



# TempAg National Food System Resilience



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## Contents

1	Introduction.....	4
1.1	TempAg.....	4
2	Background.....	4
2.1	Four key Questions .....	4
2.2	The three R's.....	7
3	Methodology.....	8
3.1	Web-Based Literature Review.....	8
3.1.1	Search Criteria .....	8
3.2	Questionnaire .....	10
3.2.1	Search Criteria.....	10
4	Results.....	12
4.1	Literature Review.....	12
4.2	Survey Responses .....	16
5	Analysis.....	17
5.1	Approach to Food System Resilience.....	17
5.2	The Food System .....	17
5.3	Society and Community Building .....	18
5.4	Environment.....	19
5.5	Research.....	19
6	National Food System Resilience Recommendations .....	19
6.1	United Kingdom.....	19
6.2	Norway.....	21
6.3	Switzerland.....	21
6.4	Actor-Specific Recommendations.....	22
6.4.1	National Government .....	22
6.4.2	Civil society .....	24
6.4.3	Producers .....	24
6.4.4	Caterers and Hospitality Workers.....	24
6.4.5	Packagers .....	25
6.4.6	Transporters and Distributors.....	26
6.4.7	Waste Managers .....	27
7	Discussion and Conclusion .....	27
8	References.....	29

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## Table of Figures

<a href="#"><u>Figure 1 Food System Activities</u></a> .....	4
<a href="#"><u>Figure 2 Food System Outcomes</u></a> .....	5
<a href="#"><u>Figure 3 Food System Shocks and Stresses</u></a> .....	5
<a href="#"><u>Figure 4 A graph displaying the different document file types across all TempAg countries</u></a> .....	12
<a href="#"><u>Figure 5 A graph displaying the relative proportions of documents along spatial scale axes</u></a> .....	12
<a href="#"><u>Figure 6 A graph displaying the proportion of documents across the TempAg countries with the 3*-1* rating criteria applied</u></a> .....	13

# 1 INTRODUCTION

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This report is the result of an analysis of resilience strategies across a number of OECD countries included in the TempAg network [<https://tempag.net/>]: Belgium, France, Germany, Netherlands, New Zealand, Norway, Sweden, Switzerland and UK. It employed two methods for each of the countries: a review of web-based literature, and a survey of selected individuals from across the food system. The report summarises the approach and main recommendations, and it is supported by two annexes: Annex A is the full list of searchable documents indicating the original source for each, and Annex B presents the survey responses as received.

## 1.1 TEMPAG

TempAg is an international collaborative research network established to increase the impact of agricultural research in the world's temperate regions. The network was established in April 2015 with support from the OECD Global Science Forum. The network's activity is jointly coordinated by the Global Food Security programme (UK) and the National Institute of Agricultural Research (France). Through its activity, the network aims to:

- Increase the impact and return on investment of national research programmes in temperate agriculture,
- Enable dissemination and alignment of existing and new research & technology and
- Identify areas of research relevant to science & policy which are currently not addressed at an international level.

The overarching goal of the network is to ensure delivery of resilient agricultural production systems at multiple levels across the “temperate” zone.

# 2 BACKGROUND

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Food systems operate at multiple, interacting levels across spatial, temporal, and jurisdictional scales (Cash et al 2006) and are vulnerable to multiple shocks and stresses. Recent years have seen several shocks and stresses impacting the food system. Notable examples are the 2018-19 extreme drought in Australia, food safety scares such as the 2017 Fipronil eggs contamination in Europe, potentially-disrupted food trade arrangements between UK and EU due to Brexit from January 2021, and emerging geo-political tensions between major importing/exporting nations for agricultural commodities. The massive systemic shock from COVID-19 has accelerated further scientific, policy and societal interest in the need to enhance food system resilience. Resilience is a complex and contested subject matter.

## 2.1 FOUR KEY QUESTIONS

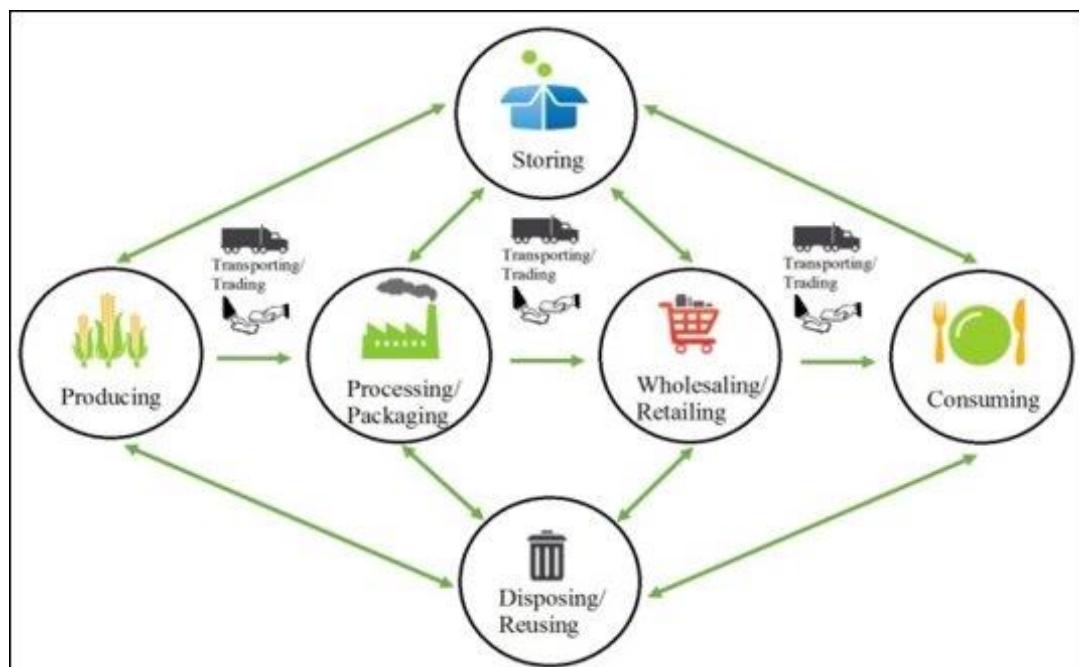
Resilience discussions need to be framed within the answers to four key questions:

1. Resilience of what?

2. Resilience to what?
3. Resilience for whom?
4. And resilience over what time period?

#### Of what?

The resilience “of what?” can be summarised as the ‘food system functioning’ (food system activities). Where does resilience need to be enhanced within the food system? Figure 1 illustrates just a few of the key actors within the food system and the function they represent.



*Figure 1 Food System Activities. Source: Erickson 2008 and Ingram 2011*

The function of the food system is the outcomes: what is produced? What is created?

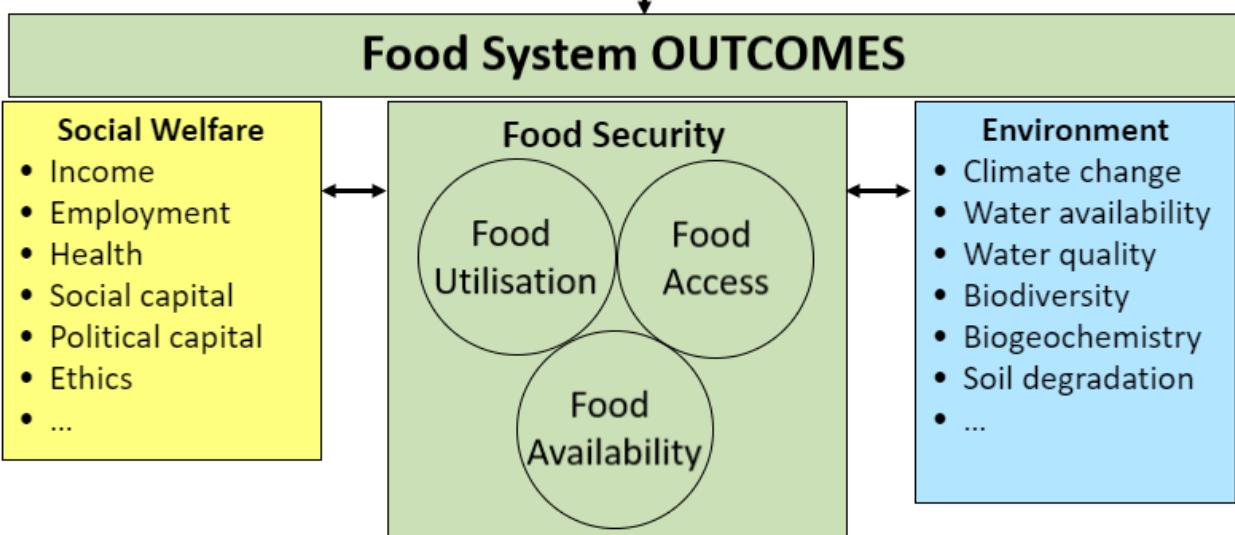


Figure 2 Food System Outcomes. Source: Erickson 2008 and Ingram 2011

### To what?

The resilience ‘to what’ refers to the numerous shocks and stresses encountered within the food system.

- Shocks can be considered as unimagined, rare and/or unpredictable events that have a big impact on the food system.
- Stresses, on the other hand, can be considered as easily perceived drivers and trends that will influence change.

<b>Stress</b> <i>pressure or tension exerted on a system</i> [Steam Trains]	<b>Shock</b> <i>sudden surprising event affecting a system</i> [Grey Swans]
Demography	Trade wars
Social & cultural norms	Election and Referenda results
Natural resource degradation	Food scares
Climate change	Extreme weather
Urbanisation	Conflict
Automation	Pandemics
Science & technology	
Geopolitics	

Figure 3 Food System shocks and stresses. Source: Ingram and Bellotti (2019)

### For whom?

Whether a food system is considered resilient ultimately depends on the people it serves. Asking ‘for whom’, (or ‘from who’s perspective’) a system is resilient is thus, an important question. There are several different food system actors that are affected by changes to the overall function and functioning of the food system. These include the national government, civil society, producers, processors, wholesalers, logistics providers, retailers, caterers, and waste managers.

### Over what time period?

Finally, strategies to enhance the resilience of a food system will depend over what time period is being considered: 24 hours (as in just-in-time delivery of fresh produce, or seasonal for an agricultural practice). A ‘shock’ can be normally result in a short-term, discrete ‘event’. Example shocks include:

- Fishing or agricultural activities (due to e.g. extreme weather)
- Critical ingredient shortfall (due to e.g. disease outbreak)
- Just in time groceries delivery (due to e.g. IT malfunction)
- Consumer shopping patterns (due to e.g. food scares)

‘Stresses’ refer to longer-term disruption, and examples include:

- Climate change
- Natural resource degradation
- Demographic change
- Change in dietary preferences

Answers to all these four questions raise important issues of significant relevance to food system policy formulation, practice, and research. Despite the importance of these questions, most research has been on debating definitions of resilience and discussing case study examples. This has however laid the foundation for more effectively applying resilience concepts to food systems frameworks to developing options for enhancing food system resilience.

## 2.2 THE THREE R's

The next consideration is *how* to enhance food system resilience. Most policy, practice and societal discussions focus on food system outcomes (i.e. its function), with emphasis on strategies of either **Robustness**, which aims to resist disruption to existing food system outcomes (i.e. maintenance of the status quo), or **Recovery**, which aims to return to pre-existing food system outcomes after disruption (i.e. bounce back to the status quo). There is however a third notion, **Reorientation** (also termed ‘transformation’) which is about

accepting alternative food system outcomes before or after disruption (i.e. bounce forward). This is based on the premise that changing societal expectations of system outcomes can enhance food system resilience by making it inherently less vulnerable to shocks and stresses. An example is aiming for diets based on a wider range of agricultural products thereby spreading risk. The reorientation notion of resilience is now extremely timely and urgently warrants further international debate.

All three strategies need to be rooted in a clear understanding of food system risks, shocks, and stresses, and all involve reorganisation. This means making changes to the food system activities (adaptation) by changing the policy, economic, social and/or technological ‘drivers’ which influence how different food system actors undertake their respective activities. The answer to the four questions and the debate about the three resilience notions have major relevance to food system policy, practice, and societal attitudes for post-COVID-19 recovery pathways.

### **3 METHODOLOGY**

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Nine countries across the TempAg network were included.

Belgium, France, Germany, Netherlands, New Zealand, Norway, Sweden, Switzerland, and the United Kingdom.

The project employed two different methods: (1) literature review, and (2) survey.

#### **3.1 WEB-BASED LITERATURE REVIEW**

##### **3.1.1 Search Criteria**

A comprehensive online search – using Google’s search engine and Google Scholar – was completed to find documents that contain information on food system resilience within the selected TempAg member countries.

Documents that were written by authors who may reside outside of the listed TempAg countries were also included in the literature review, so long as they still fulfilled our search criteria and research goals.

The following search criteria was used in order to complete our online research:

[Insert TempAg country name] + [any of the following categories] + [type of food system actor]:

- food resilience
- food system resilience
- "food system resilience"
- “food system” report
- “food system resilience” report
- “food system resilience” national report

- food resilience national report
- “food resilience national report”
- food resilience report
- “food resilience report”
- resilience in food system
- resilience of the food system

After searching with those terms, an additional criterion was added, ‘filetype:pdf’, to the search field, e.g. ‘New Zealand “food resilience report ”’ became ‘New Zealand “food resilience report” filetype:pdf’. This was done to all search criteria categories. Searching by filetype helped to filter through the abundance of webpages and helped to facilitate a quicker arrival at the materials that were of relevance.

The search was then repeated, this time, however, translating the search terms into the TempAg national languages:

e.g. ‘résilience du système alimentaire en France’

The documents found then went through a systematic coding procedure, whereby the coding was set as a Star Rating, 3\*-1\*, according to the following criteria as displayed in Table 1:

*Table 1 Document Star Rating Criteria*

3*	A document, written by an author who resides in the TempAg country, specifically discussing food system resilience about the TempAg country in question.
2*	A document that discussed the concept of food system resilience but has a greater focus on the principles of sustainability about the TempAg country in question.
1*	A document that has some/minor relevance to food system resilience in the TempAg country – e.g. discusses food security and mentions ‘resilience’ 1-5 times in the document. This also applies to documents that have a document about overall food system resilience and uses the TempAg country as a short case study

We found that though a title of a document could be rated 3\*, the contents of the document may only score a 2\*.

Each web-based document was then scrutinised during a comprehensive literature review. Notes were made on the respective recommendations of each report to decipher the understandings of what was being done to improve resilience in the food system.

## 3.2 QUESTIONNAIRE

### 3.2.1 Search Criteria

After locating, identifying and logging the web-based documents, a separate search was conducted to identify different food system ‘influencers’ (defined as National Government; Civil Society) and ‘actors’ (defined as Producers; Processors; Wholesalers; Logistics; Retailers; Caterers; Waste Managers) across the food system in the eight TempAg countries. We focused on finding bodies/associations that could represent that actor group in the food system rather than individual organisations or companies. For example, UK Hospitality, rather than Hilton Hotels.

The search criteria were as follows:

“Food + [actor in the food system] + association + in [country]”. E.g. “Food Logistics Association in Belgium”.

Where associations were not found, we adapted the search criteria, and instead inputted “food + [actor in the food system] + union + in [country]”. E.g. “Food Manufacturer union in France”.

We did this for each country and, in some relevant cases, translated the search criteria into local languages to improve the result outcomes.

The benefit of contacting associations is their ability to speak on behalf of multiple different individual businesses or member groups. This allows for a richer systemic view of the overall food system and the problems that pertain to given actors.

An analytical framework was then created and used for an online survey sent to the identified individuals across the categories in each country.

*Table 2: Analytical framework*

	<b>Resilience of what?</b>	<b>Resilience to what?</b>	<b>Resilience for whom?</b>	<b>Resilience over what timeframe?</b>
National Government				
Civil Society				
Producers				
Processors				
Wholesalers				
Logistics				

Retailers				
Caterers/ Hospitality				
Waste Managers				
<b>Notes</b>	What do you feel needs to be made more resilient? <i>E.g. a national policy maker might consider the national food system while a supermarket chain might consider its business model.</i>	What shocks and/or stresses are you most concerned about? <i>E.g. a farmer organisation might worry about extreme weather or change in subsidy regime, a logistics association might worry about a fuel cost spike and a consumer organisation about food safety.</i>	For whom do you feel resilience needs to be enhanced? <i>E.g. a hospitality sector organisation might want to ensure the livelihoods of the people working in its member bodies while a civil society organisation might focus on more vulnerable people.</i>	Over what time scale do you feel they need resilience enhanced. <i>E.g. a processor of fresh salads might be most concerned about the summer season whereas a waste manager might be thinking multi-year.</i>

We emailed each identified individual the project summary, and inviting them to complete the survey.

## 4 RESULTS

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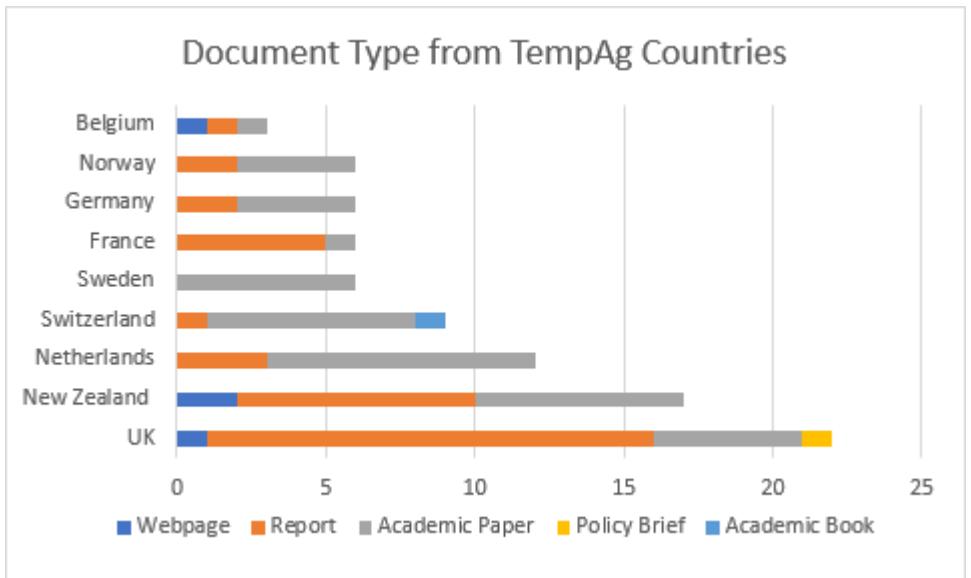
### 4.1 LITERATURE REVIEW

A sum of the total documents (86), by country, that were found following our online search is recorded in Table 3:

*Table 3 A record of the number of documents found for each TempAg country. These include all document types*

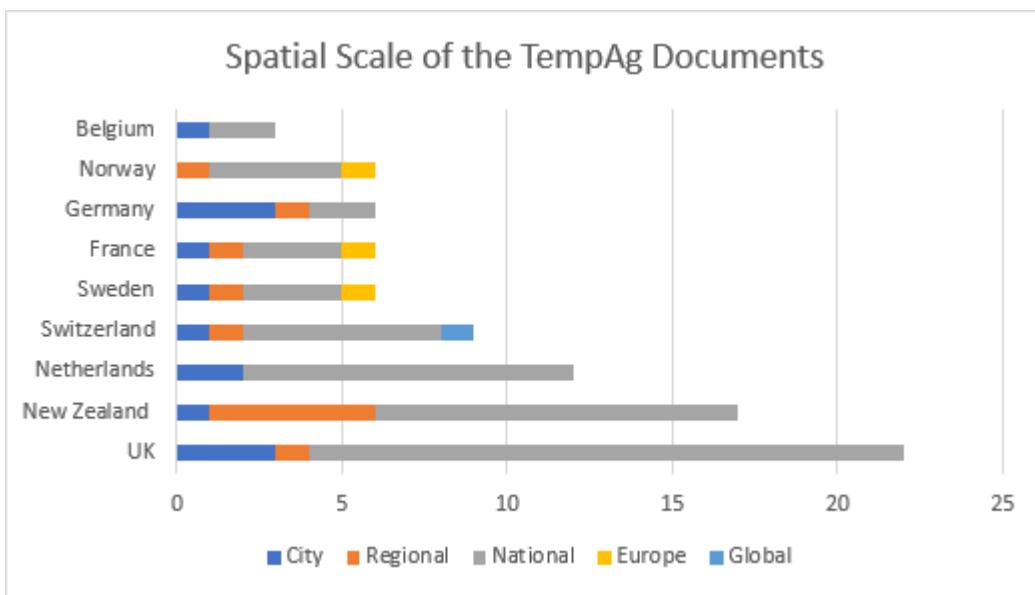
Country	Number of Documents
UK	21
New Zealand	17
Netherlands	12
Switzerland	9
Sweden	8
France	6
Germany	5
Norway	5
Belgium	3
	86

We then sorted these documents by file type: webpage, report, academic paper, academic report, policy brief and academic book. Figure 4 illustrates the relative file type proportions from the web-based documents across all TempAg countries:



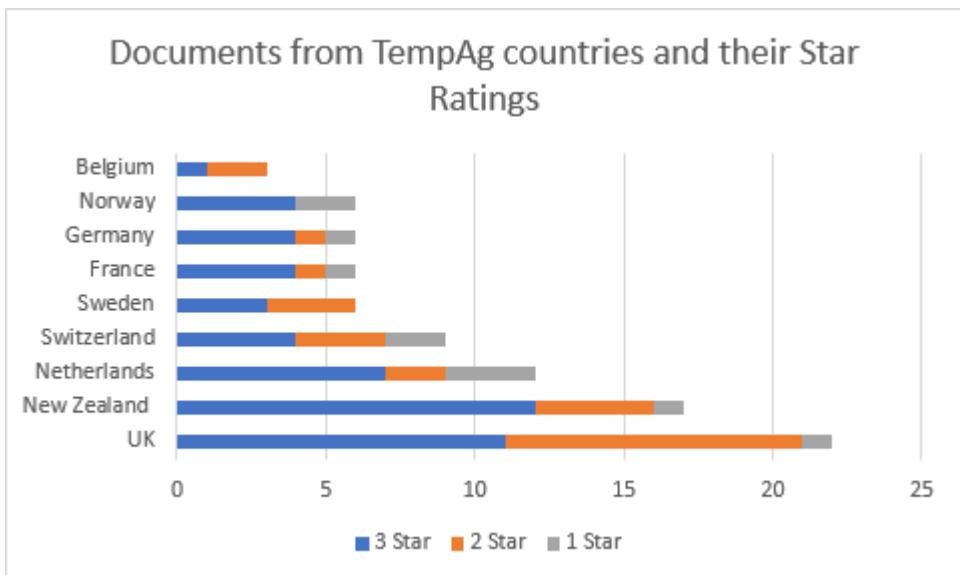
*Figure 4 Different document file types across all TempAg countries*

Finally, the documents were coded according to spatial scale/resolution. For example, a report discussing food system resilience in Bristol would be spatially coded as ‘City’, whereas, a webpage discussing global food system resilience but featuring a TempAg country as a case study would be coded ‘Global’ (Figure 5).



*Figure 5 Relative proportions of documents along spatial scale axes*

Figure 6 shows the proportion of 3\*-1\* rated documents across all TempAg countries:



*Figure 6 Proportion of documents across the TempAg countries according to star rating*

Table 4: Star Ratings for all TempAg Documents

Country	Total Number of Reports	3 Star	2 Star	1 Star
UK	22	11	10	1
New Zealand	17	12	4	1
Netherlands	12	7	2	3
Switzerland	9	4	3	2
Sweden	6	3	3	
France	6	4	1	1
Germany	6	4	1	1
Norway	6	4		2

Belgium	3	1	2	
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Table 5: Spatial Resolution of the TempAg Resilience Documents

Country	City	Regional	National	Europe	Global
UK	3	1	18		
New Zealand	1	5	11		
Netherlands	2		10		
Switzerland	1	1	6		1
Sweden	1	1	3	1	
France	1	1	3	1	
Germany	3	1	2		
Norway		1	4	1	
Belgium	1		2		

Table 6: Type of Documents for TempAg countries

Country	Webpage	Report	Academic Paper	Policy Brief	Academic Book
UK	1	15	5	1	
New Zealand	2	8	7		
Netherlands		3	9		
Switzerland		1	7		1
Sweden			6		
France		5	1		

Germany		2	4		
Norway		2	4		
Belgium	1	1	1		

#### 4.2 SURVEY RESPONSES

There was a limited response rate due to several compounding factors- Covid-19, Brexit, and lack of time.

In total, 6 survey responses were collected – 3 of which were from Switzerland, and 3 from the UK. The actors represented across the completed surveys were from the:

- National Government
- Civil society
- Catering/Hospitality sector
- Packaging industry
- Waste industry

## 5 ANALYSIS

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Resilience based recommendations from across the web-based documents were wide-ranging and varied. While there was a limited response to the survey, the answers provide a rich picture of the various actors that are entangled into the wider food system. The section below presents an analysis of the key themes and recommendations resulting from the literature review and survey responses.

Annex A presents an annotated bibliography of the web-based documents included in the review and Annex B details the survey responses

### 5.1 APPROACH TO FOOD SYSTEM RESILIENCE

Addressing the complexity of food systems requires a systems-based, long-term, resilience approach that enables action by multiple stakeholders across sectors, and understands the linkages between and feedbacks among food system components (Dowding-Smith 2013, Total, Rendall, and Reitsma 2015, SCAR 2017, Wood et al. 2019, Halloran, Wood, and Sellberg 2020). Given the complex and rapidly changing context of food systems, a strong governance approach is necessary to stimulate participation and representation (Crivits et al. 2016).

Effective collaboration across all relevant stakeholders to drive food system change from within then invites creativity in involving, educating, and learning (Nefs and Spoelman 2015). This will drive effective integration of positive actions to enhance resilience with multiple goals, such as health, employment. Creating discussions across sectors can link stakeholders to improve practices and explore how responses to stresses and shocks can be better prepared for and managed (Dowding-Smith 2013).

### 5.2 THE FOOD SYSTEM

The resilience of the overall food system is explored extensively in the literature through the lens of policy, business, workforce, food production, and technology. Food system stakeholders such as the Swiss national government also acknowledges the necessity of ensuring the resilience of “the entire food system” to impacts of climate change and other shocks. Stakeholders in UK’s hospitality sector and waste associations point to supply chain failures and minimisation of waste and industry by-products as areas of concern and action (Survey Responses 2020).

From a **policy perspective**, the examined literature recommends the creation of a “territorial food resilience policy” applicable at national and regional scales that responds to the needs of the most vulnerable, provides quality and diversified food, prioritises solidarity-based food security (Carta Academica 2020), and promotes urban food production (Baumbach 2013). From a systems perspective, there is a strong recognition to adapt food system activities such as changing food production and processing activities and adjusting food consumption patterns, food system drivers such as food production policies, agri-environment schemes, and trade regulations, and stakeholder worldview and perspectives related to tradeoffs between environment and capital related transformations (GFS 2019). A balanced approach to responsibilities and risk management across business and government is recommended

to ensure effective solutions and to design efficient, ethical, and feasible strategies in working towards food systems resilience (Meuwissen et al. 2010).

Entrepreneurship across the food system is a key factor in driving change from the **business perspective** with recommendations in increasing the number of entrepreneurs in processing and marketing, supporting the sale of local production in short supply chains and offer long-term financial support, exceptional investment aid and/or tax exemptions to support this transition, particularly for the logistical organization. The support of local producers and initiatives can be further supported by asking federated entities to regularly update platforms for promoting local producers, and recognising and marketing seeds and seedlings by the relevant councils. National governments and supply chain actors participating in the survey further recognise the importance of maintaining resilience for SMEs, food service businesses, and restaurants, pubs, and bars (Swiss national body and UK Hospitality). Facilitating access to agricultural tools, necessary spare parts, and prioritising the re-opening of stores selling agricultural equipment during the pandemic and distributing health instructions for farmers' markets (Carta Academica 2020). In terms of risk analysis and management, food-related companies and businesses stand to benefit from trying to account for unknown hazards as well as known hazards and improving risk management solutions for high-ranking calamities such as electricity and road transport crises and losses of key supplies (Meuwissen et al. 2010).

The role of the **food system workforce** in creating and maintaining resilience is critical and should be stabilised by facilitating access and accelerating measures for entry to seasonal agricultural work for the economically and temporarily unemployed, and other interested stakeholders such as pensioners and students. The workforce can be strengthened by supporting the creation of a supply and demand platform for assisting with production, creating inventories of unemployed people possessing heavy vehicle licenses, and prioritising continuing practical training in agriculture. Ensuring a decent income for stakeholders in agriculture is foundational issues with recommendations to reorient/create subsidies and ensure transitional incomes for those starting out on sustainable agriculture practices (Carta Academia 2020).

Finally, embracing **technological innovation** to improve food systems (Hollander, Temme, and Zijp 2017), build better support for those experiencing transformation, create and maintain better communication of transformation trajectories (Meuwissen et al. 2019). Specifically, Gerritsen, Groot, and Nieuwenhuizen (2014) recommend promoting greenhouses as an efficient way to grow crops and replicating the Netherlands model of production in other places.

### 5.3 SOCIETY AND COMMUNITY BUILDING

Resilience strategies addressing society and community are examined in the context of inclusive community building and driving transformational food system change from within. For example, there are recommendation to create inclusive expert groups for territorial resilience policies for implementing short-term proposals that are still linked to a medium- and longer-term vision (Carta Academia 2020). Community building, maintaining a diverse food supply network, and strengthening adaptability by retaining the necessary knowledge and skills will increase resilience (Benton et al. 2012). With recognising the value of grass roots and community-based approaches to transformation (Dowding-Smith 2013) rural

recovery and food system transformation can be grounded in the lived realities of residents and regional socio-economic and environmental contexts (Cradock-Henry, Fountain, and Buelow 2018). There is also a strong recommendation to encourage and support diverse edible initiatives in local communities (Baptiste et al. 2016), and encourage food production by individuals, promoted by starter kits, resource persons, and educational tools (Carta Academia 2020).

## 5.4 ENVIRONMENT

Recommendations specifically focused on the environmental aspects of food system resilience consider the reduction of food waste and unwanted emissions, inputs, and outputs (Hollander, Temme, and Zijp 2017), improving and scaling up organic and local food initiatives, and developing a better understanding of potential trade-offs between local diversity and global resource efficiency (von Oelreich and Milestad 2015). A coordinated multi-stakeholder strategy is necessary to address these issues at national levels, partly because of current priorities and a lack of political pressure and urgency (Last et al. 2015). Vrodoljak, Alencar, and Tesic 2020 recommend the creation of a concept-oriented transparent strategy to match Alternative Food Networks (AFNs) to political frameworks and existing policies and develop common indicators based on SDGs to monitor their impacts.

## 5.5 RESEARCH

Research and academia have a key role in prioritising further research on forecasting extremes and on understanding the nuances of weather distribution changes, assessing potential impacts of climate change, and scenario planning to manage simultaneous impacts, challenging stakeholders, and informing adaption strategies (Benton et al. 2012). Resulting data should be used to gain a better understanding of why resilience varies across sectors within the system, and what type of shocks sectors and industry are the most vulnerable to (Jones, Koch, and Schrober 2019). Developing pathway based approaches to adaptation in agriculture is a key area of future research to articulate the context, risks, objectives, barriers, and options for decisions on adaptation. These can be used to identify appropriate adaptation strategies, examine knock-on effects on connected systems, and explore feasibilities. Experts on consumer studies can also shed light on consumer perceptions on the continuity of supply chains and their demands in terms of choice, availability, price, and product type (Meuwissen et al. 2010, Wilson 2014).

# 6 NATIONAL FOOD SYSTEM RESILIENCE RECOMMENDATIONS

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A significant number of the reviewed documents contain country-specific recommendations for resilience. These have been supplemented by the results from the survey and have been summarised below with references (a full list of documents reviewed is found in Annex A):

## 6.1 UNITED KINGDOM

(WRAP 2017, Greater London Authority 2018, and Bash and Donnelly 2019)

- Promote diets prioritising plant-based proteins and a ‘less and better’ approach to animal-based foods.
- Advocate for British agriculture policy that accounts for human health.
- Advocate for all agricultural trade agreements to support public health and environmental sustainability, particularly in the post-Brexit environment.
- Advocate for reduction in antibiotic use in the livestock sector.
- Take a global view on food systems and align public health policies with key international agreements.
- Support regulation for labelling related to food production methods.
- Stimulate demand for sustainable food including British and local vegetables, pulses and fruits through public procurement, for example, implement DEFRA’s Balanced Scorecard across public health sector catering and procurement and support the re-specification of the School Fruit and Veg Scheme to support sustainability.
- Commission food programmes that support sustainable food systems.
- Promote and support community-based agriculture schemes that bring farming and green spaces into the urban and peri-urban environments and provide open access and exposure to these green spaces for members of the local community.
- Develop and support local policies and contracts that aim to reduce wasted food within public sector food provision and wider large-scale catering.
- Promote the London living wage.
- Create supply chains fit for the future.
- Invest in food chain data capabilities.
- Promote innovation and consumer engagement on health and sustainability.
- Businesses should:
  - Show leadership on climate change,
  - Drive product innovation through harnessing diversity,
  - Drive down farm-to-fork food waste,
  - Unlock the value of landscape partnerships,
  - Drive product innovation through clear data strategy and through use of health and sustainability agenda,
  - Increase consumer engagement on health and sustainability
- Policy makers should:
  - Support the creation of business tools for food system resilience,
  - Create a regulatory environment that fosters partnerships and diversity,

- Develop an open spatial data infrastructure,
- Create a food and drink sector strategy,
- Fund training and skills development in the food chain data,
- Pursue joined up policies on health and sustainability,
- Extend food enterprise zones to support health outcomes,
- Champion international agreement on dietary advice,
- Use public procurement to drive health and sustainability agenda,

## 6.2 NORWAY

(Wood et al. 2019)

- Begin immediate action to transform Nordic food systems.
- Initiate a multi-stakeholder scenario development process to define a common vision for Nordic food systems.
- Develop strategies to handle the trade-offs of change.
- Evaluate Nordic food systems in the global context.

## 6.3 SWITZERLAND

(Survey Responses 2020)

- Build resilience into the entire food system.
- Protect from the impacts of climate change and other external shocks.
- Ensure resilience for small producers, SMEs, food entrepreneurs, professionals in food production and distribution, politicians, and consumers.
- Empower consumers in making easier and informed choices about sustainability and food using tools like information, lobbying, professional education in food and commerce sectors and taxation that incentivizes sustainable production and consumption.
- Protect consumers from marketing practices that favor pre-processed and industrial foods.
- Code better consumer information into laws and regulations (e.g. nutriscore codification and shops that can facilitate consumers to make sustainable food choices).

## 6.4 ACTOR-SPECIFIC RECOMMENDATIONS

A proportion of reviewed documents provided recommendations specifically for some actors within the food system.<sup>1</sup> These are summarized below:

### 6.4.1 National Government

(Carey 201, Labour Party 2013, De Vries et al. 2016, EurActiv 2020, Llanos and Border 2020, survey responses (see Annex B))

- Stimulate product variety.
- Increase competition which will lead to resilience.
- Improve transparency and trust in the supply chain.
- Food policy should encourage and facilitate initiatives and institutions working on the sustainable management of common pool resources.
- Promote a Green Deal.
- Boost both local food production and international trade.
- Build stronger links to public sector catering establishments, transport infrastructure services, and markets to strengthen the wholesale and distribution sector.
- Invest in technology
- Learn to deal with changing circumstances and make room for experimentation and selection based on results.
- Invest in training and education to improve the processing industry.
- Invest in training the workforce and promote jobs within the supply chain as a whole
- Build food system resilience across multiple years.

#### 6.4.1.1 New Zealand National Government

(Christchurch City Council 2014 (43))

- Collaborate with the community to achieve the food resilience vision, objective and outcomes, for example by being a participant in the creation and implementation of a Food Resilience Action Plan for the city and by being an active member of the Food Resilience Network.
- Identify and make available suitable Council land for food production, community gardens and related activities, and establish supportive frameworks that enable community use of these spaces.

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<sup>1</sup> No recommendations were found for processors, packagers, and disposers.

- Encourage the establishment of productive gardens on suitable land around the city that is not in Council ownership, for example homes, schools, church land, institutions, and market gardens.
- Protect locally productive soils surrounding the city from inappropriate development that undermines the lands productive capacity.
- Commit to increasing the nutritional quality of food in Council facilities, events and food stalls on public land (for example ensure that low sugar, fat and salt options are provided).
- Advocate on behalf of the community on issues that affect the city's food resilience, for example advocacy to central government about healthy food choices in schools.
- Support initiatives that increase the availability, distribution, and affordability of fresh, healthy food in our communities, for example farmers markets, green grocers, local food cooperatives and community kitchens.
- Work with food producers, distributors, retailers, other agencies, and the community to encourage the availability, affordability and uptake of healthy food in our community.
- Support community education through community gardens and other local initiatives that increase knowledge of how to grow, harvest, prepare and consume healthy locally grown food to support edible gardens and a thriving local food economy.
- Support competitions, awards or harvest festivals that celebrate our garden city identity, encourage edible gardens, community gardens, and educate the community about the benefits of our food resilient edible garden city.
- To better target our regulatory activities so that the food safety system is fit-for-purpose, resilient and proactively encompasses new technology and innovation.
- Increase engagement with businesses and stakeholders to make sure regulatory controls are understood and improve compliance.
- To make authoritative information about food safety issues more accessible to consumers, in ways that suit their communication preferences.
- To foster stronger partnerships between central government agencies, local government, academia, and industry which raise consumer awareness and help inform their choices.
- To enhance our understanding of Māori rights and interests in relation to the food safety system, and the Crown's Treaty of Waitangi obligations.
- To seek out and include consideration of Māori mātauranga (knowledge), values and perspectives in New Zealand Food Safety/Haumaru Kai Aotearoa's decision-making.
- To further invest in an emerging risks system and a horizon-scanning system that systematically identifies emerging threats and opportunities, and tackles those which are most significant.

#### **6.4.2 Civil society**

(Health in All Policies Team, Community & Public Health 2019 (49), survey responses (2020))

- Integrate multiple understandings of health.
- Promote taxation that incentivizes sustainable choices.

#### **6.4.3 Producers**

(Kenny 2011, Duranovich et al. 2015, Berg 2018, EIP-Agri 2020, Popp and Nowack 2020)

- Diversify agriculture: Including agro-forestry, mixed-crop livestock systems, crop rotation and diversification to increase productivity and resource efficiency and create new market opportunities.
- Increase cooperation and knowledge transfer beyond system boundaries which would contribute to a holistic risk management allowing for improved farming system resilience.
- Boost knowledge intensive and low input systems as they are consistent with the resilience picture drawn from farmers.
- Maintain ongoing engagement with smart farmers, focused on resilience, as this contributes significantly to the development of a coordinated ‘bottom up’ and ‘top down’ response capacity.
- Boost these six attributes that are relevant for individual resilience:
  - self-efficacy
  - locus of control
  - willingness to accept uncertainty and change
  - open-mindedness
  - sense-making
- Alternative food networks: Boost AFNs as they contribute to resilience, giving economic gain and social embeddedness in the form of appreciation and identity.

##### ***6.4.3.1 UK Producers***

(Doherty et al. 2020)

- Reduce reliance on EU imports
- Currency hedging.
- Retain EU migrant employee.
- Forward buying logistics capacity.

#### **6.4.4 Caterers and Hospitality Workers**

(UK Hospitality and CGA 2019a, 2019b, survey responses (2020))

- Promote the experience-economy to help the hospitality sector.
- Promote careers in the sector and invest in skills and training.
- Promote staff wellbeing should be an industry priority.
- Invest in tech.
- Remove red tape.

#### ***6.4.4.1 UK Caterers***

- Develop resilience for the food service sector, restaurants, pubs, and bars.
- Have a pre-Brexit tick-list:
  - Review the supply chain,
  - Assess potential impacts on service quality and commercial sector, and
  - Collaborate with stakeholders.
- Develop a national database to ensure supply chain data integrity, particularly in relation to ingredients, allergens, and biocide regulations.
- Have the ability to source key ingredients all year around.
- Ensure high food standards to prevent infections.
- Increase the volume of the UK hospitality sector.
- Protect against supply chain failures because of delays in border crossing for short shelf-life products, tariffs causing price increases due to multiple border crossings, and reduced volumes leading to unsustainable delivery costs.
- Protect against extreme weather and disease impacts on production.
- Ensure affordable, comprehensive, and quality service to vulnerable children served by schools and hospitals, and clients across the whole country.
- Consider an annual review of key concerns because of the impact of seasonal crops, longer term issues, and the impact of Brexit tariffs and custom administration.

#### **6.4.5 Packagers**

(Survey Responses 2020)

- Ensure chemical safety of food packaging, especially in the context of a circular economy.
- Examine the number of unknown chemicals used in food packaging and the unknown mixture effects on the human body.
- Protect sensitive population groups and the broader public from chemicals used in food packaging.
- Resilience for packaging related concerns should be managed continuously.

#### **6.4.6 Transporters and Distributors**

(Baker and Morgan 2012)

##### ***6.4.6.1 UK Transporters and Distributors***

- Estimate more accurately the ability to transfer freight and vessels to other routes should there be any disruption to the UK ports RoRo network.
- Commission work to investigate the adaptability of RoRo ferries between Dover operational mode and non-Dover mode.
- Investigate the economic development and installation of dual-purpose RoRo ramps, along with the scope to increase potential capacity through the Channel Tunnel.
- Conduct a full analysis of UK Deep Sea container service and port capacity (allied to container feeder service capacity and Continental port capacity), along similar lines to the UK Short Sea Freight RoRo and LoLo Capacity Analysis and Report would help to clarify the flexibility and potential transferability of vessels and containers from one port / service to another, should disruption occur.
  - It is currently not clear whether enough container feeder, short sea and Channel Tunnel train capacity is available to feed containers back to the UK if a key UK container port is disrupted.
- Address the potential benefits for UK food supply resilience generated by “added value” service developments around the new London Gateway “hub” terminal along with the potential added resilience that transshipment hub developments at Scapa Flow, Hunterston or other deep water facilities might generate.
- To improve the understanding of potential disruption and planning greater resilience scenario analysis, planning needs to be carried out at an individual flow level.
- Improve resilience planning and business continuity modelling by having greater openness and transparency among stakeholders (ports, shipping lines, food and drink industry, local and national government, government agencies, port community system providers).
- Discussions with the developers and providers of the Port Community Systems in use at the UK’s major container ports; Marine Cargo Processing (MCP) and Community Network Services (CNS) should explore the development of computer system based facilities that could assist the transfer of container and RoRo ferry calls from one port to another in the event of port disruption.
- The detailed inputs, outputs and scenario assessment capabilities of the DfT's Deep Port model should be assessed in terms of its ability to model the impact and resolution options (vessel and traffic diversion) in the event of port disruption. If it is not considered 'dynamic' enough work should be commissioned to develop and maintain such a live and interactive model.

- Fill some evidence gaps by bespoke analysis of the DfTs Maritime Statistics database, allied with support for Border Agency and Port Health Author(s)ity initiatives to identify food consignments carried in trailers and containers arriving into the UK from EU countries. Provision to identify food grade liquid bulk imports as part of the DfT's data collection process for the Maritime Statistics would fill another gap.
- Make the location and volume of stock in the supply chain more transparent, to enable more enlightened planning and government intervention, if felt necessary.

#### 6.4.7 Waste Managers

(Survey Responses 2020)

- Minimize and manage the whole supply chains' by-products and waste.
- Change market demand due to shocks (e.g. adverse weather, food production gluts, food contamination, disease, strikes, and deliberate adulteration) for by-products.
- Manage capacity of waste recycling, anaerobic digestion, composting, and processing to deal with sudden surges of waste due to shocks and stresses.
- Remove barriers to waste recycling across the supply chain.
- Build capacity in the supply chain to respond to short and long-term impact of system shocks that can cause growth in waste (e.g. rapid growth over days because of food safety events, or 2-3 weeks to deal with good harvests).
- Strive for a resilient food system with low waste as a key feature and a diversity of markets for by-products.

## 7 DISCUSSION AND CONCLUSION

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Evidence from the literature review and the survey responses reveal broad agreement on the four resilience questions.

There is broad agreement in the documents reviewed and the actors surveyed on developing resilience across the whole food system and they key food characteristics at each stage. While the survey had a low response-rate, it demonstrated that while all participants agreed on the necessity of resilience across the different food system aspects, actors from different countries drilled into areas of the system. Secondly, a common theme observed across the survey responses and the reviewed literature was that there is significant overlap of the concepts of 'sustainability' and 'resilience'. Thirdly, there is a trend among the food system actors reviewed to focus on policy as a key tool to address food system resilience and there are very few suggestions on other methods.

This report's findings emphasize that resilience is a complex and contested subject:

However, there is agreement among food system actors in the TempAg countries on **where resilience needs to be enhanced in the food system**. The food system overall, the supply chain, and each food system 'activity' must be resilient. The food system must be made

resilient to **numerous shocks and stresses** such as climate change, economic and financial crises, pandemics, border controls, tariffs, and unknown interactions of various activities and substances. Actors from different sectors focus on specific shocks and stresses that influence their activities and intended outcomes and national documents explore the impact of various regional and global drivers they are subject to. **The key actors who are affected by changes to the functioning of the food system** range from consumers to food sector professionals and include businesses, the service sector, and vulnerable population groups. While the **timeframe of resilience** is not explicitly discussed, survey responses highlight the seasonality and rhythm of food system activities and explore short, medium, and long-term timeframes for various objectives and projects and the continuity of these concerns.

Besides the four areas of resilience discussed above the literature examines the role of business, government, and the food system workforce in developing and ensuring resilience in the context of inclusive community development. There is a recognition of the role of alternative food production networks and improving and scaling up organic and local food initiatives. Recommendations and areas of future work tend to differ by country-contexts, but there is a consensus on working towards food systems that supply and encourage sustainable and healthy eating that minimizes waste and certain types of inputs. The role of technological innovation in the future of food is recognized and encouraged through clear data strategies, transparency, inclusivity, and an accounting of trade-offs. The necessity of multi-stakeholder approaches and empowerment is noted across the board and suggestions are made for supportive policies and strategies.

While every effort was made to find relevant documents from each TempAg country and each food system actor defined above, gaps persist in the review. These gaps can be attributed to flaws in the search criteria in terms of terminology used and a search bias towards the United Kingdom. Language barriers and an overlap of sustainability and resilience might have contributed to other documents having been omitted from the analysis. A full annotated review and anonymized survey responses are available in the Annexes to support future research efforts.

Future food systems resilience work will benefit from a broader and intensive research agenda that interviews actors across the food system in a way that separates objectives around sustainability with resilience and considers the impacts of resilience measures in one food system area with another. This will be particularly useful given that some of the sector-specific recommendations have not considered the system-level and long-term impacts of proposed policies and the perspectives of other food system actors. Insights from food processors, wholesalers, packagers, and waste processors will be valuable particularly as practices around circular economy, alternative packaging, commodity tracing, and shortening supply chains are embedded more deeply into global food systems. It is proposed that a collective effort is needed across OECD countries to work together to build a more resilient food system globally and nationally. Finally, the report demonstrates that while food systems resilience is in an early stage in this cohort of countries, the concept is gaining significant traction and resilience-related policies and strategies are being implemented at different stages of the food system.

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