has been online since October 2020. This project also served as an inspiration for CEReAI and many of the indicators presented in our work overlap with both. CRATer is the most elaborate of the three undertakings, having visualized 15 different indicators on 4 different resolutions (communes, community of communes, departments and regions) as of February 2023. The association has a similar goal as the ones above: informing citizens of the state of the food regions in the country.

Chapter 2

Methods

2.1 Indicators

To give an overview of the resilience of a region, we calculated five main indicators. These were then displayed on an interactive map, available on the district and cantonal level, where the user can select one region and investigate it in detail. We created an overlap of the indicator variables with the CEReAI and CRATer tools to be able to compare the values internationally. In the following sections we present the calculations of the different indicators along with a brief summary.

2.1.1 Average Farm Size

The average farm size is an indicator which is relevant to the resilience but also the sustainability of a region. Not only are smaller farms often not large enough to threaten the stability of the local ecosystem [16], but they can also have a higher economic performance per UAA (utilised agricultural area) than larger farms due to their production diversification [17]. This diversification also results in increased biodiversity [18] which in turn could lead to more resilience to financial shocks and market shifts due to external factors such as competition, plant diseases or political decisions. Larger farms also often rely on modern solutions which can be more harmful than traditional farming techniques. Shi-le Qin and Xin-ye Lü, for example, have shown that farm size directly correlates with the dosage and application frequency of pesticides in rice production in China [19]. Nevertheless, other sources mention how smaller size farms in Africa are less self-sustainable and are less likely to lift the owners out of poverty due to their limited capacity [20].

In their action plan towards more resilience [21], Les Greniers d'Abondance [15] mention: 'La diminution des actifs agricoles va de pair avec l'augmentation de la taille des exploitations agricoles.' [The decrease of the number of people active in the agricultural sector goes hand in hand with the increase of the size of farmholdings.] This is a first good example of how these indicators are strongly intertwined and linked, and one can only get a good overview of a region by considering various different approaches to resilience.

The average farm size indicator calculates the size in hectares of the average farm of the area. We calculated the average farm size for a given region by inputting data [22, 23] into the following formula:

$$\text{average farm size} = \frac{\text{area of agricultural production}}{\text{number of farms}}$$

2.1.2 Rate of Soil Artificialization

When referring to soil artificialization, we will be referring to the process of modifying natural soil by human activities such as farming or construction of buildings and other infrastructure. This includes completely covering, replacing or transforming the soil. Altering the biological and chemical composition of the natural ground can have severe negative impacts: the degradation of soil has been 'associated with off-site problems of sedimentation, climate change, watershed functions, and changes in natural habitats leading to loss of genetic stock and biodiversity' [24].

This indicator denotes the rate at which natural landscapes are being turned into artificial ones. We used data [25, 26] for the amount of artificial area which is composed of the following (only available in German):

künstlich angelegte Flächen =
befestigte Flächen + Gebäude + Treibhäuser + Beetstrukturen + Rasen
+ Bäume auf künstlich angelegten Flächen + gemischte Kleinstrukturen

Translated this corresponds to:

artificial area = paved areas + buildings + greenhouses + bed structures + lawns + trees on artificial areas + mixed small structures

This data is available for the years 1985, 1997, 2009 and 2018 and we decided to use the two most recent measurements to give an idea of the current rate of artificialization. We then calculated the percentage of the total area which was artificialized between 2009 and 2018 in the following way:

rate of artificialization =

$$\frac{(\text{artificial area 2018}) - (\text{artificial area 2009})}{\text{total area}} \times 100$$

This gives us the percentage of the total area of the region which was not artificialized in 2009 but is as of 2018 (not annually but the total percentage difference between these two years). This calculation therefore deducts rewilded landscapes and gives us an idea of how fast a region is turning natural habitats into artificial environments. The rate of artificialization was positive for all regions except the Distretto di Leventina in the Canton of Ticino, where there was actually less artificialized land in 2018 than in 2009.

2.1.3 Organic Farming

Organic Farming (farming without the use of synthetic pesticides and with an emphasis of using natural processes to improve yields and fight weeds and diseases [27]) 'displays encouraging and promising features and mirrors the characteristics of farm resilience' such as 'the compatibility with natural cycles, the inclusion of the wider social and ecological impact, the promotion of agro-biological diversity through sustainable production systems and the protection of their ecological context' according to Milestad [28], while she also says it is still facing some challenges. Organic farming has been shown to be more efficient in its use of nitrogen inputs [29] and, compared to non-organic agriculture, can show a similar productivity [30].

For the organic farming indicator we wanted to display data on how much of the total area utilized for agriculture was cultivated by farmers practicing organic farming. To calculate this percentage, we used the area used for organic farming and compared it to the total area dedicated to agriculture, both of which we sourced from the FSO [31]:

$$\frac{\text{organic farmland}}{\text{total farmland}} \times 100$$

2.1.4 Impermeability

Impermeable surfaces are surfaces which do not let water pass through them. The main difference between our definition of artificialized and impermeable areas is that we include farmland, gardens and any other water-absorbent human-made environment in the artificialized area whereas in the impermeability indicator we only consider surfaces that impede the drainage of water, such as houses and other infrastructure. Blocking the passage of water leads to runoff which can cause issues: instead of pollutants being distributed evenly, enabling microorganisms to break them down, harmful particles can be washed off too quickly and end up contaminating water sources [32, 33]. Additionally, this higher amount of runoff has been shown to increase the likelihood of flooding in the surrounding areas [34] and, according to Les Greniers d'Abondance [15], in France the growth of impermeable surfaces is the main reason for the loss of farmland [35].

When calculating this indicator, we only considered data [25, 26] on surfaces which were rendered impermeable by humans. Cliffs, for example, would not be included in our calculation, due to their natural occurrence. Therefore, we used the following calculations:

AIA (artificially impermeable area) =
befestigte Flächen + Gebäude + Treibhäuser + gemischte Kleinstrukturen

Translated this corresponds to:

AIA (artificially impermeable area) =
paved areas + buildings + greenhouses + mixed small structures

$$\text{percentage of AIA} = \frac{\text{AIA}}{\text{total area}} \times 100$$

2.1.5 Population Active in the Agricultural Sector

How much of the population is involved in food production in the primary sector can constitute an important factor of how resilient a food system is. We know that in Asia and Africa a higher percentage of the workforce is employed in the agricultural sector than in the rest of the world and the richer a country is, the higher the labor productivity in agriculture (the agriculture value per added worker) [36]. It is also highly relevant in Europe, as 'La mécanisation, l'amélioration des techniques de culture, la sélection des plantes et animaux, l'utilisation d'engrais de synthèse, sont autant de facteurs qui ont provoqué la diminution du besoin de main d'œuvre agricole.'[The mechanization, the improvement in farming techniques, the selection of plants and animals, the use of synthetic fertilizers are all factors that have caused the need for agricultural labor to decrease.] [21]

In general, this indicator is not the most descriptive on its own, but in combination with other values, it can provide insightful information on the food system.

We used data from the FSO [22, 23, 37] and calculated the population employed by the agricultural sector as a percentage with the following formula:

$$\frac{\text{population active in agriculture}}{\text{total population}} \times 100$$

2.2 Visualization

The main part of this bachelor thesis was spent on the data analysis and coding the website in order for the data to be displayed in an intuitive manner. The website was coded in HTML, CSS and JavaScript while the calculations of the indicators were done using Python.

2.2.1 Map

The first step on the journey to our finished product was to acquire a precise map onto which to project the data. We decided to use the shapefiles of the cartographic bases which are publicly available through the Federal Office of Statistics [38]. We decided to use these shapefiles because they are precise enough for our purpose while still enabling low latency loading of the map.

The next step was figuring out how we want to display the shapefiles. We opted for leaflet [39] because it is a popular JavaScript library used in many applications to display interactive maps and it is highly customizable and well-documented. It is also open-source and free to use as long as one attributes the use of the library in the project. To create interactive leaflet maps from the shapefiles, we used Python to import and specify the necessary parameters of the shapefiles, then created a folium [40] object and exported this to a .html file.

The subsequent period was devoted to connecting the data to the map and customizing the appearance of the region tiles. We sourced the data from the FSO and calculated the indicators using the pandas library in Python. This was done by importing the respective data for all regions as various DataFrame objects, joining them into one DataFrame and then calculating the indicators as a new column. After dropping the input columns to the calculation, we then exported the final results in .json files to display them on the website. These json files are then imported into the leaflet map and are used to define the saturation of the leaflet tiles (higher values cause a higher opacity which leads to a deeper color). We also customized the popups of the different indicators to display the value of the current indicator which the mouse is hovering over.

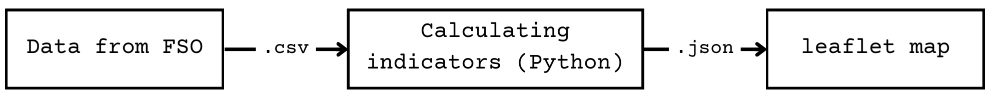

Figure 2.1: The data pipeline.

2.2.2 Details Window

Because we want to display some more information on the different indicators than just their calculated values on the map, we decided to implement a custom popup when a tile is clicked (see Figure 2.4). At first this popup would only display limited information about how the calculation was made, with a 'Details' button below it, enabling users to access more specific information such as the mean values at the federal level for the different indicators and a short description of what the calculated results represent.

We quickly realized that most people would click the 'Details' button regardless, leading to a more cumbersome experience. Therefore, we implemented a single details window which contains all information and which opens directly upon clicking on a tile (see Figure 2.5). To verify if users effectively preferred this, we conducted a user study (more on this in section 2.3).

The implementation of the window was done by using an <iframe> inline frame element [41]. This is hidden at the beginning but upon clicking on a tile we set some flags so that it is shown. The information on which tile was clicked is saved in a global variable and then called upon by the iframe by accessing its parent window. This way the iframe can display information relevant to the tile which was previously selected and is specific to the area the user is interested in.

2.2.3 Charts

We deemed it necessary to also display the data in a sorted bar chart, to easily identify the top and bottom regions for every indicator and to visualize the distribution. This helps users who are more interested in an indicator than a district or canton to quickly analyze the spread of the regions and to pinpoint outliers in the category. The chart helps complement the geographic visualization of the calculated indicator, leading to a more comprehensive view on the data.

After looking into various options on how to implement the charts, our decision fell on the D3.js (Data-Driven Documents) JavaScript library. More specifically we opted for a brush-able and interactive bar chart following the example of Visual Cinnamon [42] (see Figure 2.2).

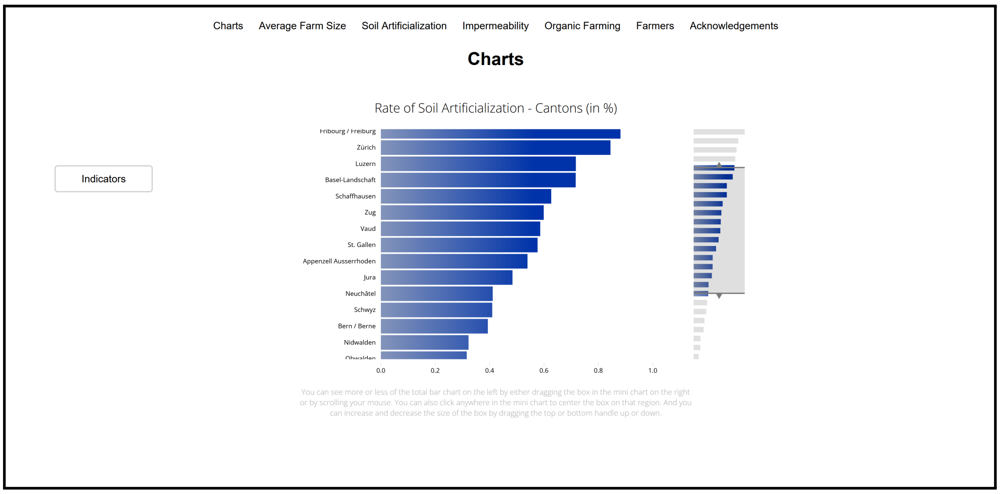

Figure 2.2: The charts tab.

2.2.4 Web Deployment

It made sense to host the website on Infomaniak [43] together with the other websites of the Résilience Paysanne project. Infomaniak is a Swiss platform which provides various services such as cloud-computing, servers, web-hosting solutions and more. It is also known for being environmentally friendly (all the data centers run on 100% renewable energy) and valuing the privacy of its clients. However, the easiest way to host our site on Infomaniak was to transfer it to a PHP framework. This was done by creating .php files with HTML and JavaScript content and creating the file structure with 'include' statements (see Figure 2.3).

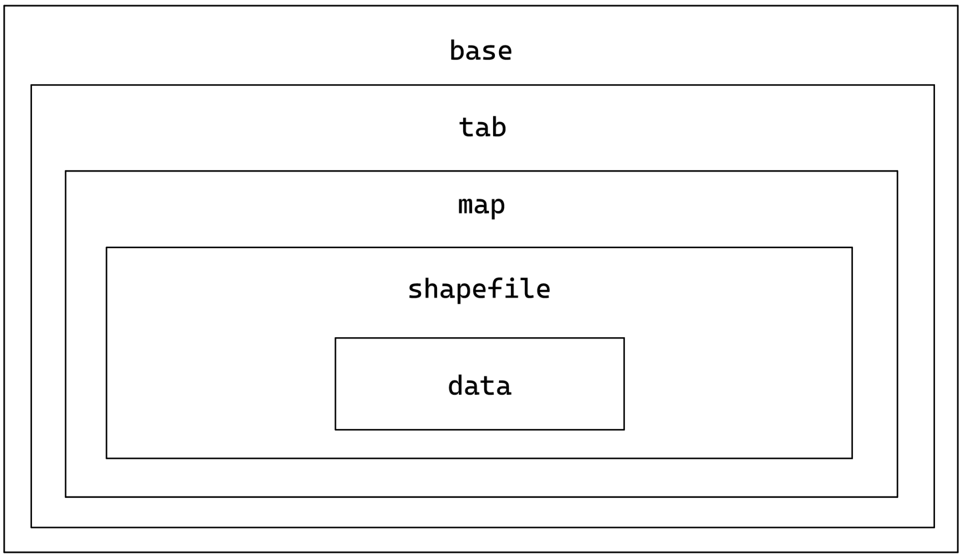

Figure 2.3: The file structure of the project: boxes represent files and nested boxes symbolize that the file is included in the one around it.

2.3 User Study

During the process of developing the website, we first implemented the established leaflet popup to display more detailed information about certain regions on the map. In later stages, once more functionality had been added, we thought it better to create a custom window which would open instead of the popup. To verify if people actually preferred these changes, we conducted a user study.

2.3.1 Overall Study Goal

The goal of this study was to find which of the two versions of the Resilience Map of Switzerland website is more intuitive, with a specific focus on efficiency and satisfaction (according to J.Nielsen, 1996 [44]). We wanted to find out if, when selecting a tile to inspect, it is better to only show the most relevant information in a small popup which then leads to more detailed data, or if it is more efficient and intuitive to reduce the number of clicks needed to access information and display everything in a single window.

Workflow Version Popup

In the first version, which we will reference as 'Version Popup', upon clicking on a tile of the map, the user sees a popup which denotes the absolute values with which the calculations were made (see Figure 2.4). For example, in the Average Farm Size tab, the popup will display the number of farms and the total area of all farms, in addition to the resulting average farm size. There is a 'Details' button at the bottom of this popup, which then opens a separate window on top of the map, displaying bar charts which compare the value of the currently selected region with the mean of this indicator for all regions.

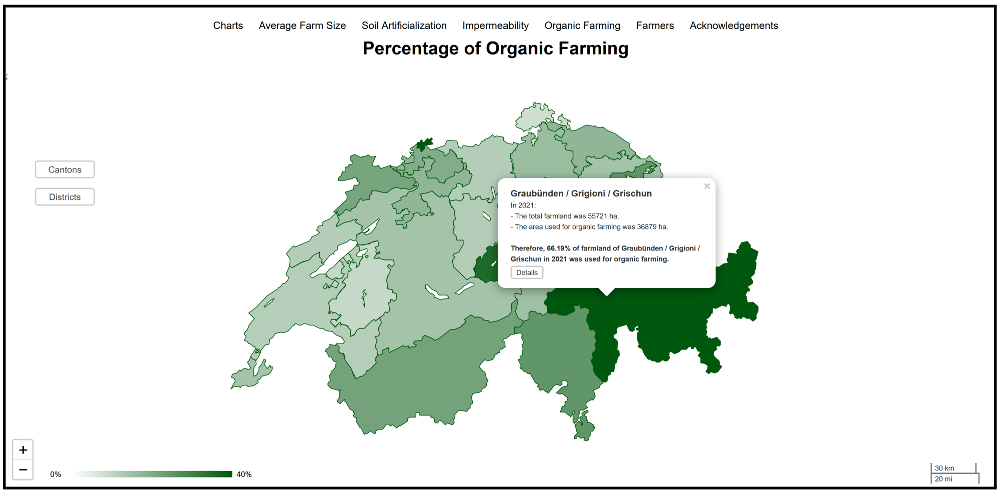

Figure 2.4: Version Popup

Workflow Version Window

In the second version, which we will call 'Version Window', when a user selects an area of the map by clicking on it, the window which contains the charts is opened directly (see Figure 2.5). The information about the absolute numbers which were used to calculate the indicator is displayed in the bigger window, above the bar charts. In short Version Window eliminates the need for a popup by including all information in a single window.

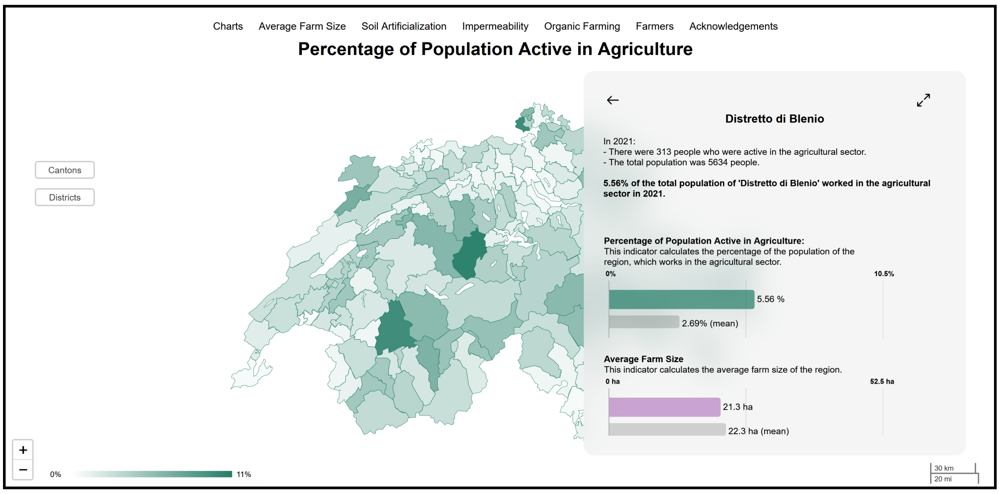

Figure 2.5: Version Window

2.3.2 Variables and Hypotheses

Independent Variables

The independent variables are the type of the interface we choose to present information, so varying the version of the website between Popup and Window.

Dependent Variables

The dependent variables are:

- Effectiveness: being able to complete the task [45].
- Satisfaction: degree to which users were happy with their experience while completing the task [45].
- Task completion time: how long did the participants take to find the data points which they require?
- Usability: defined by the System Usability Scale (SUS) score [46].

Hypotheses

- There will be no effect of the interface type on effectiveness.
- There will be no effect of the interface type on satisfaction.

- There will be no effect of the interface type on task completion time.
- There will be no effect of the interface type on usability.

Experiment Apparatus

The Experiment is carried out on a laptop with a mouse, in a quiet place with no other people around except for the examiner and the participant. The laptop is passed between the examiner and the participant, with the examiner changing between the different versions. The task completion time is taken by the examiner with a stopwatch and all materials (such as a pen and paper to write down the answer and a printout of the task description) are provided.

Study Protocol

1. The participant is welcomed and made aware of the study purpose and the fact that all data will be anonymized.
2. The participant is handed the laptop and fills out the pre-questionnaire, recording their demographics.
3. The participant is shown a very short (< 1 min) demo of the website by the experimenter: the experimenter shows the graph tab (mentioning that it is not relevant), opens two different tabs of indicators, switches between cantons and districts for both and zooms in and out. This is done without clicking on a tile to make sure that the popup or window is not opened, making this introduction the same for both participants who start with Version Popup and those who start with Version Window. The fact that the tiles are clickable is also mentioned.
4. The participant is asked to find and subsequently write down the total area used for organic farming in the district of Zürich and the mean percentage of organic farming in the district of Zürich. These instructions are read out loud and additionally passed to the participant on a sheet of paper.
5. The participant is handed the laptop with either Version Popup or Version Window open on the Average Farm Size tab and the time is started.
6. Once the participant has written down an answer for both questions, the time is stopped.
7. The participant now fills out the SUS questionnaire and the satisfaction questions for this version.

8. The version is changed to the one not yet tested and the participant is now asked to repeat steps 4-7 but with the number of farmers (people active in the agricultural sector) instead of the area of organic farming.
9. The participant then fills out the concluding subjective rating questions and hands the laptop back to the examiner.
10. The participant is asked a few short interview questions about the website.
11. The participant is debriefed and thanked.

Pilot Study

During the pilot study (where we tried out a preliminary study protocol) that we conducted, we saw that it was of paramount importance that the participants are able to reread the task. It was quite complex for some and they had to repeatedly ask for the task description. In an effort to remove examiner bias the participants will receive the instructions on a piece of paper. The study protocol was adapted accordingly.

Executing the Study

The study was conducted with students of ETH Zürich who were selected using convenience sampling [47]. In total, 20 students participated in the study, half of them doing the first task with the Version Window and the second task with Version Popup while the second group used the versions the other way around. All of the participants (ranging in age between 20 and 27) stated that they use a computer every day. Conducting the study usually took about 10-15 minutes in total.

2.3.3 Results

We derived some clear results from our study: our first null hypothesis ('There will be no effect of the interface type on effectiveness.') could be confirmed, considering that all of the participants were able to complete both tasks, albeit with differing completion times. This was to be expected, as the tasks were designed to be simple enough to be solvable in a few minutes without external help.

The second null hypothesis ('There will be no effect of the interface type on satisfaction.') was also confirmed: the users gave the Version Popup an average satisfaction rating of 4.3/5 and the Version Window an average satisfaction rating of 4.25/5. This proved not to be statistically different when tested (due to lacking normal distribution) with a Wilcoxon signed-rank test.

Our third null hypothesis ('There will be no effect of the interface type on task completion time.'), could be discarded and we were able to show that there was in fact a statistically significant difference in the time it took for users to solve their first task, with the Version Window having a faster task completion time than Version Popup. To show this, we first visualized the data to make sure we did not have any abnormal observations or outliers (see Figure 2.6). We then calculated the means of both versions, which were 153.2 seconds

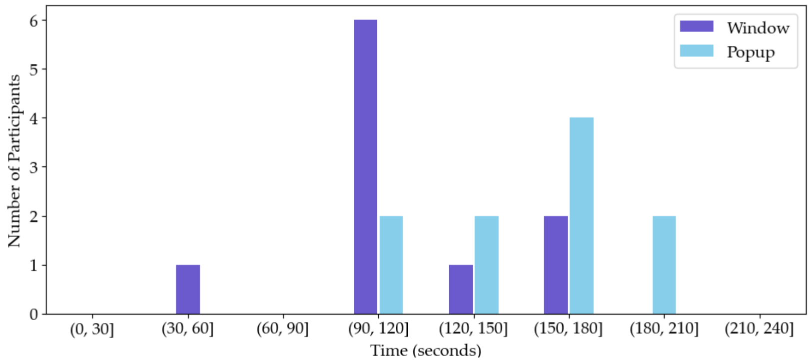

Figure 2.6: Task completion times with the two different interfaces.

(with a standard deviation of 31.2 sec) for Version Popup and 120.3 seconds (with a standard deviation of 33 sec) for Version Window. We verified that both spreads were normally distributed using the Shapiro-Wilk test (p-value > 0.05 for both) and that the samples were drawn from a population with equal variances (homoscedasticity) using Levene's test (p-value > 0.05). After this we were able to apply an independent samples t-test, which gave us a p-value of 0.0344 which we consider statistically significant as it is smaller than our chosen $\alpha = 0.05$. These results indicate that the interface of Version Window was faster to use than Version Popup. We attribute this to the fact that all information is displayed on one window instead of in two separate popups which is more intuitive.

For our fourth and final null hypothesis ('There will be no effect of the interface type on usability.'), we were not able to reject it. After evaluating the SUS score [46] by writing a short script which adds up the weighted scores of the answers for both versions, we found that the mean for Version Window was 79.875 and for Version Popup 79.5 which did not prove to be a statistically significant difference. Nevertheless, to the question 'Which interface did you prefer?' 15 out of the 20 participants answered that they liked the Version Window better. Evaluating these subjective ratings with a binomial test using the probability of 0.5 (null hypothesis: 'there is no preference between the two versions') we saw a p-value of 0.041. Therefore we conclude that the participants actually preferred using the Version Window, even if this did not reflect in the SUS scores, most probably due to the fact that all information needed for the task was to be found in one place and not spread out over various pages.

Chapter 3

Discussion

3.1 Completion of Tasks

At the beginning of the thesis, we set up the following tasks to act as a guideline for the process:

- Analysis and selection of available Swiss databases for calculation of resilience indicators (what data is relevant/reliable?)
- Write code that calculates the score of resilience indicators for each region (districts, canton and/or other region to be defined)
- Code a map visualizing the indicators using Leaflet (using the preferred programming language) already thinking of web integration
- If possible, publish the map (even if not perfectly finished) on `resiliencepaysanne.ch`

We are confident in saying that these goals were attained. As we invested a significant amount of effort into the database analysis, we are satisfied with how we accomplished the first step. Making sure the data was correct and cross-referencing it with different sources was crucial to ensure that we had accurate figures for our calculations, as they are the basis of our tool. Once we had the raw data to work with, calculating the resilience indicators proved to be a straightforward task and was completed without any complications. In hindsight however, we probably underestimated the implementing of the map, as this took quite a bit more time than expected, due to lacking experience with HTML and JavaScript. Nevertheless, we greatly profited from the work and were able to acquire valuable programming skills, which will prove useful in similar projects. Finally, publishing the map was a relatively simple process, due to the intuitive structure of Infomaniak.

3.2 Future Works

Even though we finished and published a first version of the Resilience Map of Switzerland website, we are still going to keep on improving the site after the conclusion of this thesis. A few of the next steps which we are going to implement are:

- Adding more indicators.

  At the time of writing the website hosts five indicator with their corresponding maps. This corresponds more or less to the scope of the Belgian CEReAI project. The CRATer website however, displays information on 14 indicators. We aim to implement the most amount possible of these, providing an overlap with our international colleagues to enable a more elaborate comparison. Adding these indicators, might entail a slight redesign of the website, to accommodate the different tabs.

- Make the scale persist over tab changes.

  During our user study, one participant brought the detail to our attention that every indicator opens the canton map first. Therefore, users solely interested in districts would have to manually change the scale every time they opened a new map.

- Make maps and data downloadable.

  It would be convenient for visitors of the site to be able to easily download the contents. We would like to implement a download button allowing users to save the data to their local machine.

- Enable easy comparisons between regions.

  It would be interesting to compare two cantons or districts. We want to build a feature which compares two regions: a tool where you can select two tiles and then see the differences and similarities both in absolute and percentile measures.

- Calculate resilience scores from the indicators

  It would be convenient for users to be able to evaluate regions without comparing absolute numbers of the indicators but rather having a score from 1 to 10 (or similar) which denotes the resilience of the region for a given indicator. We could also calculate an overall score, factoring in the different indicators so people can compare the regions quicker, without even having to look at the individual values we calculated.

3.3 Conclusion

In conclusion, the implementation of a public website which displays a visualization of the resilience of food systems in Switzerland was achieved successfully. The interactive and minimalist design will help non-expert users navigate the data, while still allowing for the detailed information which a specialist might demand, to be readily accessible. The user study which was conducted, helped guide the process and make the website more intuitive. Overall, the project constitutes a valuable contribution to the cause of understanding the Swiss regional food systems. It represents an accessible platform where farmers, policymakers and other stakeholders can acquire data which would else be harder to obtain and therefore has the potential to play a part in the ongoing effort of developing sustainable and resilient food systems in Switzerland.

The website is available here.

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