The values underpinning Iceland's food system risk

Implications for resilience planning

by
Holly Johanna Jacobson

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Bowdoin College 2011

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Author: _____
Holly Johanna Jacobson
Department of Urban Studies and Planning
May 6, 2016

Certified by: _____
Janelle Knox-Hayes
Associate Professor of Urban Studies and Planning
Thesis Supervisor

Accepted by: _____
P. Christopher Zegras
Associate Professor of Urban Studies and Planning
Chair, Master in City Planning Committee

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ABSTRACT

Some claim Iceland's food security is in grave danger. Farms fear financial failure as they compete with cheaper imports; high import reliance renders the country vulnerable to natural, political, and financial volatility; climate change threatens to exacerbate these food system weaknesses. Yet Iceland has no contingency plan, and adaptation measures are absent from national climate change reports. While this gap could be perceived as negligence, to do so assumes a universalistic framework for risk and resilience—a trend currently seen in the global proliferation of formulaic, resiliency plans. Ecological resilience is defined as the ability of a system to absorb disturbance so as to retain *essentially the same function*. In a social-ecological system, what defines that function? Who decides what is at risk?

This thesis seeks to understand the defining parameters behind risk and resilience within Iceland's social-ecological food system—a dynamic and evolving set of tensions between human livelihoods, legal frameworks, biological cycling, and emotive response. Interviews, backed by risk theory and corroborated with survey data, uncover the tendency for risk to be framed in the context of particular value logics. Explored through factor analysis, the aggregate risk scale that focuses on agricultural vitality, for example, correlates with a value scale that embeds *preparedness* and *self-sufficiency*, but also *cultural heritage*. These findings suggest several implications: First, there is a need to go beyond economic valuations in understanding risk. Moral, sentimental, and ideational values shape risk perception, and our current tools—such as discounting—cannot adequately consider what a future community will value. Secondly, if a value at stake underpins how risk is defined, then, inversely, preserving that value can define resilience. In other words, value-based resilience offers a framework for defining the *function* resilience preserves. And yet finally, this logic highlights a powerful hazard in resilience planning—the risk of systematically establishing preference for certain values and perpetuating a dominant set of social, political, economic ideologies. Value-based resilience is thus a call to planners to recognize the vulnerability built into the plans we make.

Key words: risk, resilience, values, food systems, food security, Iceland

Thesis Supervisor: Janelle Knox-Hayes
Title: Associate Professor in the Department of Urban Studies and Planning

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Keflavik
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PREFACE

What this thesis is not

At the World Health Summit in 1996, The World Health Organization defined food security as the following:

> When all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life. (World Health Organization, 2016)

This globally adopted framework rests on three main pillars: 1) food availability (sufficient and consistent quantities of food), 2) food access (sufficient resources to obtain appropriate and nutritious food), and 3) food use (adequate consumption based on knowledge of basic nutrition as well as adequate water and sanitation). Although the majority of food security dialogue to date has focused on insufficient intake of dietary energy and protein (caloric malnutrition) in developing contexts, there has been increasing recognition—as the WHO definition effectively seeks to embrace—in the need to perceive food security more holistically, incorporating micronutrient deficiencies, as well as obesity (Gómez et al., 2013). In other words, countries across continents and socioeconomic strata can all have food insecure populations.

The theory, analytical process, and argumentation constituting this thesis *do not* emerge from this framework. Every aspect of the World Health Organization's definition is embedded normatively into what may comprise a well-functioning, equitable, and robust food system. However, this present analysis does not quantify risk via an objective set of metrics at a specific point in time. It will not evaluate the level of food security in Iceland compared to other nations; it will not tell Icelandic populations whether food security is a national threat, nor will it make the case for putting food security on a national securitization agenda.

What this thesis aims to do

This thesis seeks to understand a complex social-ecological system. It digests the dynamic and evolving tension between human livelihoods, legal frameworks, biological cycling, and emotive response—mixing statistics and poetry as a means to comprehend risk over space and time. It

takes the current food production practices, ecological limitations, and cultural conditions and considers the future functioning of the system under shifting sociopolitical structures in the face of a changing climate.

This thesis asks how we, as humans, perceive risk and rationalize decisions. It investigates the cognitive reasoning behind how risk is defined, the affective and normative impetuses to why we perceive risk and how we choose when and how to act—or not to act—when the future is uncertain. More specifically, it considers the relationship between values and risk perception, or in other words, how values shape what we believe to be at risk.

Lastly, this thesis suggests crucial implications for resiliency planning. If values affect what we perceive to be vulnerable, they offer a framework for evaluating what is resilient in a manner that is not universal, but rather community-embedded. Yet, the very process of value-defined resiliency exposes a substantial hazard underpinning all normative processes—that is, the question of whose values are not heard. Ironically, by defining resilience based on values, we risk perpetuating a dominant set of social, political, and economic ideologies that likely instituted the vulnerability in the system in the first place.

With those analytical aims in mind, I proceed with the following: Chapter I sets the stage in the context of climate change and problematizes universally framed resiliency plans; Chapter II introduces the theory behind social-ecological systems and resilience as a systems-based framework for understanding the dynamics within Iceland's food system. This section calls into question whether resilience—a once purely ecological and descriptive construct—can effectively be applied to social systems. Chapter III employs that resilience-based thinking for understanding Iceland's food system, including the system components and perceived vulnerabilities. Based on the myriad of oftentimes contradictory risks, Chapter IV explores food security as a political construct, a position that both amplifies and undermines its position as a national concern. In questioning what determines whether or not risk exists, Chapter V offers an overview of risk theory, and proposes a theoretical framework within which to proceed. Chapter VI delineates the study's methods and results, including the relationship between values and risk perception. Chapter VII further discusses that relationship and takes a political ecology lens to understanding

the emergence of particular value logics. Lastly, implications for resiliency planning and concluding thoughts are discussed in Chapter VIII.

Fully understanding the vulnerabilities in a system is context-dependent—a process that requires reflection on the past, literacy of the present, and a normative evaluation of what an improved future could hold. It is a task not meant for one year, or only 100 pages of text, but in scratching the surface and challenging what we believe to be true, I would like to think I have shed some light in that process.

I. INTRODUCTION

Iceland: a landscape of risk or resilience?

The Arctic region has become a poster child for climate change vulnerability. Evidence of glacial retreat populates the media, supported by widely published concern from the science community; the 2004 Arctic Climate Impact Assessment alerted that the Arctic's average temperature had risen nearly twice as quickly as the rest of the world's in the last few decades (Hassol, 2004). Just outside the Arctic Circle, extreme weather events, volcanism, erosion, and ocean acidification are predicted to have accelerating impacts on Iceland's ecological, social, built, and economic systems (Chapin et al., 2006; Goldenberg, 2015; Hassol, 2004; Ministry for the Environment, 2015; Turner II et al., 2003). Iceland's food system, embedded in a legacy of agriculture, fisheries, and high import dependence, is unlikely to remain unscathed.

In response, Iceland's climate change strategy takes a mitigation approach (Ministry for the Environment, 2015). It commits to a 50-75% reduction in net emissions of greenhouse gases by 2050, using 1990 emissions as a baseline. Along with implementing regional afforestation plans as a carbon sequestration tactic, the country has made major investments in renewable energy: 99% of electricity and over 80% of total energy production comes from geothermal and hydropower (Ministry for the Environment, 2015; S. Runólfsson & Ágústsdóttir, 2011). Yet, despite Iceland's active response in mitigating *global* climate change, there is little focus on climate adaptation—or the reduction of vulnerability at a *national and local scale*—in any of the climate change reports.

While at one level this absence could be perceived as a lack of comprehensive or proactive planning, to do so assumes a universalistic framework for risk and resilience. The conceptualizations of risk, vulnerability, and resiliency are inherently values-based, generated by negotiated trade-offs, and varied based on societal, cultural, and physically contextual conditions (Ingólfsdóttir, 2011; Jóhannesdóttir & Gísladóttir, 2010; Knox-Hayes, Brown, Sovacool, & Wang, 2013; Leiserowitz, 2006). To better understand adaptive capacity to climate change at a global or national scale, it becomes necessary to disaggregate the plurality of local perceptions of risk and vulnerability. These perceptions both dictate decision-making and shape what constitutes resiliency at a local level (Amundsen, 2012; Turner II et al., 2003).

II. THEORY: RESILIENT SOCIAL-ECOLOGICAL SYSTEMS

> *A close correlation exists between the welfare*
> *of the land and the welfare of the nation.*
>
> (Sveinn Runolfsson, Soil Conservation Service of Iceland)

Social-ecological systems

In their 2011 AMBIO article, "Reconnecting to the Biosphere," Folke et al. call for a fundamental shift in perspectives. Echoing ecological economists such as Herman Daly (see Daly, 1996, 2005), these authors bid caution: current worldviews (at least in the United States and Western Europe) cognitively disconnect notions of human progress and economic growth from the biosphere. The result has been economic growth at the expense of ecosystem growth—a wash of resource depletion and the hamstringing of ecosystem services, a combination of operating beyond the bounds of a finite planet and crippling the systems within.

Yet, perhaps spurred by witnessing environmental degradation and climate change impacts, this perspective seems to be changing. Although it remains unclear how to effectively reconcile short-term and long-term needs for both human wellbeing and ecosystem integrity, there is now widespread agreement that the two systems are fundamentally linked (Adger, 2000; Fischer et al., 2015). Humans have not only altered ecosystems and atmospheric chemistry, but ecological change (and the way that we *perceive* nature) likewise shifts human behavior and management practices (Brown, 2010; Peterson, 2000). Soil type and quality prescribe a location's agricultural practices; markets, quotas, and agricultural support schemes shape the intensity of production, and thereby the soil's biological cycling rate and speed of nutrient depletion. Likewise, technological developments increase fishing efficiency, causing depletion in fish stocks; the threat of fisheries collapse leads to a readjustment in regulatory and ownership hegemony, again with repercussions throughout the food web as well as the community's economy. These social-ecological interactions extend beyond resource extraction. Human health is closely linked with air pollution, mitigated by vegetation, and natural features such as rivers, mountains, or forests serve as muse for cultural and spiritual iconography and practice.

The interactions of these two systems are both symbiotic and show commensalism. They are cyclical, co-evolving, and characterized by multi-scalar (spatial and temporal) feedbacks that amplify or dampen change. Vulnerability resides in the coupling of these systems, particularly where the systems' feedbacks are not quick enough and the response capacity breaks down (Fischer et al., 2015; Turner II et al., 2003). As articulated by Amundsen (2012), "The only way to build a sustainable society is through the understanding of social and ecological systems as inseparable," and interpreting social-ecological systems through resilience-based thinking shows great capacity to enhance sustainability in an uncertain future (Adger, 2000; Folke, 2006; B. Walker, Holling, Carpenter, & Kinzig, 2004; Xu & Marinova, 2013). This thesis is grounded in this assumption.

Resilience

Resilience-based thinking, as originally developed by Holling (1973, 1996), takes two fundamentally distinct conceptual forms. The first, deemed "engineering resilience"—also called "equilibrist resilience" (White & O'Hare, 2014)—is defined as the ability of a system to return to a steady state after a disturbance, widely interpreted throughout policy and practice as a system's "bounce-back-ability" (Davoudi, 2012). Measured by the resistance to disturbance and the speed at which the system returns to equilibrium, engineering resilience[1] places emphasis on efficiency and return time, while preserving constancy, stability, and predictability via "fail-safe" engineering design (Davoudi, 2012; Folke, 2006; Holling, 1996).

Generally speaking, this engineering resilience is the resilience-based thinking that now pervades political rhetoric in the United States and Western Europe[2] (Davoudi, 2012; White & O'Hare, 2014). The term resilience has been widely criticized for its nebulous and indiscriminate use in strategic planning (Davoudi, 2012; Pizzo, 2015), and for its reinforcement of technocratic and engineering-based approaches (Joseph, 2013; Pizzo, 2015; White & O'Hare, 2014). Others further argue that the resilience rhetoric is simplistic and fatalistic, failing to challenge current norms of

[1] Although deemed "engineering resilience," this single equilibrium view has also historically underpinned traditional ecology and environmental resource management—particularly through attempts to maintain "optimal" resource flows (Folke, 2006).

[2] See Davoudi (2012) and White and O'Hare (2014) for examples of the engineering-based resilience rhetoric in current policy documents, particularly in the UK.

risky behavior and privileging reactive responses to risk (Davoudi, 2012; White & O'Hare, 2014). *After all,* the undertones suggest, *in an uncertain world the best we can do is "bounce back."* In this light, many contend that resilience has become a tool of neoliberal governmentality—a call for taking the "imbalance of the world as a given" and developing "a buffer capacity for preserving what we have and recovering to where we were" (Pizzo, 2015). In the effort to return to normal, the process never challenges what 'normal' entails (Davoudi, 2012; Pizzo, 2015). The rhetoric emphasizing bounce-back-ability enforces self-reliance, characteristic of neoliberalism's normative mode of mobilizing social agents (and flagrant in the classically American "pull oneself up by one's bootstraps" mentality) (Aldunce, Beilin, Howden, & Handmer, 2015; Davoudi, 2012; Joseph, 2013). White and O'Hare (2014) make the claim that this "market-oriented responsibilization" positions individuals as active citizens in ensuring their own resilience, thereby shifting the responsibility of risk governance to the private sector. It is speculated that resilience has been able to "colonize" governments worldwide, because it so easily maps itself to this neoliberal ideology (Aldunce et al., 2015).

Nevertheless, Holling's original framing of resilience was not to explicate engineering resilience, but rather to use it as a comparative lens to explain an arguably more sophisticated and alternative-paradigm interpretation of resilience-based thinking. This second conceptualization, deemed ecological resilience, refers to the ability of a system to absorb disturbance and to reorganize so as to retain essentially the same function, feedbacks, and identity (Berkes, 2007; Holling, 1973; Walker et al., 2004). Key to interpretation is the maintenance of *function* rather than stability of component populations or even—in ecological terms—the persistence of a single steady state (Adger, 2000). In fact, the traditional notion of ecological stability, characterized by a "balance of nature" and linear succession has given way to an understanding of ecology that is dominated by non-linear responses, thresholds, and multiple steady states (Berkes, 2007). Whereas equilibria are measured in moments, resilience in this framework is measured evolutionarily, considering how periods of gradual and rapid change interplay, how such dynamics interact across temporal and spatial scales, and ultimately how certain aspects when carried out over time can lead to systemic vulnerability (Christopherson, Michie, & Tyler, 2010; Folke, 2006). As quoted by Cowell (2013), "Resilience is not related to equilibrium, a return to 'normal', or even to resilient outcomes; it is instead a 'dynamic attribute associated with a process of continual development'" (Cowell, 2013, p. 213, requoting Pendall et al., 2010).

This concept of ecosystem resilience, sometimes called *evolutionary* resilience, is the resilience-based thinking applied by researchers and practitioners to understand the vulnerability, adaptability, and coevolution of social-ecological systems. More specifically, Folke et al. (2010) suggest that resilience represents the capacity of a social-ecological system to continually change while remaining within critical thresholds. Adaptability—an element of resilience—is the system's capacity to respond to external and internal stresses and processes, allowing for development of the system along the current (economic, social, ecological, political) trajectory within thresholds. Meanwhile, *transformability* represents the capacity of the social-ecological system to cross thresholds into alternative development trajectories (comparative to ecology's alternative steady states). Folke et al. claim that transformational change at smaller scales facilitates greater resilience at broader scales, and many argue that the changes seen in social-ecological systems currently (i.e., climate change impacts) are so substantial that large-scale transformation will be vital or even inevitable. Certain economic activities may become unviable in particular regions within the next century due to climate change (Amundsen, 2012; Nelson, Adger, & Brown, 2007).

In incorporating social systems into the original conceptualization of ecological resilience—thereby rendering the concept useful to urban or regional planning or economic development—ecological resilience has been rearticulated in ways that apply to communities, including:

- "The ability of a community to cope and adjust to stresses caused by social, political, and environmental change and to engage *community* resources[3] to overcome adversity and take advantage of opportunities in response to change" (Amundsen, 2012, p. 46)
- "A process linking a set of *adaptive capacities* to a positive trajectory of functioning and adaptation after a disturbance" (Albers & Deppisch, 2013, p. 1600)
- "The amount of change that a system can undergo while retaining its structure and functions, the degree to which it can *reorganize*, and the degree to which it can create and sustain the capacity to *learn and adapt*" (Christopherson et al., 2010, p. 7)
- "The community's ability to build and increase its *capacity for learning and adaptation*" (Berkes & Jolly, 2001, p. 19)

[3] Italics in this definition and the following three definitions are my own, added for emphasis.

These conceptualizations emphasize access to resources (natural, but also social, cultural, informational, political, or economic), and the ability for communities to "adjust" to stress through reorganization, adaptability[4] and social learning—emphasizing human (social and political) processes critical to influencing change. Beyond rearticulation, practitioners and academics have sought ways to *operationalize* resilience-based thinking in planning and policy, by offering metrics or principles of resilient social-ecological systems; Berkes (2007), for example, proposes four "clusters of factors relevant to resilience building" (living with uncertainty, nurturing diversity, using different kinds of knowledge for learning, and creating opportunities for self-organization and cross-scale linkages).[5]

Nevertheless, despite progress in developing working parameters, skepticism arises in the framework's operationalization. Like engineering resilience, it faces critique for its abstractness, tendency towards inherent ambivalence, and lack of effective guidance to aid practice (Brand & Jax, 2007; Pizzo, 2015; White & O'Hare, 2014), but more critically its legitimacy in extending an ecological concept to a social context comes into question. Like many frameworks in the natural sciences, resilience takes the form of a politically neutral natural law, purely descriptive in its utility. Brand & Jax (2007), among others, caution that extending the framework to cities, regions, and social systems by necessity adds a normative dimension—defining resilience ultimately requires a judgment of what is desirable. Consequently, the process of building social-ecological resilience becomes embedded in governance (Lebel et al., 2006; Wagenaar & Wilkinson, 2015). *Who decides what is resilient, and what should be made resilient? Resilience along what basis? What are the metrics for measuring, and what are the outcomes we seek?* This thesis uses an ecological resilience framework to investigate Iceland's social-economic food system, and in doing so, both explores answers to these questions as well as problematizes and further questions the answers offered.

[4] Stemming from a social-ecological framework, Chapin et al. (2006) define adaptability as "developing new socioecological configurations that function effectively under new conditions."

[5] For further examples, Albers and Deppisch (2013) offer "eight principles for urban and regional resilience:" (diversity, redundancy, flexibility and adaptability, modularity, interdependency, stabilizing and buffering factors, mobility, as well as planning and foresight); Amundsen (2012) offers "six dimensions of community resilience" (community resources, community networks, institutions and services, people–place connections, active agents, and learning) as well as compares these dimensions to three further frameworks that pinpoint factors for community resilience (see Amundsen, 2012).

III. ICELAND'S FOOD [SOCIAL-ECOLOGICAL] SYSTEM

Iceland's food system represents a complexly intertwined social-ecological system. The process of identifying the system components (for example, dominant and supplemental food production sectors); the spatial dimensions and their evolution over time (for example, where fishing ports have emerged and where they are closing due to industry consolidation); and the cultural, political, and economic forces underpinning practices, economic markets, and legal frameworks (for example, the system of Individual Transferable Quotas designed under an ideology of efficient resource management, which has led to industry consolidation) help to clarify both the opportunities and vulnerabilities embedded within the system.

System overview

Fisheries – Iceland's foremost food-based industry hails from the sea. In fact, Iceland with its small population of 320,000 provides 1.2 percent of the world's catch (Karadottir, 2013). Small-boat fishing emerged as early as the 1300s. Although a year-round industry did not develop until the nineteenth century, fish and marine products surpassed homespun as the country's main export by the 1400s, and remained the leading export until the mid-twentieth century (Gislason, 1973; Knutsson & Gestsson, 2006; The Central Bank of Iceland, 2006). In the 1960s, fishing and fish processing made up 15 percent of the national GDP, 16 percent of the labor force, and 90 percent of total merchandise exports; these numbers have dropped in 2015 to 11 percent, 5 percent, and 37 percent, respectively, due to the emergence of the aluminum industry and growth in the financial and service sectors (Karadottir, 2013; "Statistics Iceland," 2016; The Central Bank of Iceland, 2006). Despite fishing's relative decline in the job market, the industry remains a substantial source of livelihood for rural communities, providing 12 percent of jobs outside the greater Reykjavik area (Islandsbanki, 2013).

Cod is the most valuable fish stock; 214,400 tonnes were caught in 2014, accounting for approximately 31 percent of the fishing industry's exports (Karadottir, 2013). Other major species include herring, golden redfish, haddock, saithe, and Greenland halibut. In 2013, 58 percent of the total catch was exported (Islandsbanki, 2014). Aquaculture has been growing since the early

1990s; 6,900 tonnes of farmed fish were harvested in 2013, predominantly consisting of arctic char, salmon, farmed cod, and rainbow trout (Islandsbanki, 2014).

The industry has cycled through boom and bust, influenced by the growing efficiency of trawlers and onboard processing, the decline and eventual collapse of certain fish stocks, and the emergence of new regulatory systems to manage catch levels.[6] The industry currently operates under a system of Individual Transferrable Quotas (ITQs)—a system instituted in 1990 that privatized fish stocks by tying quotas to the ownership of fishing vessels. The initial quotas were allocated free of charge to fishing vessel owners who had been in the business for the previous three years; these harvesting rights became instant valuable assets and in many cases were sold for considerable profit (Benediktsson & Karlsdottir, 2011). In the name of increased economization, this system has led to a spate of mergers and acquisitions, illustrated in the 15 percent decrease in the number of vessels between 2000 and 2012. Today, the 20 largest seafood companies (of over 50 companies) control 71 percent of issued quotas; the 10 largest companies hold over 51 percent (Islandsbanki, 2013). Based on the Act on Fishing Fees established in 2012, vessel operators must pay a general fishing fee designed to cover the state's cost of research, management, and monitoring of fishing and processing, as well as a special fishing fee intended to ensure that the nation benefits from the excess dividends generated from the limited resource (Islandsbanki, 2013).

Livestock farming – Although fishing dominates Iceland's economic and cultural legacy, agriculture constitutes the country's land-based heritage. For the first 500 years after Iceland's settlement, stockbreeding formed the basis of the Icelandic economy. Dairy and meat products were produced for domestic consumption, and wool, made into homespun, served as the country's main export through the end of the thirteenth century. Today, although agriculture only contributes to just over 1 percent of the national GDP and 2 percent of the labor force (Farmers Association of Iceland, 2016), stockbreeding remains a prominent cultural mainstay, and

[6] Major investment in the Icelandic trawling fleet occurred from 1945 to 1952, stern trawlers were introduced in 1970, and processing at sea began in 1983. Demersal species started to decrease in 1955, continuing to a certain degree through 1997; herring stocks collapsed in 1967; capelin stocks collapsed in 1982 and again in 1991. The fishing jurisdiction was extended out to 12 nautical miles in 1958 due to the strain on fish stocks, extended to 50 nautical miles in 1972, and to 200 nautical miles in 1975; quotas were set for herring in 1975, capelin in 1980, and for all major fish species in 1983, again to try to stop the decline in fish stocks (Knutsson & Gestsson, 2006).

accompanies fishing as the economic backbone for many remote rural areas (Government of Iceland, 2011). Outside the capital region, pastoral (and volcanic) landscapes blanket the countryside. An estimated 15 percent of the country is utilized agricultural area (including common land), punctuated by 3,117 working farms[7] that raise over 74,000 cows, 487,000 sheep, and 72,000 horses, among goats, pigs, rabbits, mink, and hens (Farmers Association of Iceland, 2016; Statistics Iceland, 2012). Every September, hundreds of Icelanders take part in one of the country's oldest cultural traditions, Réttir, where (amidst celebration) the sheep are round up and brought back to the corrals after grazing in the mountains and valleys through the summer.

Beyond the cultural implications, livestock contribute to a significant portion of Iceland's domestic meat and dairy market. In 2014, 29,309 tonnes of meat were produced (8,291 tonnes of which were exported), serving 90 percent of Iceland's total meat consumption in 2014.[8] However, this percentage has drastically decreased from 97.4 percent in 2009, driven in large part by a new contract set with the EU in 2007, which introduced tariff-free quotas and encouraged a drastic increase in imports.[9] Domestic dairy production, however, still nearly meets 100 percent of in-country demand; imports only make up 0.5 percent of consumption and primarily consist of specialty cheeses.

The ability for Icelandic agriculture to serve the domestic market has always been contingent on substantial state support. The country's market is small and cost of production is high, both due to climatic conditions and the need to import machinery, fuel, feed, and fertilizer. In the 1980s, producer support estimates (PSE) were as high as 80 percent of gross farm receipts. Today total support has dropped substantially to 48 percent in 2014 (1.1 percent of GDP), but remains notably high in comparison to other OECD countries (OECD, 2015a). Two main legal acts guide the country's agricultural policy: Act No. 99/1993 on the Production, Pricing, and Sale of Agricultural Products sets policy objectives and provisions for production control, market measures, and direct producer support, whereas Act no. 70/1998 on Agriculture sets provisions

[7] This is the number of farms that paid levies in 2014, which according to Act No 84/1997 is mandatory for all farms with annual agricultural income in excess of ISK 500,000 (approximately $4,000 USD).

[8] All totals and percentages relating to imports, exports, and consumption were calculated based on trade and consumption quantities provided by Statistics Iceland, 2016 (http://www.statice.is).

[9] The effect of the new contracts was not felt immediately; the financial crisis in 2008 tempered the purchasing of foreign products. By 2010, however, this had begun to change.

for development projects, livestock improvements, and extension services. Under these acts, renewable, multi-year agreements—specifically for dairy, sheep, and horticulture producers—are set between the Government of Iceland and Farmers Association, laying the framework for financial support schemes and production control.

Sheep and dairy producers receive direct support based on entitlements, which were originally based on production levels, but are now freely tradable among producers (Government of Iceland, 2011). Roughly half the dairy sector is also production regulated; the total support entitlement for milk producers (set at 140 liters in 2015) is also the total production quota, divided among producers. For milk delivered within this quota, producers are guaranteed a minimum wholesale price, set by a government-chaired committee with representation from both the Farmers Association and—representing the consumers—the labor union (OECD, 2015a). No production control is enforced within the sheep sector; two-thirds of the support is based only on entitlements (contingent on keeping at least 60 winter-fed sheep per every 100 sheep), while the remaining one-third is paid based on production quantities and participation in a comprehensive quality control scheme, which, among other factors, focuses on animal welfare, product quality, and sustainable land use. Any surplus meat not sold on the domestic market is exported.

All livestock producers also gain from market price support, maintained through border measures. Most Favored Nation (MFN) tariffs are set at 30 percent for eggs and most meat products, with further tariffs applied depending on the product (OECD, 2015a). However, because Iceland is a member of the European Economic Area and has free trade agreements with 35 countries, products originating from these countries are often subject to lower tariffs. Notably, the March 2007 agreement between the EU and Iceland established a number of duty-free quotas, specifically for beef, veal, pig meat, poultry, cheese, potatoes, and ptarmigan. Nevertheless, strict import regulations on meat, live animals, and other biota in an attempt to control livestock diseases and invasive species slow import rates through regulatory barriers.

Beyond direct support and market mechanisms, Act No. 70/1998 provides myriad sources of financial aid that target direct policy agendas, including development grants (for barley production, improvement of animal welfare, maintenance of drainage systems, conversion to

organic agriculture, among others), regional afforestation projects, and land reclamation on farms to reduce desertification and sand encroachment. All producers of agricultural products are subject to an agricultural levy, set at 1.2 percent of gross income (2011), which is distributed between the Farmers Association, the regional agricultural associations, the sectoral producer associations and the Emergency Relief Fund—and provides much of the funding for these grants and support schemes. The Emergency Relief Fund grants compensation payments for farmers that face large financial losses due to extreme weather, livestock disease, natural disasters, or accidents for which there is no other market insurance (OECD, 2015a), thus playing a substantial role in mitigating financial vulnerability for farmers during shocks.

Horticulture – Although livestock provides 87 percent of farm income, the remaining 13 percent comes from horticulture (Government of Iceland, 2011). Due to the short growing season, outside cultivation is largely limited to root vegetables and brassica, including potatoes, turnips, cabbages, cauliflower, and carrots. As early as 1924, however, geothermal energy has been used to heat greenhouses, allowing for the cultivation of tomatoes, cucumbers, and peppers (paprika), as well as other vegetables in smaller quantities. Today the total surface area within greenhouses is estimated at 175,000 square meters, 55 percent of which is used for vegetables and the remaining for flowers and potted plants (Nguyen, Arason, Gissurarson, & Pálsson, 2015). Just over 14,500 tonnes of vegetables were produced in 2014, compared to the 55,700 tonnes of produce that were imported that same year (Farmers Association of Iceland, 2016; "Statistics Iceland," 2016).

Like the dairy and sheep sectors, greenhouse horticulture for tomatoes, cucumbers, and peppers receives direct support per kilogram produced. These producers also receive subsidized electricity (through distribution to the greenhouses and through the purchase and installment of lighting equipment) in order to ensure the price of electricity is similar to what is paid in neighboring countries (i.e., Canada and Norway) (Government of Iceland, 2011). Greenhouse growers have recently been petitioning, however, for the same highly discounted electricity rates offered to aluminum smelters.

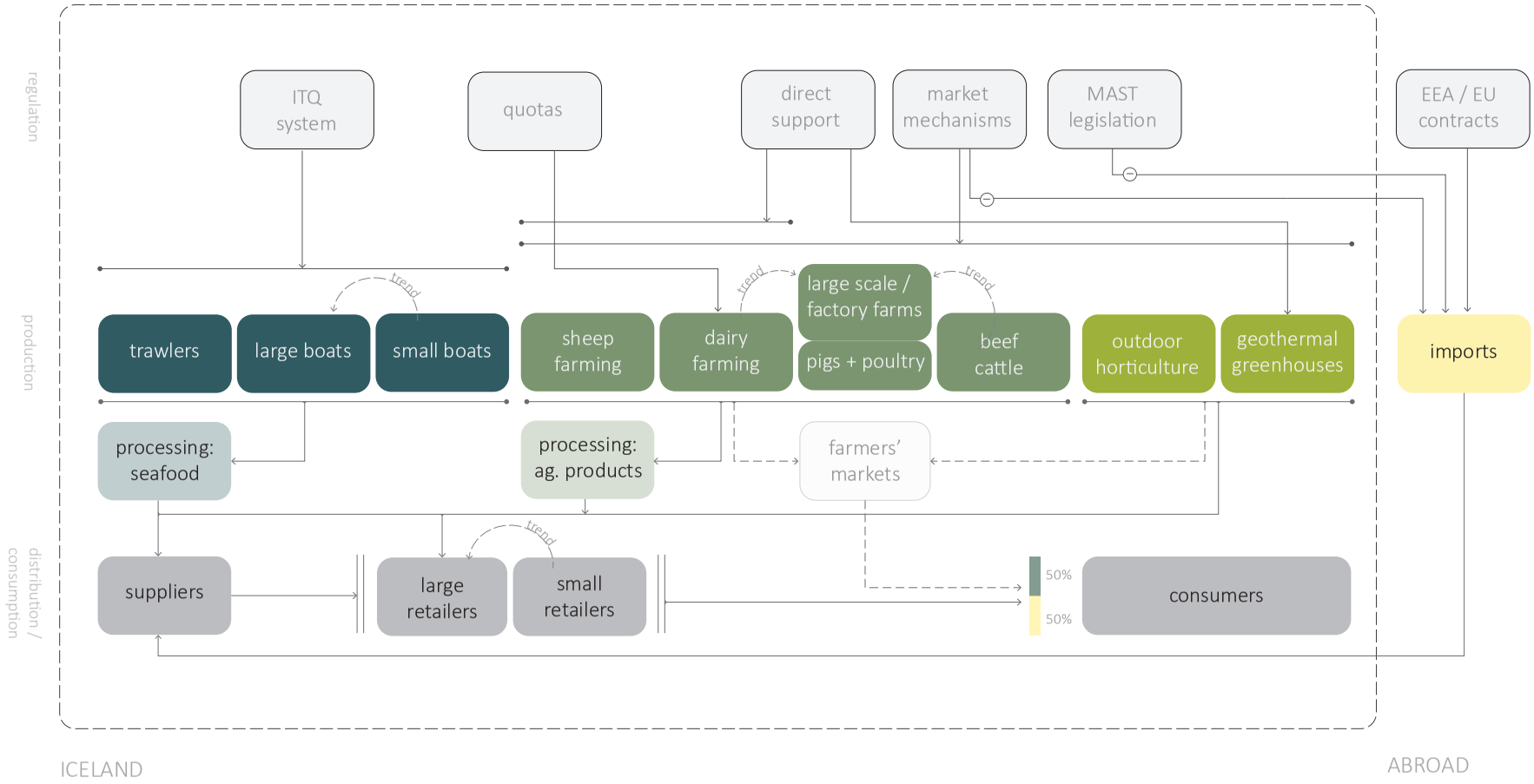
Imports and grocery distribution – Other than seafood, meat, dairy, and some vegetables, the majority of food products are imported. In total, domestic food production is estimated to cover

half the country's nutritional needs, but for the products it does produce, the country depends greatly on imported inputs such as machinery, fuel, animal feed, seeds, and fertilizer[10] (Bailes & Jóhannsson, 2011; Government of Iceland, 2011). For food products specifically, there are a multitude of suppliers in Iceland that handle wholesale purchasing and selling of both domestic products and imports.[11] While these suppliers formerly controlled all transactions between producers and small retailers, the rapid growth of three retail groups—Hager, Kaupás, and Samkaup—has led to these three chains directly importing their own groceries (Icelandic Competition Authority, 2012). These three retailers operate many of the grocery store chains in Iceland, including Bónus and Hagkaup (Hager); Krónan, Nóatún, 11-11 and Kjarval (Kaupás); as well as Nettó, Kaskó, Samkaup-strax and Samkaup-úrval (Samkaup). In total, approximately 174 grocery stores were in operation in Iceland in 2010. Direct producer to consumer sales—such as through farmers markets—were not common in Reykjavik in 2012, but a couple businesses have been emphasizing such transactions in recent years (Jonsdottir, 2012; McMahon, 2014).

In this food system, the ecological limitations and opportunity, new technologies and traditional practices, and evolving network of financial redistribution through support payments, market mechanisms, and levies shape the system's current trajectory (Figure 1). In the moment, it meets needs: the fishing, farming, and horticulture sectors persevere, and foodstuffs—in ample quantities and diversity—line grocery store shelves. And it may continue to do so. Like in most systems, however, there are also vulnerabilities. There may be pressure points that will cave under the impact of a sudden shock, which are the vulnerabilities hazard mitigation plans tend to seek in order to prevent. However, there may also be slow stresses, causing aspects of the system to cycle forth through the power of reinforcing feedback loops that are inequitable, risky, or degrading—and ultimately unsustainable. The following section highlights myriad sources of potential vulnerability, identified both in the literature and through interviews. They illustrate an interrelated network of conflicting and often contradicting risks.

[10] For example, Iceland imported over 2,700 tonnes of farm machinery, over 41,200 tonnes of animal feed, and over 58,000 tons of fertilizer in 2014 ("Statistics Iceland," 2016).

[11] The six largest suppliers include Mjólkursamsalan (milk and dairy products), Ölgerðin Egill Skallagrímsson (soft drinks, juices, and imported dry goods), Íslensk-Ameríska (bread, cakes, and imported dry goods), Sláturfélag Suðurlands (meat, meat products, and imported dry goods), Nathan & Olsen (imported dry goods, cleaning products, and cosmetics), and Norðlenska (meat and meat products) (Icelandic Competition Authority, 2012).


regulation
production
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dairy farming
large scale / factory farms
pigs + poultry
beef cattle
outdoor horticulture
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processing: ag. products
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ICELAND
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Figure 1. Map of Iceland's food system. The dashed box illustrates the Icelandic national boundary. The country's food supply originates at the various producers [teal boxes: fishing, dark green boxes: livestock agriculture, light green: horticulture, yellow: imports], and continues (downward in the map) through processing, suppliers, and retail, to consumers. Roughly 50 percent of food that reaches consumers comes from imports from abroad. Semi-circles labeled "trend" illustrate the trajectory of certain components due to competition to consolidate into larger firms. Above the flow of production, the map depicts the top-down regulations (gray boxes) that influence the food system by supporting or hindering the various food producers. (MAST is the Icelandic acronym for the Icelandic Food and Veterinary Authority, which in particular regulates the import of live animals and meat products.) Unless otherwise noted with a (-) sign, pathways are reinforcing; in other words, the regulations increase production or imports.

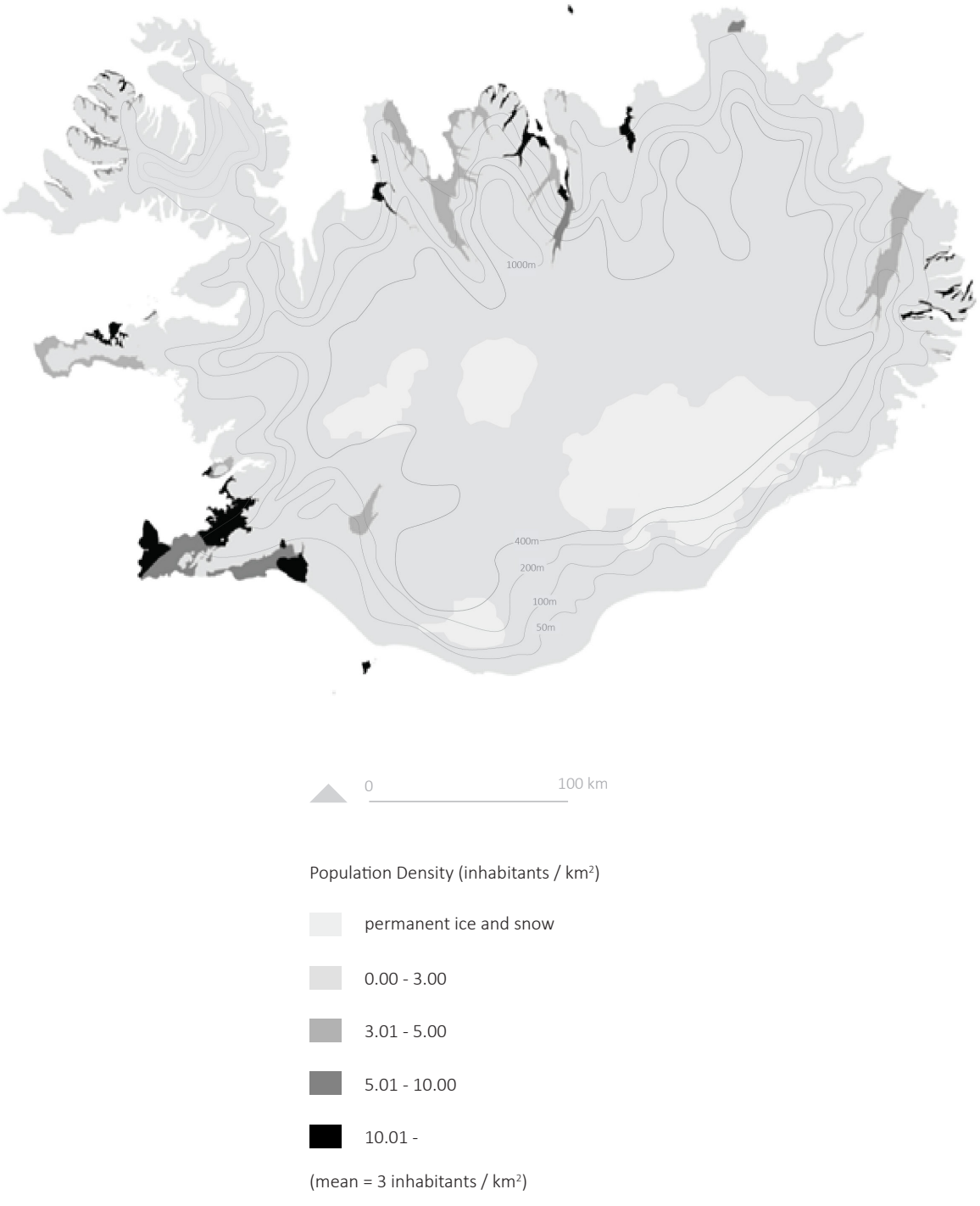
Networked vulnerabilities

Growing is not easy in Iceland. Barren highlands, lava fields, glaciers, mountains, and volcanoes sweep and consume the highland interior, rendering nearly 80 percent of the country uninhabited—and perhaps uninhabitable. For the 58 percent of the country's area above 400-meters altitude, mean annual temperatures linger between 0 and - 4˚ C (Arnalds, 2015). Volcanic and seismic activity rumbles under the surface, threatening biota with gaseous plumes, glacial bursts, suffocating ash fall, and an ever-changing habitable surface.[12] The country's latitude between 63˚ and 66.6˚N beckons the cold East Greenland Current, stirring the loose, glassy andosols into sandstorms, scarring denuded land, refrigerating soil, harboring permafrost.

Yet the warm Irminger Current, traveling with the Gulf Stream, counters the harsh chill, preventing climatic conditions from becoming entirely Siberian. The population clusters in the country's peripheral lowland areas, a narrow seaside belt surrounding the country where temperatures in the summer months can reach 10˚ C—and where both habitable space and arable land converge (Figure 2). In these pockets, the growing season still remains short. Only three to four months offer adequate warmth and daylight hours. Additionally, centuries of high-intensity sheep grazing have reduced the resilience of particular ecosystems against volcanic eruptions or cold spells, and today soil erosion (and accompanying desertification) is considered to be one of the country's most substantial environmental hazards (Arnalds, 2015). Because of these conditions, the World Bank (2013) records only 1.2 percent of the country's land as arable. Facing cold temperatures, dark days, loose and eroding soils, the Icelandic people in many ways have had to engineer the agri-ecosystems. Geothermal greenhouses foster warmer climates and artificial daylight; substantial fertilizer applications encourage growth under stilting conditions; farm-based and regional afforestation projects—with both native and introduced species—have recreated forest ecosystems to stabilize the land; and careful importation of new genetic material has been discussed in order to improve the productivity of the native livestock breeds. Nevertheless, the context raises costs and adds challenges; a prolonged dip in temperature, a dry spell, a volcanic eruption offer a perilous backdrop for the system's production.

[12] Bird & Gísladóttir (2012) offer details on the impacts of the 2010 Eyjafjallajökull eruptions on livestock health, hay production, agricultural livelihoods, and psychological well-being for communities to the south and east of the volcano. Due to ash fall, for example, farmers had to cut their pastures higher than usual—resulting in a 30 percent loss from normal harvest and threatening food shortages for livestock during the winter.

Figure 2. Map of Iceland's topography and population densities. The highest population densities cluster around the country's periphery. (Map recreated based on those produced by the European Environment Agency, 2010 and Rekacewicz, 2005).



And the geographic isolation tends not to help. Largely due to the country's physical isolation, each type of livestock in Iceland has only one breed (Dyrmundsson, 2014; Ministry of Agriculture, 2003). While the pig and poultry breeds were imported within the past few decades, Iceland's cattle, sheep, goat, and horse breeds can be traced to the country's original settlement (874 AD). These pure Icelandic breeds have had little to no genetic crossbreeding with foreign types, and likewise have had significantly reduced exposure to disease. While on one level this isolation helps maintain livestock health, the animals now lack genetic immunity against many foreign diseases. Consequently, common and relatively innocuous diseases elsewhere wreak havoc on Icelandic livestock herds (Campana et al., 2012; Ministry of Agriculture, 2003). In response, the country maintains strict import restrictions for live animals, as well as animal food products (MAST: Icelandic Food and Veterinary Authority, n.d.; Ministry of Agriculture, 2003). Legal act nr.25/1993 prohibits the import of all food of animal origin; raw meat is imported on derogations from the law. Livestock cannot be brought into the country, or—particularly relevant for horses in international races—re-enter the country once they have left for fear of disease introduction (Campana et al., 2012).

The country's geographic isolation, as well as the remoteness of rural communities within Iceland, also attenuate resource flows in and throughout the country. Bailes & Jóhannsson (2011) expose a number of hazards that could capsize Iceland's food system, strictly on the basis of distribution and trade dynamics: natural disasters, including volcanic eruptions, earthquakes, avalanches, storms, mudslides, floods, and glacier bursts can limit imports and shut off regions within Iceland due to limited road connections; energy shortages caused by natural disasters and the vulnerability of long and limited electrical lines can shut down distribution networks; financial volatility can impact food prices and access to imports; external pressure from foreign countries can outbid the domestic market for food produced in Iceland; and war, external conflicts, and terrorism can hinder access to supplies if import routes are blocked or trade deals are suspended. Because 50 percent of Iceland's nutritional needs come from abroad—not to mention the substantial proportion of inputs required to make domestic production possible—any interruption in imports places both access to foreign supply and domestic production in jeopardy.

And these events are not merely hypothetical. On October 9, 2008 in the heat of the country's financial crisis, the Icelandic Króna was suspended from trade due to its rapid devaluation (Zarrilli,

2011). The international crisis closed down the credit market, making import financing difficult, and the paralyzation of banking transactions resulted in currency shortages and disruptions in trade (Bailes & Jóhannsson, 2011). Furthermore, at a time when global food prices were increasing sharply, the purchasing power of Icelandic firms contracted due to the Króna's devaluation.[13] The inability to import grain in particular highlighted the short supply of in-country stores (less than a month's worth), which had the potential to be catastrophic for the nation's livestock had feed supplies run dry (Jóhannsson, 2011b). Likewise, two years later, the Eyjafjallajökull volcano erupted, putting all air traffic in Europe and over the Atlantic on hold. Although the temporary halt on imports did not seem to spur long-term concern over food security (Dýrmundsson, 2015; H. Runólfsson, 2016), the event still served as a recurrent reminder that a high reliance on imports exposes the country to risk (Butrico, 2013).

Yet ironically, despite the Króna's devaluation and the substantial distance imports are shipped, the high cost of production in Iceland often makes imports the cheaper option (Government of Iceland, 2011; Laubach & Wise, 2005; Sigmundsdottir, 2009). Consequently, both budget retail chains and many representatives of the Consumers' Association advocate for imports not only for market diversity, but also affordability (Halldorsdottir, 2013; Icelandic Competition Authority, 2012; Jónsson, 2016). The basis of this argument has been contested, however, (Fitzgerald, 2010), with the claim that the price differential is oftentimes nominal—contingent on supply and demand and the time of year. Furthermore, statistics from the Icelandic Competition Authority (2012) indicate that between 2008 and 2011 the price of Icelandic products and foreign products increased by nearly 50 percent and 80 percent, respectively, suggesting foreign imports have not offered respite during financial hardship. If fuel prices increase in the coming decades as fossil fuel reserves decline (Halford, 2015; Monteleone, 2015), then it is likely the price of imports will rise further.[14]

[13] The devaluation of the Icelandic Króna did, however, help make Icelandic exports more competitive, which helped support the fishing industry through the crisis (Benediktsson & Karlsdottir, 2011).

[14] Interestingly, studies that have tried to develop indices for measuring economic resiliency have identified three drivers of vulnerability for small states: 1) the level of trade openness, which increases susceptibility to external fluctuations in the global market; 2) high dependence on a narrow range of exports; and 3) a high dependence on imports—all of which are characteristic of Iceland's economy (Briguglio et al., 2009; Kokštaitė, 2011; Krausmann et al., 2014).

In the meantime, however, portions of the Icelandic population continue to express interest in taking better advantage of a globalized market, including reducing many protectionist barriers to trade. The main source of this sentiment comes from the internationalist and increasingly pro-European Social Democratic Alliance, who took majority in parliament for the first time immediately following the financial crisis—with the application for EU membership on the agenda (Avery, Bailes, & Thorhallsson, 2011). The aforementioned trade contract with the EU in 2007 had already increased meat imports; the impact this market shift would have on agricultural livelihoods continues to foster fear within farming communities and in the Farmers Association. Discussions over EU membership—which began in July 2009 and lasted until the application was suspended in March 2015—thus further fanned the flames (Avery et al., 2011). EU membership threatened to relax trade regulations, reducing the domestic producers' competitive advantage and potentially raising health concerns if regulations preventing disease vectors were not upheld. In 2011, the Farmers Association published its opposition to joining the EU and set forth seven minimum demands, among which included the right to support the farming sector financially, to impose a duty on farm products from the EU, as well as to maintain regulations against raw meat and plant imports to prevent entry of disease and pests (Farmers Association of Iceland, 2011a, 2011b). As a side note, but important point, the fishing sector also ardently opposed joining the EU due to the EU's Common Fisheries Policy—legislation that gives all European fishing fleets equal access to EU fishing grounds (European Commission, 2015). Although a special Icelandic zone could have been implemented during negotiations, the fear—among all Icelandic citizens—that the arrangement would compromise Iceland's autonomy in managing a crucial national resource played a large role in suspending the membership bid.

The fear of import competition in the agricultural sector aggravates a general concern for farmers' financial wellbeing, which is shadowed by decreases in direct state support to the agriculture sector in recent years. Financial stress threatens to close family farms and drain economic opportunity—both in farming and food processing—from the rural regions. As an effort to maintain financial solvency, farm production has consolidated into larger entities and turned to factory farming methods in order to capitalize on economies of scale. Although large-scale and factory farming are seen as more economically efficient, they ironically strengthen the feedback loop towards a degrading trajectory: both tend to lead to rural depopulation and pose greater hazards for the environment and animal welfare (Alex, 2011; Dyrmundsson, 1995; Fontaine,

2011; Government of Iceland, 2011). In 2011, roughly 100 percent of chicken meat, 90 percent of pork, and 85 percent of eggs came from factory farmed animals, and the factory farmed pork, for example, came from only three farms (Alex, 2011). As mentioned in the previous section, this consolidation is also mirrored in the fishing industry where the ITQ system has led to fewer vessels with larger shares of output.

Likewise, substantial consolidation has risen in the retail market. While a large number of suppliers once used to entirely control transactions between producers and small retailers, the rapid growth of three retail groups—from 20 percent market share in 1999 to 90 percent in 2010—led to these retail chains importing their own groceries in large volumes (Icelandic Competition Authority, 2012). Although not necessarily detrimental that suppliers no longer hold all negotiating power, bargaining influence has shifted largely into the hands of these three retailers, Hager, Kaupás, and Samkaup, with 53 percent, 21 percent, and 16 percent market share in 2010, respectively. Shops that are not members of these retail chains pay suppliers 15 percent higher prices on average for goods than paid by the largest chain, Hagar (Icelandic Competition Authority, 2012). In 2012, the Competition Authority reported Hagar as having a market dominant position, whereby its economic strength prevents effective competition and allows the firm to behave relatively independently of its competitors and customers. Many question whether a competitive market is possible in Iceland due to the country's limited size (Laubach & Wise, 2005; OECD, 2015c). Ultimately, while large firm sizes often beget distribution efficiency (in farming, in fishing, or in retail), there are sociopolitical vulnerabilities—including inflated prices and power distortions—that emerge within a system dominated by very few players (Chambers & Carothers, 2016; Eythórsson, 2000; Laubach & Wise, 2005).

Lastly, increased intensity of production and resource extraction over the long-term also brings potential for environmental harm, eroding the ecological resilience that underpins the food system. Pollution largely from oil spills or radioactive chemical leaks from military vessels could contaminate or kill fish stocks (Bailes & Jóhannsson, 2011); high-intensity grazing leads to soil erosion and desertification (Arnalds, 2015); chemical fertilizers lead to a break down of macroaggregates and soil organic matter, which reduce yields over the long term (Lehtinen, Gisladottir, Lair, & Leeuwen, 2015); nitrogen and phosphorous from fertilizers—although largely diluted and minimal in impact currently—may begin to build up and alter riverine ecosystems (The Ministry for the Environment in Iceland, 2013). There is also fear around genetically

modified organisms (GMOs)—a fear that is controversial and spurs widely different opinions among the Icelandic population (Erfdabreytt, 2006; "GMO news related to Iceland," 2015). Some see GMOs as key to a new pharmaceutical and cosmetics industry in Iceland, or crucial for developing a frost-resistant strain of barley that will improve feed production domestically. Others see risk in unknown health impacts, or the hazard of new crops altering ecosystems if the introduced cultivars begin to spread in the wild. Currently, development and cultivation of genetically modified crops are restricted to greenhouses to prevent ecosystem contamination.

And yet ecosystems are still bound to change; Iceland is not immune to the global and local impacts of climate change. While politicians, media, and national climate change reports have discussed the ways in which warmer weather will aid Icelandic agriculture and afforestation schemes,[15] the vulnerability of fickle and extreme weather—bringing unpredictable dry spells, wet spells, and storms—still looms on the horizon (Ministry for the Environment, 2015). Currently, Iceland uses minimal to no pesticides on its agriculture (Farmers Association of Iceland, 2016); there is no need since the cold temperatures and geographic isolation suppress the spread of mold, parasites, and other pests (Arnorsdottir, n.d.). However, climate change is predicted to alter ecosystems and foster growth of new parasitic biota and disease. In fact, an increasing number of pests have started to damage tree growth in the last couple decades (Ministry for the Environment, 2015). This introduction will force agriculturalists to rethink cropping patterns and pesticide use, whether natural or synthetic, and consider the implications for both the health of Icelandic food products and the environment.

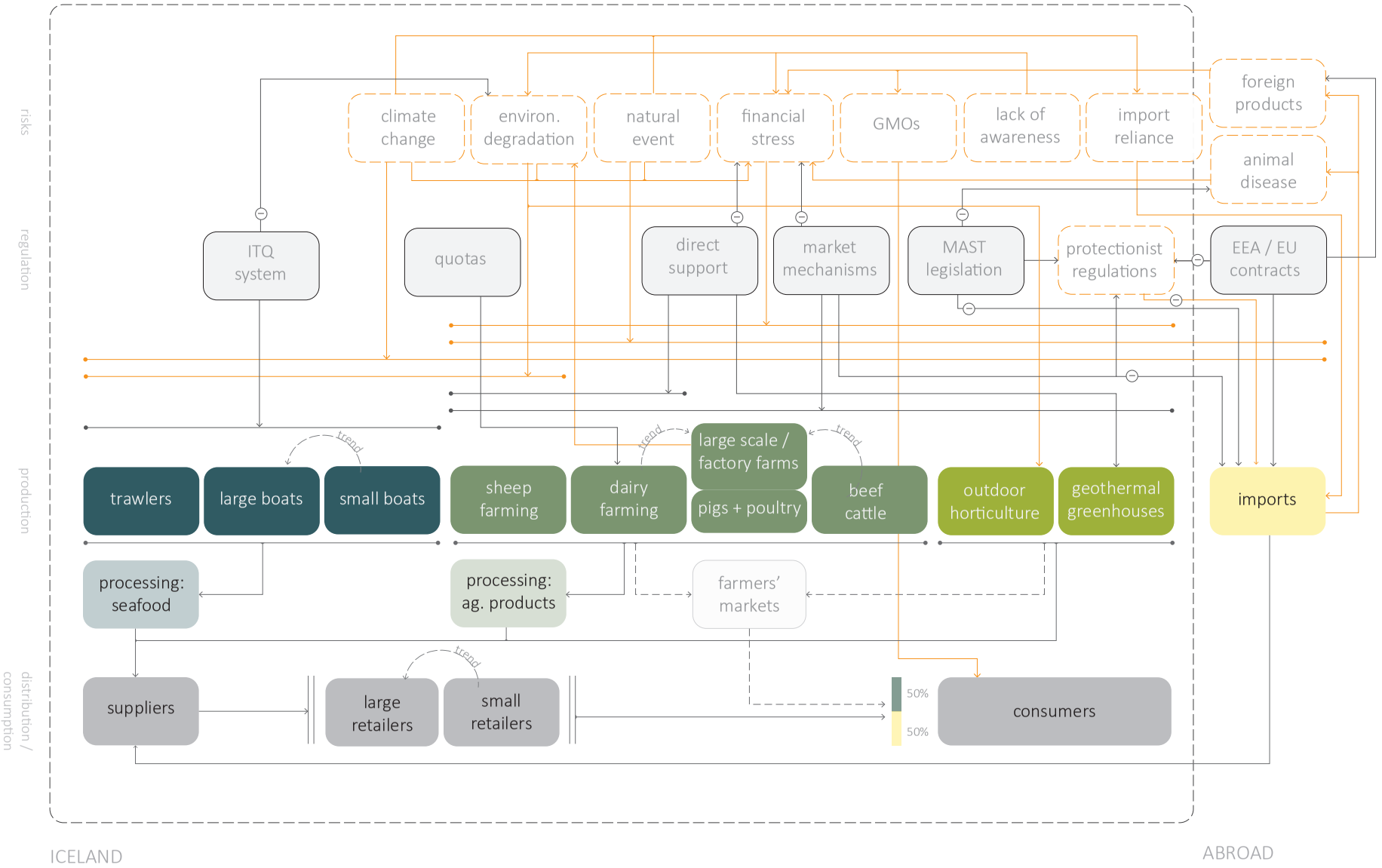
Meanwhile sea level rise threatens to flood cropland, particularly in the southwest lowlands where subsistence amplifies its effect (Ministry for the Environment, 2015). The Icelandic Sea at 68˚N shows rapid ocean acidification at rates 50 percent faster than is observed in the sub-tropical Atlantic. Impacts on fisheries are difficult to predict, but observable impacts on crustaceans and diatoms are likely to send repercussions throughout the broader food web (Jóhannsson, 2011a; Jónsdóttir, 2012). Shifting ocean currents and temperatures have changed the distribution of fish species since 1996; haddock, monkfish, and mackerel (southern species) have come further north, while capelin (a northern species) is retreating to even more northern,

[15] For example, Iceland´s Sixth National Communication on Climate Change (2015) reports that a rise in spring temperature by 1˚C can increase annual hay production by 11 percent.

colder waters (Ministry for the Environment, 2015). Recent studies have uncovered that former collapses in fish stocks—such as the collapse of the herring stocks around Iceland in the 1960s—were due to not only overfishing, but to a combination of over-extraction and changing environmental conditions (McGoodwin, 2007).[16] Alarmingly, McGoodwin contends that "virtually all fishers stress that that the current ITQ regime affords them little flexibility in being able to respond to the natural variations in fish-stock availability" (McGoodwin, 2011, p. 366). Likewise, in the freshwater systems particularly on the west and south coast, salmon has emerged in new areas, while trout populations, which prefer colder waters, have been declining. An interviewee from the Federation of Icelandic River Owners shares the visible impact: "I remember one particular river on the west coast, used to have 1,000—1,500 trout every year were taken. Now, it is less than 100. It's just gone!" Thus even under strict resource management regimes it remains likely that stocks will continue to face shifts and decline.

These implications, while local, are ultimately tied to global systems. As argued by economic resilience theorists (see Briguglio et al., 2009; Kokštaitė, 2011; and Krausmann et al., 2014), integration within a global market makes it such that booms and busts in other nations—tied to the climatic variability of those regions—impact the profitability of Icelandic products. Depending on whether El Niño curtails Peruvian fishmeal production, for example, determines whether quota rights for "reduction species" are profitable or rendered worthless for that year (McGoodwin, 2007). In a similar manner, crop failures from climate change bring unpredictable shifts in food production globally, and rising global food prices are likely to affect distribution and trade patterns. Physical or environmental hazards related to climate change will feel amplified the more that structural, sociopolitical vulnerabilities are in place. Iceland with its high reliance on imports is likely to feel the impact. Figure 3 illustrates the food system shown previously in Figure 1, while integrating these vulnerabilities.

[16] In a study on the resiliency of Icelandic farms in the 1800s, Brown (2010) came to similar conclusions—that the inability to adapt practices to changing climate conditions ultimately eroded the resiliency of the farms over time.


risks
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direct support
market mechanisms
MAST legislation
protectionist regulations
EEA / EU contracts
trend
trawlers
large boats
small boats
sheep farming
dairy farming
large scale / factory farms
pigs + poultry
beef cattle
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small retailers
50%
50%
consumers
ICELAND
ABROAD

Figure 3. Map of Iceland's food system, incorporating the influence of risks (orange dashed boxes). Risks that are included in the diagram are specifically those that emerged during the interviews and were consolidated into ten risk constructs (a process elaborated on further in Chapter VI). The risks show influence on the Icelandic food system's production processes, and the regulatory framework in turn shapes the risks.

As explained in Figure 1, the dashed box illustrates the Icelandic national boundary. The country's food supply originates at the various producers [teal boxes: fishing, dark green boxes: livestock agriculture, light green: horticulture, yellow: imports], and continues (downward in the map) through processing, suppliers, retail, to consumers. Above the flow of production, the map depicts the top-down regulations (gray boxes) that influence the food system by supporting or hindering the various food producers. Unless otherwise noted with a (-) sign, pathways are reinforcing; in other words, the regulations increase production, imports, or risk.

IV. FOOD SECURITY: A POLITICAL CONSTRUCT?

Is food security a risk?

Based on the myriad of potential hazards, is Iceland's food security at risk? Alyson Bailes, former British diplomat and adjunct security studies professor at the University of Iceland, deems Icelandic food security a "counter-example" in normal risk analyses based on a study she co-authored with former PhD student Orri Jóhannsson in 2011 that found that—other than among the Farmers Association—there is very little public concern (Bailes & Jóhannsson, 2011). This low level of risk perception is likely a contributing factor in the country's lack of a contingency plan for food shortages and limited attention to food security in legislative policy discussions (Bailes & Jóhannsson, 2011; Jóhannsson, 2011b). Between 2001 and 2011, food security—including its meaning and implications for Iceland—occupied only 82 minutes of parliamentary discussion (Bailes & Jóhannsson, 2011).

There are several speculative reasons as to why the food security dialogue remains relatively dormant. Bailes and Jóhannsson point out that for fifty years after Iceland declared full independence, the United States conducted all security assessments for the country up until it withdrew from the US navy base in Iceland in 2006. Thus, the Icelandic national government has been late to explicitly address a range of securities—including economic, energy, and infrastructure security—and not just food security (Bailes & Gylfason, 2008). One interview respondent at the University of Iceland went as far as to say:

> If you go into Iceland identity, we think of ourselves as fixers. We can respond really quickly, but we are not planners...An Icelander will save you from a sinking boat, no matter what. He will find that last piece of wreckage to hang onto in any way. But you would never put an Icelander in charge of designing the safety regulations. (Adjunct Lecturer, University of Iceland, Reykjavik)

Secondly, it is possible that urbanization in Iceland has detached the population from food production, and therefore the associated challenges and risks. Corroborating this theory, the agricultural sector has been the main voice of concern for addressing the country's food security vulnerability. Nevertheless, it also remains likely that the farmers and Farmers Association

continue to emphasize the food security dialogue largely for sector interests (Bailes & Jóhannsson, 2011).

Is the perceived risk a political construct?

Thus the term "food security"—along with its constituting ecological, economical, technical, and institutional challenges—has become politically charged. In fact, in informal conversations held with Icelanders in Reykjavik, several referred to food security as simply a "political issue." The underlying contention likely stems from the fact that many of the food system risks discussed in the last section are conflicting. That is, to decrease one risk may increase another: ramping up agricultural intensity may increase environmental harm; lowering food prices by removing restrictive trade regulations may compromise agricultural livelihoods. There is no agreed upon source of risk, or causal direction.

Furthermore, the construct itself has conflicting political embeddedness. On one level its implications advance environmental goals such as local production, supported by the Left-Green Movement. Simultaneously, food security discussions have tended towards nationalistic—verging on xenophobic—rhetoric, sustained by more conservative groups. It can be speculated that this zeal has persisted since the Cod Wars against the British from the late 1950s to late 1970s, whereby defending Iceland fishing grounds (and thus a food resource) became a military issue. A respondent from the University of Iceland describes this rhetorical legacy with respect to Iceland's fishing grounds as the following:

> The image was 'we are resource rich.' 'We are sitting on a valuable food supply, which not only supplies us, but the rest of the world wants it. And the security task is just to make sure foreigners don't get their evil hands on it.' That was a really sort of engrained attitude for two lifetimes, I mean 60 years is two generations…

With a level of satire she then continues to compare this language with current discussions around food security:

> The language of matvælaöryggi, or food security…has been seized on by the farmers' lobby to be used in a very particular way, which they deliberately associate with the long

> tradition of fighting for fish. Because there, what the farmers are saying, is that 'we have a wonderful pure country where we can raise not only sheep and horses, but pigs, and chickens, and cows and things…and that is going to be superior, and it is our birthright. And we're not going to let the filthy foreigners get their hands on it. But we also shouldn't import stuff from the filthy foreigners, because that is being untrue to our own primary right to produce. And moreover, the stuff that we bring in from the filthy foreigners is probably filthy.' There are quite a few advertisements on Icelandic radio [advertising Icelandic food products]…that end with the slogan 'you know where it comes from.' (Visiting Professor, University of Iceland, Reykjavik)

Because of the ways in which "food security" embeds several ideological frameworks, including both environmental and nationalistic agendas, the term itself and the leverage it offers straddles political parties—and consequently few parties seem fully able to embrace it. The relative contingency of the security risk thus begs the question: *If the risk is political, is it 'real'? Who decides?*

V. THEORY: RISK AND RISK PERCEPTION

The Risk Society

Modernization has ushered in a new scope for human concern—a paradigm German sociologist Urlich Beck deems the "risk society" (Beck, 1992). The elimination of scarcity, which once plagued the human psyche in the preindustrial and industrial era, has largely been eclipsed by the elimination (or mitigation) of risk as the challenge of the late twentieth and twenty-first centuries (Kasperson & Kasperson, 1996). Scientific and technological developments have given rise to new hazards, which have overwhelmed (Renn, 2004; Vasvári, 2015) and arguably altered the portfolio of risks posed by nature. "The social production of wealth," Beck argues, "is systematically accompanied by the social production of risks"; in other words, the production of "goods" produces "bads" as unsolicited side effects (Beck, 1992; Taylor-Gooby & Zinn, 2006). And the "bads"—whether pollution, antibiotic resistance, toxication, unemployment, desertification, social inequality, or flood hazards—are all "informal mechanisms of resilience decline" that can no longer be mitigated by a single state's risk mitigation attempts (Räsänen, Näsi, & Sarpila, 2012; Taylor-Gooby & Zinn, 2006). The hazards of social decisions, as Beck has said, surpass the realm of insurability (Beck, 1992; Vasvári, 2015). We have entered a "world risk society".

In other words, these risks are aggregative, systemic, and democratic. Ecosystem degradation and altered atmospheric chemistries amplify challenges faced by our social systems—whether they are environmental justice concerns driven by poor air quality, or the failure of agricultural livelihoods driven by climate change's unpredictable weather patterns. Although we have arguably never been able to accurately calculate risk, this task has been rendered entirely infeasible for many risks with the growth of high-risk technologies, globalized distribution systems, and environmental impact at a world scale; repercussions from these risks are no longer linear processes, but rather complex and catalytic (Vasvári, 2015). And risks have evolved from being personal to societal, with ramifications expanding across geographies. One of the most contested questions we currently face involves risk distribution: *Who is burdened by the risk we have accepted through particular political and economic decisions? Knowing this, who gets to decide what is safe enough?* (Renn, 2004; Vasvári, 2015).

It is likely due to this rise in risk consciousness, in the "fragmentation of liabilities," (Vasvári, 2015) and in the complex nature of these hazards that the risk literature has grown throughout the late twentieth and early twenty-first centuries. During this time, researchers have framed contested theories of risk and risk perception from the basis of technical practice to sociological phenomena. Forty years since the early debates, researchers still grapple with the myriad frameworks and measurement methods—with no agreement on what constitutes best practice for risk analysis (Renn & Rohrmann, 2000; Renn, 1998; Rosa, 1998; Slovic, 2016).

Risk as objective reality

In the 1970s and 1980s during the early days of risk analyses, risk was framed as a probability that an adverse event will occur.[17] In other words, risk was a measurement of objective reality (often with a threshold set based on a probability of mortality), and could be quantified with increasing accuracy as more was known about the situation (Hansson, 2010; Rosa, 1998). In recent years, more nuance has given rise to a commonly used and widely accepted technical definition, in which risk is the probability-weighted magnitude of the hazard's impact (risk = impact x likelihood) (Hansson, 2010; Rosa, 1998; Vasvári, 2015). Framed in this way, risk reduction can then be "optimized" by equalizing the amount paid (disutility) per marginal risk reduction (utility)—a commonly used economic paradigm of benefit-cost maximization (Hansson, 2010; Vasvári, 2015). This optimization provides rational guidance for otherwise normative judgments (Rosa, 1998).

The narrowness of this technical analysis serves as a strength—for the sake of consistency—but also its weakness (Birkholz, Muro, Jeffrey, & Smith, 2014; Renn, 1998). These technical approaches aggregate data over populations, space, and time, and exclude unexpected events by relying on relative frequencies to express probabilities. Risk is only reported in terms of harm to humans and the environment, and therefore neglects focus on other degrading social or cultural impacts (Renn, 1998).

[17] For example, in 1983, a working group of the London Royal Society defined risk as "the probability that a particular adverse event occurs during a stated period of time, or results from a particular challenge" (Royal Society, 1983).

As a result of this risk assessment protocol, for years risk research consistently uncovered that laypeople and the technical practitioners who run risk analyses had very different perceptions of risk (Gierlach, Belsher, & Beutler, 2010; Slovic, Fischhoff, & Lichtenstein, 1979; Vasvári, 2015). As reasoned by rational action in economic theory, the general population only has the ability to access and process a limited amount of information in the moment, and thus operates under "bounded rationality," constructing mental strategies, or "cognitive heuristics," in order to evaluate risk (Birkholz et al., 2014; Vasvári, 2015). Most frequently, these heuristics—such as loss aversion (losses seem riskier than gains with equal probability), overconfidence (events seem more likely to occur to other individuals rather than oneself), or availability bias (an outcome is judged with higher likelihood if a recent instance can be recalled)—cause "distortions" in risk perception (Gowda, 1999; Slovic & Peters, 2006; Taylor-Gooby & Zinn, 2006; Tversky & Kahneman, 1974). Based on empirical observations of these phenomena, Kahneman and Tversky (1979) challenged the traditional expected utility theory as the descriptive model for risk decision-making, and proposed an alternative model—prospect theory—that accounts for these pervasive cognitive patterns that lead to inconsistent and therefore "non-rational" preferences.

Most interestingly, with increasing awareness of cognitive heuristics came a simultaneous shift in the validity of the layperson's perception of risk. This transition is illustrated in the dichotomy between Slovic's publications between the late 1970s and 2016. In 1979 he writes: "Risk perception is derived in part from fundamental nodes of thought that lead people to rely on fallible indicators such as memorability and imaginability" (Slovic et al., 1979, p. 38). Although Slovic embraces the high level of subjectivity in risk analysis, suggests that risk management could never be fully turned over to experts in a democratic society, and admits that experts also face biases to a certain degree, he indicates that laypeople's heuristics present a cognitive handicap for accurately assessing objective risk. By contrast, over thirty-five years later, Slovic says: "Research shows that affective and emotional processes interact with reason-based analysis in all normal thinking and, indeed, are essential to rationality" (Slovic, 2016, p. 29). This reframing—where subjective evaluations of risk are not just sources of error, but rather integral sources of understanding—provides the theoretical grounds for the psychometric paradigm, which suggests people employ a complex layering of qualitative, often affect-based evaluations such as judging the level of dread, controllability, and trust in the situation to understand risk (Finucane, Alhakami, Slovic, & Johnson, 2000; Slovic, 2016; Taylor-Gooby & Zinn, 2006). In other words,

whereas it was once assumed that the subjectivity of risk assessment was limited to the evaluation of what level of risk is safe, it has become increasingly accepted that risk in itself is subjectively defined.

Risk as a subjective construction

The constructivist view, grounded in sociology, offers a stark counterpoint to the original realist paradigm: risk is seen as purely a social construct existing in the collective consciousness rather than based on objective facts about the physical world (Douglas & Wildavsky, 1982a; Hansson, 2010; Rosa, 1998). Douglas and Wildavsky (1982) eloquently frame the basis to this position:

> Standing inside our own culture, we can only look at our predicament through our culturally fabricated lens. The apparatus of scientific investigation is as unique to our civilization as are its results. The conceptual tools of economic analysis are entirely our own invention. (Douglas & Wildavsky, 1982, p. 192)

According to the constructivist paradigm, normative frameworks and shared ideas shape human understanding, perception, and prioritization of risks, rather than individual psychologies; knowledge and risk perception are thus formative products of social activity and are culturally embedded (Dake, 1992; Douglas & Wildavsky, 1982a; Taylor-Gooby & Zinn, 2006). Within this framework, probability is simply a degree of belief (Hansson, 2010).

Cultural Theory, also known as the "grid-group" model, offers a logic as to how values and worldviews (and consequently risk perceptions) are molded by social structures and context (Thompson, Ellis, & Wildavsky, 1990). These worldviews, or cultural biases, align along two axes: grid (the degree to which one's life is circumscribed by externally imposed order) and group (the degree to which one is bounded within social units) (Figure 4). An individual's placement along these two dimensions places him or her among four main worldviews: hierarchy (high-grid and high-group), egalitarianism (low-grid, high-group), individualism (low-grid, low-group), and fatalism (high-grid, low-group). This worldview quadrant has shown predictive power in mapping people's decision-making tendencies and risk perceptions, even more so than knowledge, economic, or political theories of categorization (Wildavsky & Dake, 1990).

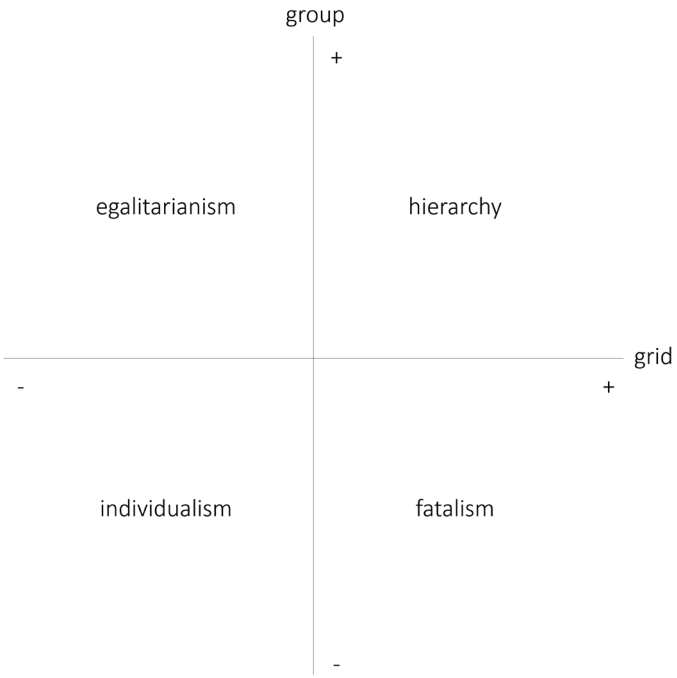


Figure 4. Typologies of worldviews along grid-group dimensions, as originally framed by Douglas & Wildavsky (1982).

Several studies have utilized grid-group theory to delineate patterns in conflicting environmental attitudes, suggesting that there is a substantial dichotomy between individualists who see nature as resilient and perceive little risk to environmental damage, and egalitarians who see nature as fragile and vulnerable to human interventions (Chassot, Hampl, & Wüstenhagen, 2014; Dake, 1992; Thompson et al., 1990; Xue, Hine, Loi, Thorsteinsson, & Phillips, 2014). Nevertheless, Cultural Theory has been criticized for its indiscriminate application, both across geographies and for attempting to integrate the theory into quantitative analysis (Marris, Langford, & O'Riordan, 1998; Oltedal, Moen, Klempe, & Rundmo, 2004; Rippl, 2002); Oltedal et al. (2004) and Rippl (2002), in particular, suggest that in quantitative empirical data, Cultural Theory frequently shows a weak correlation at best with risk perception.[18]

[18] Although Cultural Theory has shown effectiveness in studies applied to Iceland (Grendstad, 2003), it has been questioned whether the framework can be adequately re-embedded in cultures outside the United States (Xue et al., 2014). Furthermore, because Cultural Theory employed through quantitative methods has shown limited effectiveness in the empirical data, I decided not to use the grid-group model as a value-based categorization framework.

Nevertheless, Cultural Theory still offers a dominant conceptualization as to how knowledge and normative ideologies are intersubjectively developed. Cultural Theory not only presents a constructivist (versus realist) perception of risk and risk perception, but it also positions risk as a construct that is socially as opposed to individually defined. Taylor-Gooby offers this dimension—individual versus collective—as a second dimension (in addition to constructivist versus realist) in categorizing the myriad theoretical frameworks for risk. Governmentality, for example, sits at the far end of both the constructivist and collective dimensions. This perspective argues that government institutions or other structures of culturally-based power (faith, gender, employment relations, among others) shape assumptions about risk based on dominant cultural ideologies—dictating securitization, systems of welfare, economic management, education, healthcare, urban planning, and other sectors that consistently both negotiate risk and are constitutive of risk perceptions (Hansson, 2010; Taylor-Gooby & Zinn, 2006).[19]

One of the key sources of backlash towards the constructivist perspective is the seemingly hazardous ambiguity of slipping into a space of complete subjectivism, relativism, and solipsism (Aven & Renn, 2009; Rosa, 1998). If risk is founded on cultural biases, comprehended through subjective understandings, and evaluated based on normative social frameworks, then presumably risk does not exist in any true physical form. If that is the case, are all risks equal? Is there no hierarchy of risks based on the likelihood or magnitude of impact in an objective sense? Must risks be perceived to exist?

[19] An interesting caveat to this theory is that ideological evolutions seen in the United States and United Kingdom since the 1980s have since eroded the notion of the nation-state as caretaker, and have inserted a prevailing belief in self-activity and self-care in citizens managing their own risk. This ideological emphasis on individual responsibility has created a new governmentality—one that largely aligns with the aforementioned "risk society" perspective (Taylor-Gooby & Zinn, 2006). The weakening of traditional social orders (work, family, community) has been said to increase individualism (as well as uncertainty and anxiety). And as citizens exhibit greater awareness of their role as actors in their social context, confidence in authorities and technical experts decline, and risk management becomes a more pressing personal issue (Renn, 2004; Taylor-Gooby & Zinn, 2006). It is largely due to this ideological shift that risk society theory—although consistently constructivist—has been discussed both from a collective and more individualistic frame.

Risk: a realist-constructivist amalgamation

Whether risk can be characterized by objective physicality or only subjective perception spurs debates to this day. Hansson (2010) summarizes the two conflicting viewpoints as the following—both of which he deems as misleading on their own:

A) The purely objectivist risk thesis: "An accurate and reasonably complete characterization of risk can be made by stating (only) objective facts about the physical world." Objective facts are thus separate from subjective values.

B) The purely subjective risk thesis: "An accurate and reasonably complete characterization of risk does not refer to any objective facts about the physical world." In other words, objective facts cannot be separated from non-epistemic values. [20]

As clarification, Hansson delineates the difference between epistemic and non-epistemic values. The former—which include truth and avoidance of error, for example—are considered permissible and necessary for developing knowledge, even in neutral, bias-free scientific investigations. Non-epistemic values, on the other hand, are those that engage beliefs beyond scientific utility, including instrumental, moral, or aesthetic values. Non-epistemic values can be uncontroversial (such as it is better to be healthy than diseased), but it is implausible enough to deem impossible that they can be derived from facts of the physical world (Hansson, 2010).

With this theoretical framework in mind, Hansson argues that, by definition, risk has to be an amalgamation of the objective and subjective theories. "By definition" seems counterintuitive

[20] Hansson (2010) clarifies this statement by saying risks do not only have to be facts or values; there are also statements that belong to neither category. With this in mind, the statement does not imply that values have to be involved in an accurate characterization of risk; rather, risk must be described without any component of facts from the physical world (Hansson, 2010). Interestingly, despite Hansson's clarification, many researchers and theorists (Aven & Renn, 2009; Boholm & Corvellec, 2011; Rosa, 1998) define risk with respect to values—such as environmental sociologist Eugene Rosa's definition that risk is "a situation or event where something of human value (including humans themselves) has been put at stake and where the outcome is uncertain" (Rosa, 1998, p. 28).

and largely infeasible for a term without a commonly accepted definition[21] (Gierlach et al., 2010; Renn & Rohrmann, 2000; Renn, 1998; Rosa, 1998) and that evokes such dichotomous conceptualizations; in fact, Hansson does not give a final definition in the publication referred to here (Hansson, 2010). Nevertheless, he concludes (along with other theorists including Renn, 1998; Rosa, 1998; and Vasvári, 2015) that all definitions seemingly satisfy at least two fundamental qualities. First, he suggests risk refers to undesirable events. Rosa (1998) contests this standard, suggesting that risk simply "expresses a state of reality of human concern or interest," which accommodates both desirable and undesirable outcomes. I argue for a third way of framing this deliberation: risk involves a decision between two or more options of differing desirability. A situation would not be considered a risk if faced with two equally desirable or equally undesirable events. Regardless of which of these three framings are used, however, Hansson's next argument remains true: desirability is a non-epistemic value, and thus risk is a value-laden construct. The purely objective risk thesis is arguably disproven.

The second key quality is that risk contains uncertainty—in other words, a delineation between reality and possibility. No risk would exist if an outcome is certain to occur or not to occur; risk only exists if the probability of occurrence is greater than zero or less than one. The outcome that is referenced in this condition, however, is a reference to reality, a fact or stated condition about the physical world. In other words, "the ontological subjectivity of the socially constructed reality requires an ontologically objective reality out of which it is constructed... you cannot have institutional facts [socially constructed facts] without brute facts" (Rosa, 1998, p. 26, requoting Searle, 1995). As further evidence supporting this point, risk estimations (i.e., subjective probabilities) often converge towards experienced frequencies in the physical world as more knowledge is gained. Consequently, Hansson argues, the purely subjectivist risk theory does not stand on its own either.

[21] The following are a few of many definitions of risk: "Risk is the probability of an adverse event times the consequences of that event" (Wilson & Crouch, 1982); "Risks are the dangers that societies define as troublesome" (Douglas & Wildavsky, 1982a); "Risk is the possibility of physical or social or financial harm/detriment/loss due to a hazard within a particular time frame" (Renn & Rohrmann, 2000); "Risk is a situation or event where something of human value (including humans themselves) has been put at stake and where the outcome is uncertain" (Rosa, 1998); and oftentimes those in support of the constructivist paradigm refuse to define risk with the acknowledgement that it is a contextually-derived term.

Rosa (1998) also describes the failure of these purist frameworks, but for their conflation of ontology (the nature of existence) and epistemology (the acquisition of knowledge and the foundation for its justification). In the positivist realist paradigm, both risk (ontology) and risk perception (epistemology) are reduced to a neutral product of science, excluding any biases, values, or sociologically-shaped normative judgments. Under this rationale, "states of the world like risk are nearly equivalent—via correspondence rules—to knowledge claims about the world," in effect merging the ontology of risk with the epistemology of risk perception (Rosa, 1998). Along a similar theoretical rationale, positivists will often reduce ethics to science, concluding that the scientifically rational solution (e.g., maximized utility) is also the ethical solution. These conflations of the ontology of risk with its epistemology generates what Rosa calls the "realism-objectivism bias," which overlooks the political, social, and cultural contexts that influence risk perception. At the opposite end of the spectrum, constructivism falls subject to a similar trap. Under this paradigm there is no differentiation between reality and the perception of reality; both are subjective social constructs and thus risk perception is equivalent to risk itself (Hilgartner, 1992; Rosa, 1998). This ultimately means that risks can only exist in collective meaning and will not exist if not perceived. The state of the world becomes as constructivist and fallible as the perceived—leading to a "constructivist bias" that becomes blind to the presence of objective, physical, but unperceived danger (Rosa, 1998).

It is because of these theoretical downfalls in the "purist" paradigms that Rosa, like Hansson, proposes an amalgamation of the two frameworks: "ontological realism/epistemological hierachicalism" where risk is based upon objective realism, and yet risk perception may be either realist or constructivist depending on the "evidentiary basis of our claims to knowledge" (Rosa, 1998). Risk perception becomes "hierarchist" because perceived risk with greater ostensibility (i.e., "I can point to examples") and repeatability (i.e., "The examples will repeat themselves") will generate greater intersubjective agreement over the risk and ultimately have greater merit as a perceived risk.

The nexus between these two paradigms—realist and constructivist—is also where the present study lies (Figure 5). In contrast to Rosa, however, I argue that not only risk perception, *but also risk itself,* is shaped by both objective realism and subjective constructivism. As a schematic point of departure, we can think of the realist paradigm as framing *risk perception as a function of risk*

(objective reality), while the constructivist paradigm frames *risk as a function of risk perception* (social construct). This study, ultimately frames the two as mutually influential (Figure 5, arrow *a*). Furthermore, risk cannot exist without both the influence of objective reality (the probability and impact of an event occurring) (Figure 5, arrow *b*), but also without a value judgment or interpretation of desirability (Figure 5, arrow *c*)—otherwise the construct would only be a chance or probability of occurrence. Thus risk exists in the overlap between objective realism and subjective constructivism. In other words, risk observes scientific natural laws, but is culturally constrained (Boholm & Corvellec, 2011).

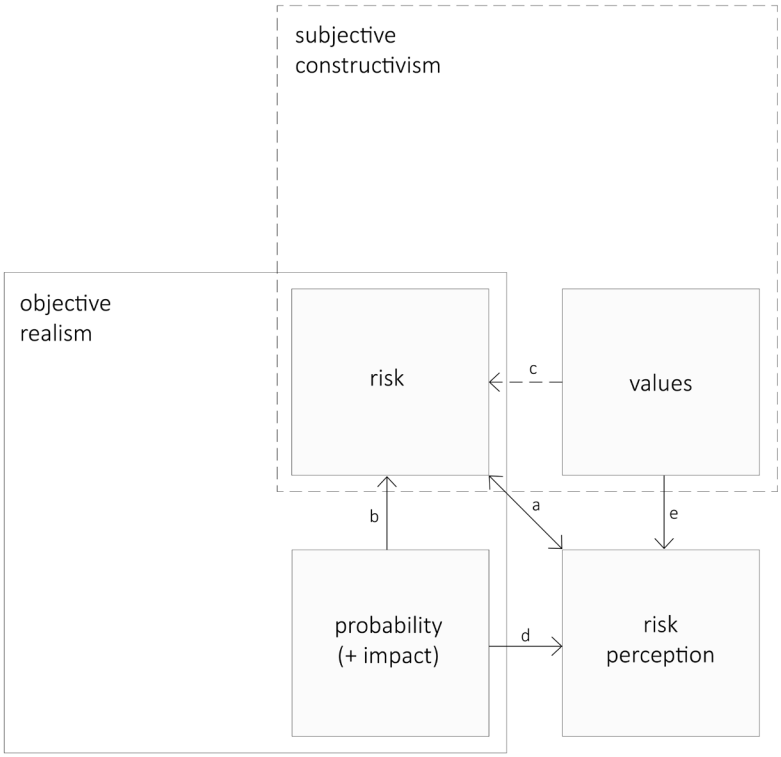


Figure 5. A framework for conceptualizing risk as a realist and constructivist amalgamation, influenced by both an objective, physical state of the world (probability and impact) as well as normative frameworks (values). Within the boxes represents ontological states; outside (risk perception) represents epistemology. Values shape risk perception and indirectly affect the existence of risk—without the normative judgment, risk would not exist.

Likewise, risk perception, the epistemological construal of risk, reflects the conceptualization and justification of risk based on various personal interpretations of the relationship between the probability and impact of the event and value judgments. For example, several studies (see Clark & Knox-Hayes, 2007; Jóhannesdóttir & Gísladóttir, 2010; Lindell, 1994; and She, Lu, & Ma, 2012) explore how risk perception (and subsequent decision-making) is shaped by both temporal and spatial dimensions. She et al. (2012) in making the claim that probabilistic distance, temporal distance, and spatial distance are psychologically equivalent in risk perception, offer an explicit formula for transforming objective proximity (in terms of space and time) into an interpreted probability. She et al. find that respondents rank less proximal events lower in risk due to the intrinsic uncertainty associated with the time delay and spatial distance; however, several other studies have noted that respondents tend to perceive greater risk for people and places in distant time and space, an effect known as the overconfidence heuristic (Leiserowitz, 2006; Lindell, 1994). These patterns illustrate the relationship between objective realism (probability) and the interpretation (risk perception) (Figure 5, arrow *d*)—or in other words, the degree to which perception is contingent on context and spatial and temporal proximity. While this correlation illustrates a contextually specific *physical* dimension, the present study further adds the influence of values (Figure 5, arrow *e*)—an additional dimension which is *socially* constructed rather than physically defined. In recognizing this influence, it is clear that attitudes towards uncertainty—an ontological state between reality and possibility—can vary by culture. The risks identified by a community or country will emerge and be prioritized based on the uncertainties that cause fear or anxiety (Vasvári, 2015). In this case, communication around risk and perception of risk, can therefore influence the existence of risk itself (Figure 5, arrow *a*).

A similar argument has been made by Kasperson et al. (1988), but focuses on how hazards interact with psychological, cultural, and institutional processes to then amplify or attenuate social or individual risk perception (Kasperson & Kasperson, 1996). This theory—called the social amplification of risk—argues that people's heightened or dampened risk perception then goes on to have secondary influences through behavioral patterns that ultimately affect other risk liability, parameters like insurance costs, a loss of trust in institutions, or risk management behaviors (Birkholz et al., 2014; Kasperson & Kasperson, 1996; Renn & Rohrmann, 2000; Renn, 1998).

Another way of conceptualizing when risk is present is by saying risk exists when a value is at stake—a point that will be elaborated upon throughout the next section of this thesis,[22] but that has also been substantiated in the literature. Boholm and Corvellic (2011), based on prior theory by Hilgartner (1992), present a "relational theory of risk," where risk is defined as a "risk object" (which causes the risk), an "object at risk," and a causal relationship connecting the two. For an object to be designated an object at risk, the authors argue, it must be ascribed value (Boholm & Corvellec, 2011). An object's value, however, is never universally observed. Thus the novelty of this framework is in its ability to articulate a logic to the variability of perceived risk. Each society has its own portfolio of risks (Renn & Rohrmann, 2000) and under this framework, one person's risk object can be another's object at risk. These definitions are fluid, shifting with the identification of new hazards and values at stake. As people develop mental networks of contingency and causality between risk objects and objects of risk, they are negotiating meaning, suggesting "moral orders of blame," and introducing a "corresponding order of governmentality." Beyond defining directional connections, these causal relationships of risk are directly linked to action; a risk construct requires that there is a decision at play (Boholm & Corvellec, 2011; Vasvári, 2015).

Influenced by Boholm and Corvellic's relational theory of risk, the present study proceeds with environmental sociologist Eugene Rosa's definition for risk, which draws on this correlation with values[23] to combine constructivist and realist reasoning: "Risk is a situation or event where something of human value (including humans themselves) has been put at stake and where the outcome is uncertain" (Rosa, 1998, p. 28). As previously mentioned, I ultimately argue that it is the presence of these values, however, that allows people to conceive of the risk in the first place (Figure 5, arrow *c*). This framework aligns best with Swedish theorist Hervé Corvellec's assessment of risk management in organizations, where he argues that an organization derives its conceptualization of risk primarily from what its managers consider to be of value both in and for

[22] This link between values and the existence of risk made itself apparent through the interviews with Icelandic government officials, NGO representatives, farmers, retailers, and consumers, who repeatedly articulated values as a basis to why a situation was a particular concern. Tables 1 and 2 articulate the risk constructs and the value constructs, respectively, that were identified throughout the interview process and consolidated through grounded theory methodology. (See Chapter VI for further details.)

[23] In everyday usage, values take on myriad meanings—from interests, likes, preferences, pleasures, moral obligations, goals, aversion, to needs. O'Brien and Wolf (2010)—in building the argument that these non-economic values are critical in approaching climate change vulnerability—define values as "relating to principles or qualities that are intrinsically desirable." I use this definition for values in this study.

the organization (Corvellec, 2010). By expanding the organizational entity to the level of a community or even a country, it provides an interesting theoretical positioning for considering citizens' values and risk perception in Iceland.

VI. RESEARCH METHODS AND RESULTS

This research employed a mixed methods approach, combining an assessment of the literature, qualitative data collection through interviews, and quantitative data collection through distribution of a survey instrument. The methodology followed techniques from grounded theory, a systematic but flexible framework for theory development and redevelopment, facilitated through iterative data collection and coding analysis (Charmaz, 2006).

Data Collection Part One | *Interviews and Literature*

From November 2015 to March 2016, I conducted eighteen interviews with individuals representing Iceland's Ministry of Industry and Innovation, the Farmers Association of Iceland, academia (with specialties in national security, sustainability, rural and regional development, social work, and ocean acidification), the farming and horticulture sector, grocery importing and retail, food engineering, as well as environmental and local food NGOs and programs. (See Appendix A for anonymous list of interviewees.) I identified and approached interviewees through one of three ways: 1) through a primary introduction from my faculty supervisor, Janelle Knox-Hayes, who leads a large body of research in Iceland; 2) through secondary introductions made by the first set of interviewees (chain-referral sampling); and 3), through identification via online research and an introductory email when no prior connection was available.

Interviews lasted between 30 and 120 minutes and were semi-structured (Hammer & Wildavsky, 1993), loosely following an interview guide that was tailored to the particular interviewee's expertise and line of work. This allowed for guided conversation while still allowing the individuals to address topics they considered significant. Individuals were asked about the nature of their work, its relationship to food production or provision in Iceland, their perspectives on various vulnerabilities related to the food system, and the trends they are seeing within their own work and in terms of national food system policies and industry developments. Interview questions were informed by the literature—both publications by the interviewees, as well as literature on related topics—and subsequently the literature review was further informed and expanded by the interviews. National reports, policies, peer-reviewed publications, as well as news sources were used to triangulate, verify, and advance understanding of interview findings.

Data Analysis and Results Part One | Interviews and Literature

Using techniques from grounded theory, I used Atlas.ti qualitative data analysis software to code the transcripts from the semi-structured interviews—a process that initially involved tracking patterns in the raw interview data to identify first-order constructs related to interviewees' risk perceptions of Iceland's food system. These constructs fit primarily within five categorizations: 1) Risks; 2) Responses (which were constructs most often framed as risk mitigators, but interestingly could also be framed as risks depending on the interviewee—an example of Boholm and Corvellic's fluid transitivity between risk objects and objects of risk); 3) Actors (which were entities influencing, engaged in, or perceiving the risk); 4) Values; and 5) Descriptive and Relational Constructs (which served as a catch-all term for repeated discursive references, such as something being a "political issue," a "fallacy," an "opportunity," or a "negotiated tradeoff." Constructs were connected with other constructs through "relations" to reflect associations—for example, "cheap imports" [risk] "hinder" [relation] "self-sufficiency" [value] or "organic farming" [response] "is associated with" [relation] "health" [value] (Figure 6). Relations were used to map positive, negative, or neutral correlations depending on the instance; for example, "cheap imports hinder self-sufficiency" illustrated a negative correlation between constructs, while "cheap imports increase product diversity" illustrated a positive correlation. In some instances, the same framing (such as "cheap imports increase competition") could be both negatively and positively construed depending on the respondent. This again illustrated the fluidity between what was defined as a risk or a risk mitigator depending on individual perception.

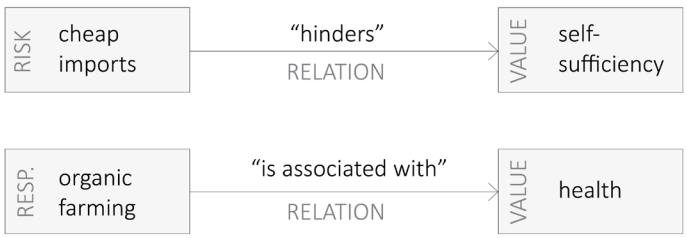


Figure 6. Coding methodology for linking constructs.

When analyzed through the risk theory framework, many of the mentioned risks, as triangulated with reports from other interviewees and the literature, were clearly embedded in objective realism. For example, the concern over Iceland's high reliance on imports is rooted in the fact that over 50 percent of nutritional needs come from abroad; the concern over competition from foreign products is substantiated by the increased market share of foreign meats in the last six years; and the fear of livestock disease hearkens back to several devastating plagues that have decimated Icelandic livestock populations in the past. Nevertheless, the interview coding process further uncovered an element of subjective constructivism in how risk was defined; namely, there was a repeated tendency for risks to be linked with values—an observation substantiating several sources of risk theory where risk itself is defined with respect to a value at stake. In other words, in the interviews values offered a particular logic for why an event was seen as risky. For example:

- In discussing the risk of Iceland's high import reliance, self-sufficiency was referenced:

  "I think there is a spirit in Iceland; there's still a strong spirit that wish to not to be too dependent on others—to be relatively self-sufficient." (National Advisor, Farmers Association of Iceland, Reykjavik)
- In discussing the risk of competition from foreign products, health was referenced:

  "The quality of our products is very, very good. We are using so few chemicals; we are not using hormones in animals, not like in the [United] States. It is very different. And we have generally very healthy products." (National Advisor, Farmers Association of Iceland, Reykjavik)
- In discussing the risk of livestock disease (and the threat of losing Icelandic livestock breeds) nationalistic sentiments were referenced:

  "'When I go into the countryside, I like to see my old Icelandic cows grazing...'[24] Yes, I wouldn't deny that. So there's a little bit of nationalism put into it." (Senior Advisor, Ministry of Industries and Innovation, Reykjavik)

Based on this repeating pattern, I focused on the Risk and Value categories, specifically, and recoded the terms into broader analytic constructs for further analysis. For example, "changing fish populations," "climate change," "new pests," "ocean acidification," and "sea level rise" were

[24] The interviewee is quoting a woman who published this statement in the media; "I" is the woman's perspective.

all risks topically related to climate change and were thus clustered in a broader risk construct deemed Climate Change. Likewise, “cultural preservation,” “landscape aesthetic,” “farm and landscape romanticism,” and “genetic preservation” (of the original Icelandic breeds) were topically related values that were clustered into a broader value construct called Cultural Preservation. This process generated ten risk constructs (Table 1) and ten value constructs (Table 2). The frequent reference to values when discussing risk had prompted the question whether there is in fact a direct correlation between people’s values and the risks they perceive. With the formation of these twenty risk and value constructs, a survey instrument was subsequently developed to test the validity of these findings and the strength of these relationships.

Table 1. Risk constructs

RISK CONSTRUCT	DESCRIPTION	EXEMPLARY QUOTE
Climate change	Associated concerns include the changing fish populations due to warmer sea temperatures; new pests previously nonexistent for Icelandic crops; ocean acidification and its effects on fisheries; and sea level rise (which is expected to affect low-lying farmland)	"The more modern version of that [volcanic eruptions and harsh weather] is the more violent and unpredictable weather—the extreme weather—that climate change is bringing in its wake for that particular arctic/sub-arctic region of the world, because it's doubly set; it affects food growing and food delivery within the country." (Adjunct Lecturer, School of Social Sciences, University of Iceland, Reykjavik)
Environmental degradation	Associated concerns include the country's policy to welcome foreign aluminum smelters; the unsustainability of conventional farming practices; ecosystem degradation; wetland draining; the potential growing use of pesticides; invasive species and altered ecologies; over-grazing; soil erosion; fossil fuel depletion; pollution from increased ship traffic; pollution and environmental degradation caused by geothermal plants and hydro power dams; the risk of oil spills; and the limitations for organic farming including the stringency of certification and the challenges in sourcing organic feed	"Today they [chemical pesticides like Roundup] are coming to Iceland also. So we must be very careful, for use of that much chemical, then the nature can't—the nature start to change and get broken down." (Geothermal greenhouse owner, Reykjavik) "The paleo record also suggests this, that the calcifying organisms are likely to be the most vulnerable [to ocean acidification]…But they, for example, make up very important aspects, very important groups in the food web. You know, you have the crustaceans that the fish around here rely on." (PhD student, Marine Biology, University of Iceland, Reykjavik)
Foreign products replacing Icelandic products	Associated concerns include imports as a cheap alternative (which may force Icelandic products out of the market); EU membership (which would increase competition from EU products); a concern that foreign imports are of lower quality; concern over importing new	"There was a lot of discussion, argument, in the year 2000 – 2001 about the import of these Norwegian fertile embryos. And then you would have articles in the paper—maybe a housewife in Reykjavik wrote an article in one of the newspapers—saying 'when I go into the countryside, I like to see my old Icelandic cows grazing. I don't like to see these foreign breeds on the grazing fields.'

Table 1 continued

	livestock breeds; and concern over foreigners buying land in Iceland	Yes, I wouldn't deny that. So there's a little bit of nationalism put into it." (Senior Advisor, Ministry of Industries and Innovation, Reykjavik)
Natural events (volcanoes, cold spells, etc.)	Associated concerns include Iceland's cold climate (and thus its short growing season); weather-related impacts such as short-term lost income from rainy seasons, droughts, or early frosts; volcanic eruptions; and earthquakes	"I think every farmer is concerned about, you know, that they need to make sure that eruptions don't negatively affect their flock. But it's not every volcano; it's different with the different chemical compositions, and what they are concerned with is losing their livestock." (Researcher and agriculturalist, Reykjavik Academy, Selfoss/Reykjavik)
Livestock disease	Associated concerns include the genetic vulnerability of Icelandic livestock breeds; the country's geographic isolation (which increases the breeds' genetic vulnerability); livestock death and the associated loss of income; threatened loss of biodiversity of Iceland's native breeds; imports and travelers as disease vectors; antibiotic resistance; and EU membership (which would require relaxation of import regulations)	"Your animals may be okay in your country, because they have immunity there, but they are carrying diseases with them—although it is not possible to show up on tests. When they come into Iceland, because our animals have been so isolated for thousands of years…we need to be very careful because we could get diseases that would really wipe out these breeds. Then that would be a lot of loss." (Senior Advisor, Ministry of Industries and Innovation, Reykjavik)
Lack of awareness	Associated concerns include complacency or shortsightedness; forgotten risk (a pattern where once time passes after an event, people are no longer concerned); and a lack of education, research, or dialogue about food system risks	"People don't realize the connection maybe—the connection between how the food is produced and the animals and nature. It's not very clear. And I think the customers are sleeping." (Owner, Organic dairy farm, Kjos)
Loss of farming industry due to financial stress	Associated concerns include an aging farming population; high interest rates for farm investments (creating a barrier to	"The problem is that if you lose the people from the countryside, as we have done in the west of Iceland—where my daughter is living now, she's in a fishing town—it is really

Table 1 continued

	entry in the farming sector); underpriced agricultural products; energy unaffordability; imports as cheap alternatives; free trade policies including new trade contracts with the EU (which remove protectionist measures); EU membership (which would require relaxation of import regulations); termination of the quota system; low breed productivity; and losing tourism (an associated industry attracted to the farms and nature)	getting very difficult. Most of the farmers there have left. They are leaving every year. Some of these rural areas are becoming basically derelict." (National Advisor, Farmers Association of Iceland, Reykjavik)
Over-reliance on critical imports	Associated concerns include Iceland's geographic isolation; the country's dependence on imports; the threat of being cut off from fertilizer and oil imports; feed and food stock shortages; the threat of another financial crisis (which limited Iceland's capacity to import) and the associated food unaffordability; the threat of a disaster overseas, war, or political tension between countries that could cut off imports; and fossil fuel depletion	"I sometimes do this with my students [ask what would happen if Iceland were cut off from imports], and I'm like, 'Okay so how would we…' 'Well, we could fish.' I'm like, 'Really, could we?' You know, if we're cut off from the outside world, we don't have much in the way of small fishing boats that would get us to... You know, we have these big trawlers that depend on oil, which we have to import…. So the much bigger deal is how would we actually get food. Do we know how to live off the land? Not very much. You know, we need imported fertilizers to grow crops in the summer; the summers are short. Again, without oil to run the tractors and whatever, could we harvest enough to store for the winter?" (Adjunct Lecturer, School of Social Sciences, University of Iceland, Reykjavik)
Restrictive or protectionist trade regulations (threat to a free market)	Associated concerns include restrictive import regulations, which are associated with subsequent food unaffordability; and the tendency in Iceland for market systems to become oligarchic	"We have a lot of regulations regarding imports. You can split that in various different fields. It's a mix of when they are making it easier for the Iceland farmers to survive in this, but so there are a lot of different regulations, which are making it difficult for us to import products. Most of them are in that field, that it will add to the

Table 1 continued

		price in customs and in excise or in things like that… It would be much easier [without the regulations] to have more variation in range, more variation in different qualities, in different price categories, definitely, it would be, from my opinion, because we have what is one of the country's policies at the moment, but our company is not agreeing on all of them. But we are to live with them. " (Purchasing Manager, major Icelandic grocery retail chain, Reykjavik)
GMOs (threat to health)	Associated concerns include harm to human health (from disease, bacterial infection, or chemicals); the potential growing use of pesticides; and hesitancy around genetically modified organisms (GMOs)	"Of course it is important to sort of make new ways to cure diseases, but it's also a risk that something goes horribly wrong. And a committee like that [referring to Iceland's committee on GMOs] with no data, except from those who are wanting to do the research, cannot really sort of accurately decide on whether that is too much risk or not, or whatever risk is involved in that. And with food, are you putting something in the food you are eating, or is it somewhere in the plant, or is something that is outside? So are you putting the GMO sequences into the food people are eating or not? There are so many uncertainties in all this." (Researcher and agriculturalist, Reykjavik Academy; former member of Iceland's committee on GMOs, Selfoss/Reykjavik)

Table 2. Value constructs

VALUE CONSTRUCT	DESCRIPTION	EXEMPLARY QUOTE
Cultural preservation	Notions clustered in this value construct include cultural preservation; an appreciation for a traditional, agricultural landscape aesthetic; farm and rural lifestyle romanticism; and preservation of the Icelandic livestock genetics	"There is a lot of culture. There is a lot of vibrant life, even if there are big distances between the farms. So young people can also find that they are quite happy. This is why we want to maintain family farming. The family farming is really the basis. If you lose that, you go into these very big specialized units, and that is food production, but it is very, very different." (National Advisor, Farmers Association of Iceland, Reykjavik)
Environmental health	Notions clustered in this value construct include support for animal welfare; support for environmental health; anti food and energy waste sentiments; a sense of responsibility towards climate change mitigation; belief in the importance of soil health; belief in the importance of an ecosystem approach; an emphasis on avoiding chemical fertilizers and pesticides; an emphasis on fostering sustainability; an emphasis on preserving biodiversity	"It [tree planting] is very important to the growing, to the growing of the grass for example, and also to keep the water, and bringing up the heat in the summertime. It is a much different climate inside the trees, than if you are standing somewhere where there is no trees. And I'm sure it helps a lot here; it makes much difference. And also for the animals—we have a very windy place here… I say you are offering land under fences and under trees. It's just a gift to the nature. You must not use every place; you must leave something for nature. So the fences are a bit shelter for birds and other life, and the life of the soil, you know. So I think it is a very good thing to have fences and trees to the animals. I think it's good, good for everybody." (Owner, Organic dairy farm, Kjos)
Efficiency and performance	Notions clustered in this value construct include an emphasis on means that allow for farming efficiency and affordability of farm outputs; an emphasis on system centralization to increase efficiency; support for chemical fertilizers; an emphasis on maximizing yields and value	"The only way of getting subsidies is to be within the system. If you are within the system, you know, you will just sell to this one buyer… I was just in a talk with the head of the dairy association. He is also a farmer and he said that we need to have this… sort of… centralization, you know, where everyone is doing the same thing, doing the same system kind of thing. He says it's necessary that, like, the transport of

Table 2 continued

		products is as cheap as possible so that they can produce food without, you know, too much extra cost." (Researcher and agriculturalist, Reykjavik Academy, Selfoss/Reykjavik) "Organic salad is very difficult and there is no profit… It grows so slowly. Everything that is organic grows so slowly. There is a lot of problem. Organic is a stupid way." (Geothermal greenhouse owner, Reykjavik)
Health	Notions clustered in this value construct include an emphasis on human health; food safety; food quality and purity; anti-GMO sentiment; anti-hormones and an emphasis on limiting the use of veterinary drugs; appreciation for fewer diseases; support for grass-fed livestock; support for organic certification; and anti-pesticides and chemical fertilizer sentiment	"This [regulations against importing fresh meat] is not only for animal diseases, because also we make a regulation that we need special certificates, for example, that the meat must be free of salmonella, and so that's mainly due to human concerns. In the import control, we do— it's both animal diseases as well as public health effects." (Senior Advisor, Ministry of Industries and Innovation, Reykjavik)
Local and sustainable	Notions clustered in this value construct include "Locavore" sentiment, which supports locally sourced food for supporting local people and the environment; food sovereignty; fully using what Iceland has to offer; an emphasis on knowing how and from where food products are sourced or grown; and support for small-scale, community production	"We started looking around in the surroundings, seeing what we can actually use in the surroundings. There is so much growing, so much growing around us, and why not use that?... Imported spinach is really expensive; why not go outside in your garden and use what we have. It was really interesting and I think this project could go a lot further… We used only things that are produced in Iceland, or grown in Iceland, or could be. We were kind of just trying to get people to look around them, and think more locally." (Product design graduate student, Iceland Academy of the Arts, Reykjavik)
Globalized free trade	Notions clustered in this value construct include competition; consumerism; market fairness; an emphasis on free trade principles;	"Well it [protectionist policies] is not a fair way of doing it. It sort of contravenes every—I mean the EU does the same thing, you know; it just has bigger borders. And the

Table 2 continued

	an emphasis on catering to the consumer; [food] freshness; product diversity; anti-nationalism sentiment; pro-Europeanism and internationalization sentiment; an emphasis on efficiency and affordability of food products	US does that, through NAFTA or it's own protectionist policies, as every state protects domestic industries. But claiming that we belong to a liberal world order, where every state is supposed to have equal access and then, you know, subsidizing the production of sugar within the European Union borders or saying, like, we won't take chicken from Denmark because we need to have chicken farming—why would we need to have chicken farming here in Iceland? It's just two different values at stake." (Adjunct Lecturer, School of Social Sciences, University of Iceland, Reykjavik)
Nationalism (buying Icelandic products)	Notions clustered in this value construct include nationalism; the belief that Icelandic food products are superior; protectionism; and an emphasis on knowing where and how products are produced (i.e., in Iceland)	"The quality of our products is very, very good. We are using so few chemicals; we are not using hormones in animals, not like in the [United] States. It is very different. And we have generally very healthy products." (National Advisor, Farmers Association of Iceland, Reykjavik)
Safety and preparedness	Notions clustered in this value construct include the belief that farms are needed to act as a safety net for travelers and tourists; an emphasis on infrastructure, food, and energy security to prevent worse case scenarios	"One of the arguments why agriculture is important is that we have people living around all Iceland is a part of keeping up our infrastructure, like roads, like internet connection, also some other services. If you don't have farmers or industries that are based on farming around Iceland, there wouldn't necessarily be access to these facilities for tourists or Icelanders traveling. There could be more areas without people living there. That would maybe even affect their security. I mean, with more tourists around twelve months of the year in Iceland, you have more accidents. You have more problems. And more or less all rescue work—if you have for example, bad weather and there are problems with cars, they go off the road, or whatever…—it is volunteers and rescue teams that come to help. And there would be no such rescue team if there

Table 2 continued

		weren't people living there." (Deputy Director, Farmers Association of Iceland, Reykjavik)
Self-sufficiency	Notions in this value construct include emphasis on independence; self-sufficiency; support for food and energy security (such that there is limited reliance on foreign supplies); protectionism; and a sentiment that supports being self-made through hard work	"We are so isolated. I think there is in the spirit of the country, there is a sense of some self-reliance. I think Icelanders have a feeling that they need to rely quite a lot on themselves; they cannot rely on others, because they are a small country and we want to be an independent country, even if it may be difficult in some cases to keep things going… I think there is a spirit in Iceland; there's still a strong spirit that wish to not to be too dependent on others—to be relatively self-sufficient. This is changing, I'm sure, but I think in the culture of Iceland, there is a certain resilience." (National Advisor, Farmers Association of Iceland, Reykjavik)
Technology and innovation	Notions clustered in this value construct include support for investment in and development of large industries; a philosophy that the innovation sector trumps the resource-based sector; a focus on national economic development; a pro-GMO and technology sentiment; and an emphasis on maximizing yields and value	"It is a question of optimizing this process… It is all exported. You can buy it in Boston and in Europe. We are trying to optimize the quality of the product… It is very expensive, but it is very good quality… It's all the ship transportation. Before we got the new boxes [containers engineered for better fish storage], and the development you have seen in the basement [lab space] where we have been simulating everything, everything that we have been doing to optimize this transportation and logistics, it was unprecedented to think of ship transportation of fresh fish. But now about 60% of our export is fresh fish." (Chief Engineer, Icelandic food and biotech research and development company, Reykjavik)

Data Collection Part Two | Risk Perception and Values Survey

I developed a survey instrument designed to gauge people's risk perception of the ten risk constructs based on a five-level Likert scale (ranging from very high risk to very low risk); section two of the survey instrument gauged people's affinity towards the ten value constructs based on a five-level Likert scale (ranging from very important to very unimportant). Both sections also asked respondents to select and rank five risks and values that they perceived as most risky and most important, respectively. Part three of the survey instrument covered demographic information of the respondent. (See the full survey instrument included in Appendix B.) Providing responses was optional for all questions.

Qualtrics research software was used as the survey platform.[25] Any Icelandic citizen over the age of 18 was encouraged to take the survey, which was offered in both English and Icelandic to prevent language barriers. I distributed the survey instrument by asking all interviewees via email to take the survey via hyperlink and to widely extend a pre-written email (or Facebook message) with the hyperlink to their contacts. The pre-written message was included in both English and Icelandic. To extend the reach into further networks, I used the search term *starfsfólk* (Icelandic for 'staff' or 'employees') in Google, which brought up over 200 webpages of staff lists and their respective email addresses. Using this publicly available contact information, I sent the survey message and hyperlink to over 3,500 individuals. Although this latter method only generated about a 5 percent response rate,[26] it more than doubled the total responses, and allowed the survey to reach geographically dispersed and diversely focused groups, ranging from consulting firms, to sports leagues, to church groups, to banks, to car dealerships, to elementary school staff. Consequently, survey distribution was not random, but rather aimed to reach respondents from a variety of sectors outside food production, regulation, and distribution to capture a

[25] By using an online platform, the distribution method admittedly creates a response bias towards internet users. However, because of Iceland's extensive internet penetration—rated by UK-based firm We Are Social at 98 percent, the highest of all countries with populations above 50,000 (Kemp, 2016)—this bias was not considered substantial.

[26] The response rate for the first method remains undetermined; the number of emails the interviewees each extended to their contacts, and whether or not the email was then forwarded beyond that second tier is unknown. However, it seems that using a personal connection created a relatively high response rate; approximately 180 responses were generated through this process. In contrast, the response rate is estimated around 5 percent for the latter method (generating about 200 responses total), presumably because the email was considered spam and unrelated to many of the potential respondents' fields of work.

diversity of perspectives, and to increase the validity of the stakeholder analysis. Nevertheless, it is likely that the sample is distorted from self-selection bias. All participation was voluntary and uncompensated.

Data Analysis and Results Part Two | Risk Perception and Values Survey

Survey collection in March and April 2016 generated 382 responses with a mix of demographic characteristics (Figure 7). Responses are evenly distributed across gender (49.7 percent female), and relatively evenly distributed across age, compared to population statistics for the country[27] (CIA World Factbook, 2015). The sample shows biases towards individuals with post-secondary education[28] and higher income levels. Although the largest proportion of respondents report to work in the private sector outside the agriculture and fishing industries, the agriculture and fishing industries as well as academic and educational institutions arguably carry disproportional weight in the sample.[29]

[27] Survey respondents and Iceland's reported demographics from the CIA World Factbook represent the following age distributions, respectively: 5 percent (18-25) vs. 14 percent (15-24) ... 69 percent (26-55) vs. 40 percent (25-54) … 21 percent (56-65) vs. 12 percent (55-64) … 5 percent (over 65) vs. 14 percent (over 64). The survey respondents in the age groups from 25-65 appear over-represented (but this is partially because no representation from the population under 18 was included in the survey), while ages 15-24 (purposefully, since 15-17 year-olds were not included) and ages over 64 (unintentionally) appear under-represented.

[28] Although 73 percent of the respondents reported having post-secondary education (26 percent undergraduate, and 47 percent graduate), the OECD reports rates of post-secondary education at 33 percent for Iceland (20 percent undergraduate and 13 percent graduate) for 2014 (OECD, 2015b).

[29] The agriculture, fishing, and fish processing industries, for example, are reported to constitute 10.3 percent of Iceland's labor force ("Iceland Labor Stats," n.d.).

Figure 7. Demographic summary

Gender

A) Male: 50.3% (n=192)
B) Female: 49.7% (n=190)

Age

A) 18-25: 5% (n=18)
B) 26-35: 17% (n=62)
C) 36-45: 22% (n=81)
D) 46-55: 30% (n=111)
E) 56-65: 21% (n=75)
F) over 65: 5% (n=17)

Size of household

A) one: 11% (n=41)
B) two: 26% (n=101)
C) three: 22% (n=83)
D) four: 23% (n=88)
E) five: 14% (n=53)
F) over five: 4% (n=16)

monthly income

A) ≤ 200K ISK: 3% (n=12)
B) 201-300K ISK: 6% (n=22)
C) 301-400K ISK: 8% (n=30)
D) 401-500K ISK: 10% (n=37)
E) 501-600K ISK: 11% (n=41)
F) 601-700K ISK: 13% (n=47)
G) 701-900K ISK: 17% (n=63)
H) 901K-1.1MM ISK: 13% (n=46)
I) ≥ 1.1MM ISK: 19% (n=70)

[100,000 ISK is approximately $805 USD (2016)]

education

A) high school: (16%) (n=59)
B) undergraduate: (26%) (n=100)
C) graduate: (47%) (n=180)
D) did not complete highschool: (11%) (n=41)

Figure 7 continued

Occupation

A) agriculture / fishing: (20%) (n=76)
B) other private sector: (25%) (n=96)
C) nonprofit: (6%) (n=21)
D) government: (17%) (n=65)
E) university / education: (22%) (n=85)
F) other: (10%) (n=37)

Political affiliation

A) Independence Party: (21%) (n=69)
B) Left-Green Movement: (16%) (n=51)
C) Pirate Party: (18%) (n=58)
D) Progressive Party: (11%) (n=36)
E) Social Democratic Alliance: (8%) (n=27)
F) other: (27%) (n=88)

Born in Iceland

A) yes: (92%) (n=353)
B) no: (8%) (n=29)

Years lived in Iceland

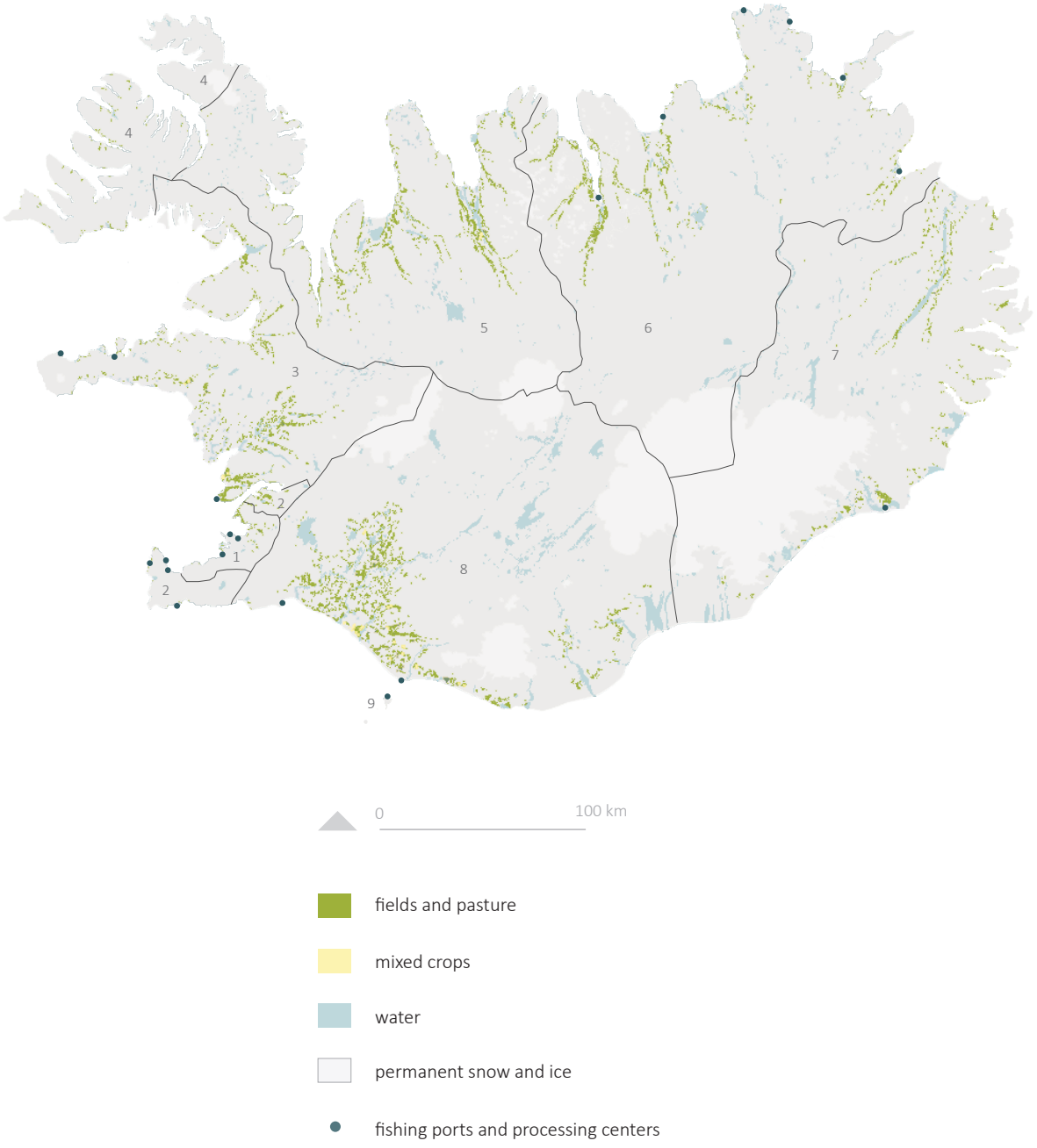
A) 1-5: (2%) (n=6)
B) 6-10: (1%) (n=4)
C) 11-20: (3%) (n=13)
D) > 20: (94%) (n=353)

[No survey respondents had lived in Iceland for less than a year]

Postal Code (first digit)

A) 1: (37%) (n=135)
B) 2: (22%) (n=81)
C) 3: (7%) (n=25)
D) 4: (3%) (n=12)
E) 5: (7%) (n=24)
F) 6: (8%) (n=29)
G) 7: (7%) (n=26)
H) 8: (7%) (n=25)
I) 9: (0.6%) (n=2)
J) abroad: (1%) (n=4)

Figure 8. Map of Iceland postal codes (first digit), agricultural land use, and fishing ports and processing centers. (Map recreated based on those produced by Rhind, 2015 and the National Land Survey of Iceland, 2012).



Pertaining to respondents' evaluations of the risk constructs, nine out of ten items were on average considered a risk in some capacity. For all risk constructs other than Climate Change and Protectionist Trade Regulations, the majority of responses in each case ranked the risks as "high risk"; the majority of respondents ranked Climate Change and Protectionist Trade Regulations as "neither high nor low risk" and "low risk," respectively (Figure 9). Livestock Disease, followed by Financial Stress, were the risks that were most frequently ranked "very high risk"; meanwhile, Protectionist Trade Regulations and GMOs were most frequently ranked "very low risk." Climate Change and GMOs were relatively evenly distributed between high and low concern (although GMOs presented more extreme positions), illustrating the split opinions in Iceland around the speculated risks and benefits for both of these exposures. Protectionist Trade Regulations was the only risk skewed towards lower risk, confirming the generalized opinion that market regulations are needed to sustain Iceland's small economy; all other risk constructs were skewed towards higher risk. These leanings are also depicted through the mean scores for each of the items (Table 3).

The value constructs tended to have even stronger leanings than the risks, with nine of ten values skewed heavily towards higher importance (Figure 10).[30] Globalized Free Trade, Technology and Innovation, and Efficiency and Performance were the only three constructs where the majority did not rank the value construct as "very important"; nevertheless, the majority ranked these three constructs "important" in all cases. Globalized Free Trade was the only value that was relatively evenly distributed between high and low importance, again suggesting the generally perceived interest in maintaining some protectionist regulations to support the Icelandic economy. Again, these leanings are also depicted through the mean scores (Table 3).

[30] By being able to individually rank each construct, respondents were able to rank multiple values or risks equally high (or low) in importance or risk. Figures 9 and 10 reflect these responses. In the last question in both the first and second section of the survey instrument, however, respondents were asked to rank their top five values and top five risks, encouraging a reported hierarchy among most highly perceived risks and values. The results of these responses are included in Appendix C.

Figure 9. Evaluations of high to low risk for the ten risk constructs.

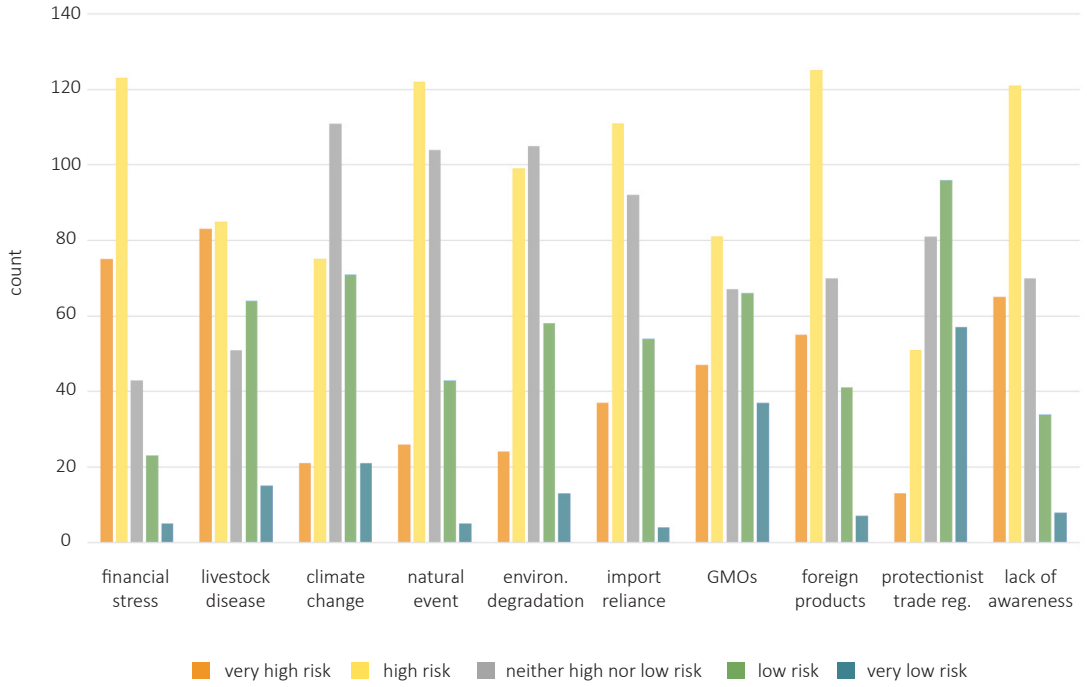
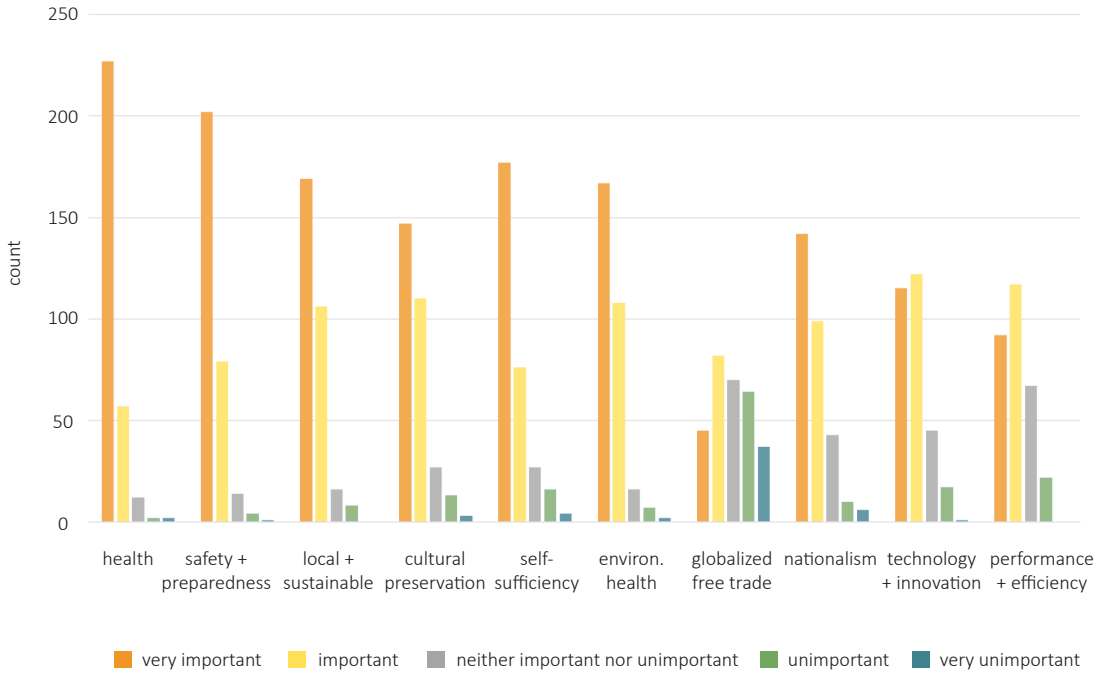


Figure 10. Evaluations of high to low importance for the ten value constructs.



From the 382 responses, the mean rankings for the level of perceived risk for each risk construct and the stated level of importance for each value construct illustrate a relative hierarchy of risk and value priorities (Table 3). On a scale from very high risk (5) to very low risk (1), risk constructs ranged from 3.94 to 2.58 with Decline of the Farming Sector and Associated Livelihoods (Financial Stress) exhibiting the most highly ranked risk and Protectionist Trade Regulations the lowest. Likewise, on a scale from very important (5) to very unimportant (1), value constructs ranged from 4.69 (Health) to 3.10 (Globalized Free Trade).

Table 3. Summary of mean rankings for risks (1 = very low risk | 5 = very high risk) and values (1 = very unimportant | 5 = very important). (n = 382).

Risks	Mean	Values	Mean
Decline of the farming sector due to financial stress	3.94	Health	4.69
Lack of awareness of food system vulnerabilities	3.73	Safety and preparedness	4.59
Foreign products could replace Icelandic products	3.61	Environmental health	4.44
Livestock disease	3.56	Local and sustainable	4.43
Over-reliance on critical imports	3.44	Self-sufficiency	4.36
Natural events (volcanic eruption, bad weather, etc.)	3.42	Cultural preservation	4.25
Environmental degradation	3.24	Nationalism (Icelandic products)	4.23
Genetically modified organisms (GMOs)	3.15	Technology and innovation	4.14
Climate change	3.03	Efficiency and performance	3.94
Protectionist trade regulations	2.58	Globalized free trade	3.10

Interestingly, the lowest rated risk (Protectionist Trade Regulations) and lowest rated value (Globalized Free Trade)—which are clearly conceptually related—exhibit a significant drop in ratings compared to the other risks and values, respectively; Protectionist Trade Regulations is ranked 0.45 points below the next lowest construct (whereas any other two adjacent risk constructs are on average 0.11 points apart), and Globalized Free Trade is 0.84 points below the second lowest value construct (whereas any other two adjacent value constructs are on average 0.09 points apart). This divergence in the Globalized Free Trade value construct, in particular, can be further seen in the multivariate multiple regression analysis (Table 4) described below, as Globalized Free Trade was the only value construct that correlated negatively with any of the risk constructs.

The relationships between the ten risk constructs and the ten value constructs were evaluated using multivariate multiple regression analysis in order to investigate correlations between particular risk and value constructs (Table 4); the risk and value constructs were also each evaluated against demographic parameters. (Tabulated results for the demographic analysis are included in Appendix D and E.) Many of the correlations between risks and values uncover conceptually expected patterns; for example, respondents that see Environmental Degradation as a threat place high valuation on Environmental Health as well as Local and Sustainable values. Other results were less predictable; respondents that perceive GMOs to be a high risk, for example, place high value on Health, but also Self-Sufficiency and Cultural Preservation—suggesting that GMOs may be feared for their role in introducing a reliance on foreign technology and new ecologies in Iceland.[31] As mentioned previously, the Globalized Free Trade value construct correlates negatively with numerous risk constructs, including the threat of Foreign Products, Livestock Disease, Natural Events,[32] and Lack of Awareness. Conversely, Globalized Free

[31] Interestingly, when the ten risk constructs were analyzed against demographic data, GMOs were the only risk that correlated with education; individuals with an undergraduate degree ($p < 0.10$), or graduate degree ($p < 0.05$) perceived GMOs as less risky compared to individuals with a high school degree, while those who have less than a high school degree see GMOs as more risky ($p < 0.10$) than those with a high school degree. (See Appendix D.)

[32] This correlation makes sense if a counter-logic is applied: natural events would not be seen as a risk by those who value global free trade based on the assumption that all food product needs could simply be imported in the case of a natural disaster.

Trade as well as Technology and Innovation correlate positively with Protectionist Trade Regulations, suggesting that the fear of limiting trade aligns with futurist, international values.[33]

All ten risk constructs showed a statistically significant correlation with one or more value construct(s); one value construct (Safety and Preparedness), however, did not show a statistically significant correlation with any risk constructs.

Figure 11 illustrates the food system map as previously depicted in Figures 1 and 3, now with the influence of values incorporated. Relationships between values and risks in the map represent the correlations seen through the multivariate regression analysis of the survey data (Table 4).

[33] Analysis with the demographic data suggests that these values pattern on the basis of occupation: the private sector (other than farming and fishing) ($p < 0.01$), the nonprofit sector ($p < 0.10$), and the academic/education sector ($p < 0.05$) perceive Protectionist Trade Regulations as a greater risk that the fishing and agriculture sectors. Likewise, the private sector (other than farming and fishing) ($p < 0.01$), the government sector ($p < 0.01$), and the academic/education sector ($p < 0.01$) place higher value on Globalized Free Trade than the agriculture and fishing sectors. (See Appendix D and E.)

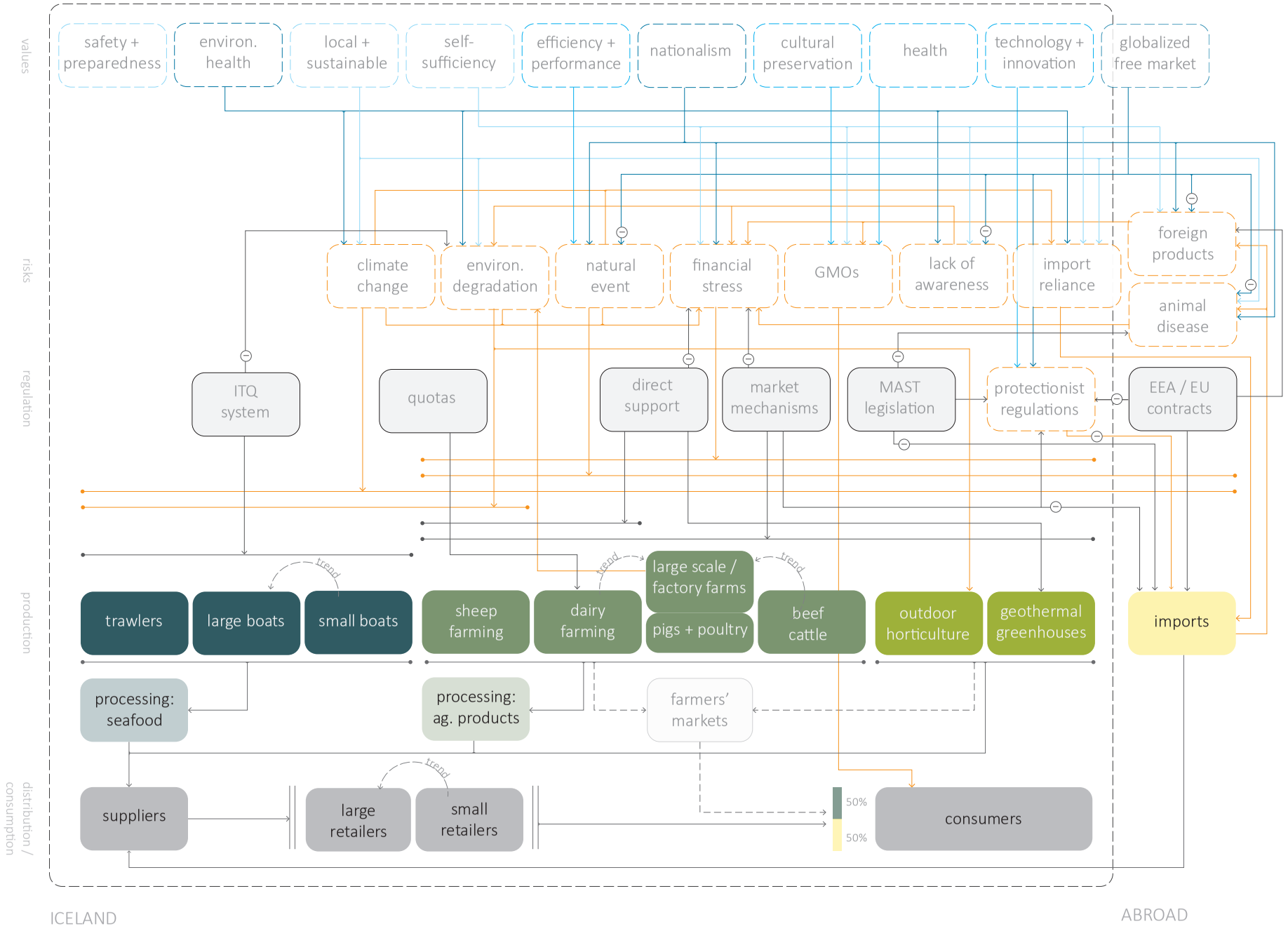

values
risks
regulation
production
distribution / consumption
safety + preparedness
environ. health
local + sustainable
self-sufficiency
efficiency + performance
nationalism
cultural preservation
health
technology + innovation
globalized free market
climate change
environ. degradation
natural event
financial stress
GMOs
lack of awareness
import reliance
foreign products
animal disease
ITQ system
quotas
direct support
market mechanisms
MAST legislation
protectionist regulations
EEA / EU contracts
trend
trawlers
large boats
small boats
sheep farming
dairy farming
large scale / factory farms
pigs + poultry
beef cattle
outdoor horticulture
geothermal greenhouses
imports
processing: seafood
processing: ag. products
farmers' markets
suppliers
large retailers
small retailers
50%
50%
consumers
ICELAND
ABROAD

Figure 11. Map of Iceland's food system, incorporating the influence of values (blue dashed boxes; variations in shades of blue are included simply for legibility). The values represent the ten value constructs identified through the interviews, and relationships between the value and risk constructs are those that were identified through correlations in the survey data. Unless otherwise noted with a (-) sign, pathways between values and risks indicate that the value correlates with increased perceived risk.

As explained in Figure 3, risks that are included in the diagram are specifically those that emerged during the interviews. The risks show influence on the Icelandic food system's production processes, and the regulatory framework in turn shapes the risks.

As explained in Figure 1, the dashed box illustrates the Icelandic national boundary. The country's food supply originates at the various producers [teal boxes: fishing, dark green boxes: livestock agriculture, light green: horticulture, yellow: imports], and continues (downward in the map) through processing, suppliers, retail, to consumers. Above the flow of production, the map depicts the top-down regulations (gray boxes) that influence the food system by supporting or hindering the various food producers. Unless otherwise noted with a (-) sign, pathways are reinforcing; in other words, the regulations increase production, imports, or risk.

To further investigate relationships between values and risks, I employed correlation as well as factor analysis—a multivariate analysis designed to facilitate data reduction (consolidating or reducing variables to a set of key scales), data exploration, and the development and confirmation of theoretical hypotheses ("Factor Analysis," 2007; J. Walker, 2012). Ultimately this process aimed to see if correlations between the various elements of perceived risk, for example, could be explained by a reduced number of composite factors—which would shed further light on particular characteristics of perceived risk with respect to Iceland's food security. The inverse of the correlation coefficients matrices (AIC) and the Kaiser-Meyer-Olkin (KMO) measures for both the set of risk variables and the set of value variables confirmed suitability of the correlation matrices for factor analysis (Cleff, 2013; Kaiser & Rice, 1974).[34]

Two factors for the set of risk variables and three factors for the set of value variables were chosen to represent the original data. Based on the Kaiser criterion,[35] all factors with eigenvalues greater than one were retained; for the set of value variables, an additional factor with an eigenvalue below one was retained based on the location of the "elbow" of the scree plot[36] and to increase nuance for exploratory purposes. In both cases, the factor matrix was rotated—using a varimax (orthogonal) rotation—until the sum of the variances of the squared loadings were maximized, which facilitated assignment of the variables to particular factors. Factor scores (i.e., standardized values for each respondent per each factor) were then generated through regression analysis, producing new indices for each new scaled variable. Through this process, the following scaled variables were produced:

Risk Scales

- ***Agri-health Risk Scale:*** indicating high perceived risk associated with the decline of the agricultural sector and associated livelihoods due to financial stress, foreign products

[34] Less than 25% of the elements below the diagonal in both the risks and values AICs had values larger than 0.09; the KMO was 0.79 for the risk variables and 0.75 for the value variables, which both fall into average score ranges for sampling adequacy.

[35] The Kaiser criterion is a widely used guideline in factor analysis that sets an eigenvalue of one as the lowest threshold for retaining a factor. Eigenvalues below one suggest that the factor explains the variance less adequately than the individual items do, which is why one has been adopted as the commonly used threshold (Cleff, 2013).

[36] For analyses suitable for factor analysis the curve of the plotted eigenvalues exhibits a sharp decline and then bends, continuing the line at a smaller slope. The point where the bend occurs is the "elbow"; all factors after this point are omitted (Cleff, 2013).

replacing Icelandic products, livestock disease, GMOs, and a lack of awareness of vulnerabilities in Iceland's food system. (Factors were loaded with an eigenvalue of 1.66 and a Cronbach's alpha of 0.70.)

- *Environmental Risk Scale:* indicating high perceived risk associated with climate change, natural events (such as volcanic eruptions or stretches of unusually cold, wet, or dry weather), and environmental degradation. (Factors were loaded with an eigenvalue of 1.32 and a Cronbach's alpha of 0.67.)

Value Scales

- *Nationhood Value Scale:* indicating high valuation of preparedness, self-sufficiency, local and sustainable food sources, cultural preservation, and nationalism. (Factors were loaded with an eigenvalue of 2.31 and a Cronbach's alpha of 0.77.)
- *Technology Value Scale:* indicating high valuation of technology and innovation, as well as efficiency and performance. (Globalized Free Market also loaded on this factor, but it ultimately lowered the Cronbach's alpha and was therefore removed.) (Factors were loaded with an eigenvalue of 1.05 and a Cronbach's alpha of 0.68.)
- *Enviro-health Value Scale:* indicating high valuation of health, the minimization of environmental impact, and cultural preservation (as associated with preserving the genetics of the original Icelandic animal breeds). (Factors were loaded with an eigenvalue of 0.55 and a Cronbach's alpha of 0.52.)

Like the Kaiser criterion, Cronbach's alpha is a measure of scale reliability, and suggests the degree of inter-relatedness of the variables within the group (Santos, 1999; Tavakol & Dennick, 2011). Generally, a factored variable is considered reliable if the Cronbach's alpha is between 0.7 and 0.9. Lower alpha values can be due to poor interrelatedness between items or due to a low number of questions (Tavakol & Dennick, 2011). The Agri-health Risk Scale and the Nationhood Value Scale produced alphas within the range of acceptability, and the Environmental Risk Scale and the Technology Value Scale produced alphas just below this range; the Enviro-health Value Scale had a low eigenvalue and a low Cronbach's alpha, but again was included for exploratory purposes.

Table 4. Multivariate regression analysis assessing correlations between value and risk constructs (n=362). Positive values indicate higher stated importance in values correlating with higher perceived risk.

	Risk Constructs									
Variables	Financial stress	Foreign products	Livestock disease	Climate change	Natural event	Environment degradation	Import reliance	GMOs	Protectionist trade reg.	Lack of awareness
Value Constructs										
Health								0.24**		
Safety + preparedness										
Self-sufficiency	0.17**	0.16**					0.21***	0.39***		0.16**
Local + sustainable			0.24**	0.20**		0.29***	0.18**			
Cultural preservation								0.21**		
Environmental health				0.25***		0.21***	0.15**			0.18**
Globalized free trade		- 0.15***	- 0.21***		- 0.08*				0.26***	- 0.17***
Nationalism (buying Icelandic)	0.21***	0.30***	0.16*		0.13**					
Technology + innovation									0.13*	
Efficiency + performance					0.10*					
R^2	0.21***	0.27***	0.20***	0.11***	0.10***	0.09***	0.13***	0.22***	0.14***	0.16***

*p < 0.10, **p < 0.05, ***p < 0.01

These new indices were further explored through a multivariate multiple regression analysis (Table 5). The two risk scales regressed against the three value scales indicated correlations between certain aggregated risk and value constructs: the Agri-health Risk Scale showed a positive, statistically significant correlation with the Nationhood Value Scale, and a negative, statistically significant correlation with the Technology Value Scale. The Environmental Risk Scale showed a positive, statistically significant correlation with both the Nationhood Value Scale and the Enviro-health Value Scale.

Thus results suggest that in the aggregate risk associated with Iceland's food system falls into two main factions—one focused on the sustainability and health of the country's agriculture, and the other entrenched in environmental concerns. As to be expected, values associated with environmental health correlate with the Environment Risk Scale. Interestingly, however, both risk scales are underpinned by a strong correlation with the Nationhood Value Scale, suggesting that threatening either the loss of agriculture or environmental vitality challenges a sense of national identity. Furthermore, the negative correlation between the Agri-health Risk Scale and the Technology Value Scale suggests remnants of a long-standing traditionalist (agricultural) versus futurist (technological) divide (Byock, 1992).

Table 5. Multivariate regression analysis assessing correlations between risk and value scales (n=362)

Risks (x) *Values (y)*	Agri-health Risk Scale	Environment Risk Scale
Nationhood Value Scale	0.58***	0.19***
Enviro-health Value Scale		0.22***
Technology Value Scale	- 0.13**	
R^2	0.42***	0.10***

*p < 0.10, **p < 0.05, ***p < 0.01

The two risk scales and three value scales were also analyzed against the ten demographic parameters in order to identify patterns according to geographic and socioeconomic characteristics (Table 6).[37]

Gender — Female respondents were more likely to consider both risk scales a higher risk (Table 6)—a result that corroborates the "white male effect," a repeated observation from other studies that suggests Caucasian men have lower perceptions of risk than women and minorities (Olofsson & Rashid, 2011). Women also placed greater importance on the Nationhood and the Enviro-health Value Scales than the male respondents. (Similarly, when the risk and value constructs were independently evaluated against demographic parameters, women perceived all risks other than Livestock Disease, Foreign Products, and Protectionist Trade Regulations as higher threats than men; men perceived Protectionist Trade Regulations as a greater risk, whereas Livestock Disease and Foreign Products produced no statistical correlation based on gender. Women also placed greater importance on all values except for Globalized Free Trade, Technology and Innovation, and Efficiency and Performance. See Appendix D and E for tabulated summary.)

Income and occupation — The value scales did not correlate with income, but the risk scales—particularly the Environmental Risk Scale—were ranked a lower risk by higher income brackets (Table 6). This finding mirrors those found by Lo (2014) who found that populations within lower income brackets perceive long-term environmental hazards as riskier. All occupation categories indicate lower perceived risk for the Agri-health Risk Scale and lower stated importance for the Nationhood Value Scale compared to those in the agriculture and fishing industries. Interestingly, the agriculture and fishing industries place less emphasis on the Environment Value Scale than other areas of the private sector, government, and academia. (When risk and value constructs were evaluated independently, Environmental Degradation and Import Reliance were the predominate risk constructs that were considered less risky to higher income brackets. Environmental Health shows to be more highly valued by the government, academic/educational, and "other" occupational categories than the fishing and farming sectors. Meanwhile, the fishing

[37] Education, number of years the respondent had lived in Iceland, whether the respondent was born in Iceland, age, and household size showed no or very few statistical correlations with the value and risk scales, and thus are not elaborated on in this discussion. These parameters did show some statistical correlations with individual risks and values, however, shown in the regression results in Appendix D and E.

and farming sectors more highly value nationalism and self-sufficiency in comparison to all other sectors. See Appendix D and E for tabulated summary.)

Political affiliation — Political affiliation was a significant predictor along the value and risk scales; the majority of parties indicated higher risk perception in both the Agri-health Risk Scale and the Environment Risk Scale than the Independence Party (Table 6). The Left-Green Movement, the Social Democrats, and the Progressive Party also ranked the Nationhood Value Scale higher in importance, and all parties ranked the Enviro-health Value Scale higher than the Independence Party. The Left-Green Movement and the Progressive Party ranked the Technology Value Scale lower in importance. These observations are conceptually substantiated by the fact that large investments in hydropower dams and foreign investment in the aluminum smelting industry within Iceland have been largely championed under the ruling Independence Party to the frustration of more environmentally focused parties. (Similar results were found when the risk and value scales were evaluated independently; Health, Cultural Preservation, and Environmental Health were more highly valued by nearly all other parties than the Independence Party. The Left-Green Movement valued Technology and Innovation and Efficiency and Performance less than the Independence Party. Protectionist Trade Regulations are perceived less risky to the Left-Green Movement and agricultural Progressive Party than to the Independence Party. See Appendix D and E for tabulated summary.)

Area of Residence — Lastly, clear trends could be seen based on the postal codes (first digit) of respondents' primary residence (refer to Figure 8 for map of postal codes). Postal codes three, five, and seven, which are highly agricultural areas, indicated higher perceived risk on the Agri-health Scale (Table 6). Interestingly, postal code eight did not show high perceived risk in the Agri-health Scale despite being a highly agricultural area; perhaps benefits from heavy tourism in this area lessen the risk of financial stress, in particular. Almost all postal codes correlated with higher stated importance on the Nationhood Value Scale than postal code one (downtown Reykjavik)—showing an urban-rural divide in values. Postal codes three, seven, and eight ranked the Technology Scale lower in importance (again, highly agricultural areas); three and nine ranked the Enviro-health Value Scale lower in importance; and postal codes three, four, and eight ranked lower perceived risk on the Environment Risk Scale. (In terms of the risks and values evaluated independently, Nationalism, in particular, showed a much higher importance in almost all other

postal codes compared to downtown Reykjavik; Globalized Free Trade was considered less important in five of eight postal codes outside downtown Reykjavik; Foreign Products was considered a greater threat in five of eight postal codes outside downtown Reykjavik. See Appendix D and E for tabulated summary.)

Table 6. Summary of twenty-five multivariate regression analyses assessing correlations between each of the risk or value scales against demographic parameters. Negative values represent higher perceived risk than the baseline (risk scales), or higher stated importance than the baseline (value scales).

Variables	Agri-health Risk Scale	Environment Risk Scale	Nationhood Value Scale	Technology Value Scale	Enviro-health Value Scale
Gender					
Female (baseline)					
Male	0.20**	0.26***	0.49***		0.29***
Monthly household income					
200K ISK or less (baseline)					
201-300K ISK					
301-400K ISK					
401-500K ISK					
501-600K ISK					
601-700K ISK		0.41*			
701-900K ISK	0.50**	0.49**			
901K - 1.1 MM ISK		0.47*			
Over 1.1 MM ISK	0.57**	0.69***			
Occupation					
Farming or fishing industry (baseline)					
Other private sector	0.55***		0.67***	- 0.24**	- 0.19**
Nonprofit sector	0.40**		0.43**		
Government sector	0.59***		0.48***		- 0.34***
Academic /education sector	0.37***	- 0.25**	0.40***		- 0.33***
Other	0.33**				

*p < 0.10, **p < 0.05, ***p < 0.01

Table 6 continued

Variables	Agri-health Risk Scale	Environment Risk Scale	Nationhood Value Scale	Technology Value Scale	Enviro-health Value Scale
Political affiliation					
Independence Party (baseline)					
Left-Green Movement	- 0.33**	- 0.41***	- 0.33**	0.49***	- 0.37***
Pirate Party		- 0.48***	- 0.35**		- 0.34***
Progressive Party	- 0.47***		- 0.55***	0.27*	- 0.23*
Social Democratic Alliance	0.42**	- 0.34*			- 0.55***
Other		- 0.31**			- 0.32***
Postal code, primary residence (1st digit)					
1 (baseline)					
2			- 0.28**		
3	- 0.60***	0.33*	- 0.48**	0.34*	0.26**
4		0.42*			
5	- 0.57***		- 0.67***		
6			- 0.54***		
7	- 0.38**		- 0.61***	0.30*	
8		0.38**	- 0.45**	0.37**	
9					0.70*

*p < 0.10, **p < 0.05, ***p < 0.01

VII. DISCUSSION: RISKS AS DEFINED BY VALUE LOGICS

The Icelandic food system risk psyche: validating the correlation with values

The nature and rankings of the ten risk constructs offer evidence that objective realism and subjective constructivism rationalities simultaneously have merit in risk interpretation. Past and current experiences in Iceland verify risk on objective grounds: disease outbreaks have devastated livestock herds (Crofts, 2011; Ministry of Agriculture, 2003); government support schemes for agriculture have been declining in recent years and are under renegotiation in 2016 (OECD, 2011a); volcanic eruptions have sickened livestock and suffocated crops (Ágústsdóttir, 2015; Crofts, 2011; Streeter, Dugmore, & Vesteinsson, 2012); the financial crisis showed capacity to hinder access to imports and has increased grocery prices (A. J. K. Bailes & Jóhannsson, 2011; Icelandic Competition Authority, 2012); both very wet and very dry weather in the last two years have decimated hay production for many farms (Oddsson, 2016).

Nevertheless, it can be easily substantiated that the risk constructs also have subjective, perhaps socially constructed, underpinnings. Judging "the level of risk" using a Likert scale is admittedly a schematic exercise; many would argue the risk outcomes are incomparable between items (a case of comparing apples to oranges) without a technocratic methodology for weighting and normalizing probabilities and the magnitudes of impact. It can be argued that without these calculations (and even with these calculations!) a set of heuristic and subjective reasonings facilitate evaluation—and these personal interpretations ultimately drive the variation in responses.

I explore the relative ranking of the Natural Events risk construct, in particular, as a means to consider how subjectivity or normativity may play a role. To an outsider—such as this author from the northeast United States, a region without volcanoes—the threat of volcanic eruptions compromising livestock and crop health instills a much greater sense of risk than the risk that Icelandic products may be replaced in the market by foreign ones; yet survey respondents ranked Foreign Products 0.19 points higher in risk than Natural Events. By noting this as "surprising," I am overlaying my own subjective understanding of risk. I have not witnessed the regrowth of crops after the volcanic ash subsides; I have not participated in the renowned volunteer rescue team

that instills confidence in the national hazard response system. In other words, context matters for risk perception.

As such, the demographic data suggest that perceived risks are spatially patterned, shown by correlations between particular regions and risk constructs. An interviewee alluded to this tendency with respect to natural hazards, suggesting that perceptions of volcanic risk may be influenced by geographic as well as temporal implications:

> Certain parts of the country [think about volcanic eruptions] a little bit more than elsewhere… especially in the south near Eyjafjallajökull and Katla, which is further east. People see this everyday in their backyard. So I guess they think about it, but it's not like it is a major influence on how they go about their daily lives. (Professor, University of Iceland, Reykjavik)

In other words, risk perception as applied to volcanic eruptions is spatially and temporally relative, according to physical proximity, frequency of the event, and moderated by the regularity of thought. Interestingly, however, the survey results illustrate that the Natural Event risk construct is ranked lower in perceived risk for postal code area eight where Katla and Eyjafjallajökull are located ($p < 0.10$) than in postal code one (downtown Reykjavik) (See Appendix D). This finding may, again, point to the aforementioned "overconfidence heuristic" whereby affected populations underrate their own risk in comparison to other more distant populations.

From another perspective, based on Cultural Theory (see Wildavsky and Dake, 1990), the relatively low ranking of the Natural Events risk construct across Iceland could be attributed to a fatalistic worldview: nature is capricious, and nobody, even experts, can control its random outcomes (Dake, 1992; Rippl, 2002). One respondent from the University of Iceland similarly suggested this notion:

> People are very fatalistic, almost. It's like, well, if Katla goes—the biggest volcano near Eyjafjallajökull—then you're just gone. It's not a big deal. It's a risk, but it's not going to be either/or, you know. You're not going to live. (Adjunct Professor, University of Iceland, Reykjavik)

Coulthard (2012) notes that a fatalistic worldview is commonly cited among fisheries-based societies who continuously contend with hazardous and unpredictable work conditions. Yet fatalism—or the seemingly diminished risk perception around volcanic eruptions even when the risk is spatially relevant—does not explain why the influx of foreign goods instills a greater sense of risk. In other words, this speculated worldview does not blanket all food system risks.

If we distill fatalism into its characteristics, a key component of the worldview is the relinquishment of decisions, the notion that no decision matters and thus no choice is involved. This characteristic may serve as the differentiating factor for the Natural Event risk construct in comparison to one like Foreign Products. Many risk theorists have drawn a distinction between man-made versus natural risks (Bohm & Pfister, 2000; Renn, 2004; Taylor-Gooby & Zinn, 2006). Bohm and Pfister (2000) suggest that environmental risks (which could either be anthropogenically-driven or naturally-driven) are assessed based on consequentialist evaluations (concerns about losses) and deontological evaluations (concerns about the violation of ethical principles or morals). When the risk is man-made—in most cases assuming an intentional *decision* was made—the deontological assessment of the risk evokes a greater emotive response. In other words, the difference in perceptions of natural versus man-made risks indicates that value logics shape responses to risk. Note that this does not suggest that natural hazards cannot place values at risk, rather the causation of the violation creates a more limited emotive response. Thus, even if we disregard Cultural Theory's categorical worldviews in this specific case, the basis of the theory remains relevant: it is possible and highly likely that socially constructed value logics influence the conceptualization of risk. Supported through this theoretical logic, the results of this study corroborate with and reaffirm this correlation.

Directionality of the correlation between risk and value logics

A relationship between risk perception and value logics emerged both qualitatively through discursive patterns in the interviews, and quantitatively through correlations in the survey data. Continuing with the example from the section above, those that perceived Natural Events as a high risk correlated with those who value Efficiency and Performance ($p < 0.1$). Meanwhile, those that perceived Foreign Products as a threat correlated with those that value Self-sufficiency ($p < 0.01$), Nationalism (buying Icelandic products) ($p < 0.01$), and correlated negatively with those that value Globalized Free Trade ($p < 0.01$).

From these correlations, it is tempting to assume causation. We can presume that value logics shape risk perception—that is, citizens see the influx of imports as a risk, *because* they value the nation's ability to be self-sufficient. But, it is not possible to draw this causation from statistical tests, and going by reason alone, the reverse relationship could be true in some instances: nationalism (as defined as buying more Icelandic products) could seem of value because foreign products are replacing Icelandic products. Another logical example would be: local and sustainable food sources are valued because environmental degradation is seen as a risk. The following quote from a product design master's student who helped develop a local food initiative suggests this logic:

> We had some environmental courses, and I just realized how fucked we are… We are just not really thinking about our planet enough. So I just started thinking… how can we make products that we need… We started thinking about local production versus importing stuff—we import a lot of food. (Master's student, Iceland Academy of the Arts, Reykjavik)

The value logic that producing locally is superior to importing products grew from the perceived risk of environmental degradation. From this directionality, it is provocative to consider the ways in which values may change over time, influenced by a changing riskscape.

Ultimately, however, I argue the directionality does not matter for the implications that the correlation holds. Just as value logics shape risk perception, it is plausible that risk makes particular values apparent. The importance is defined by the relationship: the identification of the value at stake reifies the risk construct, while risk may make us cognizant of otherwise latent value logics if and when we fear their loss.

Summary of findings through the risk-value relationship in Iceland's food system

Under the assumption that values underpin the perception of risk, the interview and survey findings suggest that perceived risks with respect to Iceland's food security are equally—if not more so—related to reconciling a changing sense of national identity as they are to ensuring adequate quantities of food. Risks that pose threats to the health of Icelandic agriculture, including financial stress, livestock disease, GMOs, and foreign products, are perceived by citizens

that value self-sufficiency, nationalism, local food sources, and cultural preservation. These values seem to represent a sense of "nationhood" that is thereby placed at stake by losing the agricultural sector.

These nationhood values, however, also underpin the perceived risk to environmental health—a correlation that could be explained through two means. First, the results suggest that Iceland's national identity is largely attached to a sense of wilderness, epitomized by the unique and vast landscape that constitutes much of the country. Secondly, the fishing sector—which has enormous legacy in Iceland's cultural heritage and sense of identity—is placed most at risk through environmental degradation, both through potential pollution and more urgently through the effects of ocean acidification.

Health emerges as a recurring theme—articulated through concerns for human health (an argument against GMOs), animal health (the fear around livestock disease), as well as environmental health (the risk of environmental degradation). These constructs seem to represent tightly intertwined conceptions of value and risk: health as a value shows high intersubjective coherence (as shown by its high ratings across the survey results) as well as a notable tendency to be used as an emotive vehicle for articulating risks, such as the hazard of foreign products replacing Icelandic ones. Representations of health—the promotion of high quality, healthful Icelandic products, hormone-free livestock, and a pest-free landscape—are generated and focused upon to reinforce this widely understood value, and subsequently the Icelandic national identity. Health is used as a metric by which to distinguish Iceland from other nations, and is simultaneously seen at stake by losing the health embedded in traditional economic sectors and in the Icelandic wilderness, which likewise characterize Icelandic identity.

Lastly, the results illustrate a recurring division between traditionalist and futurist sentiments. Trade regulations—seen as a means to maintain traditional Icelandic agriculture and reduce the influx of foreign products—are perceived to place globalization and notions of technological ingenuity at risk. Not unexpectedly, these trends represent a rural to urban dichotomy as well, with rural areas more likely to perceive foreign products as a threat, to perceive protectionist regulations as not a threat, and to value self-sufficiency and nationalistic sentiments. Interestingly, this pattern maps to a male/female dichotomy as well: Protectionist Trade

Regulations was the only risk construct that men perceived more risky than women, and the only value constructs that women did not value more than men were Globalized Free Trade, Technology and Innovation, and Efficiency and Performance. Nevertheless, the majority of survey respondents—regardless of residence location or gender—ranked those three value constructs, as well as the Protectionist Trade Regulations risk construct lowest in terms of level of importance or level of risk, suggesting that a more traditionalist and nationalist-focused population represented the sampling subset, if not represents trends in the country as a whole.

Have these always been the pervasive Icelandic values? It is possible that many of these traditionalist values are felt strongly now due to the sense that they may be threatened—through a more globalized economy, through industrial development, through urbanization, and through the shift away from traditional livelihoods. Interpreting risks with respect to values encourages consideration for how these values emerged in the first place, their perseverance, and the likelihood of evolution in years to come.

The speculated origins of Icelandic values: A detour into political ecology

Section III of this thesis discusses the risk constructs that emerged through the literature and interviews within a historical, economic, and geographical context. Can the same be done for values? Can evidence from history, ecology, society, and the political economy situate the value logics identified in this study? While I do not try to claim that these—nor only these—prescribe the Icelandic psyche, five key historical threads or events help to offer context:

Resilience – The pervasive Icelandic historical narrative tells a tale of survival: the land discovered by the original Viking settlers in 870 was harsh, cold, and unwelcoming, yet despite the Little Ice Age, famine, disease, volcanism, land degradation, political marginalization, and poverty the Icelandic people have lived on (Byock, 1992; Crofts, 2011; Dugmore et al., 2012; Gislason, 1973; McGovern et al., 2008; Mclean & Bevan, 2013; Streeter & Dugmore, 2013).

The pinnacles of hardship that hit in 1780 and again in the 1880s illustrate the magnitude of this feat. The Laki eruptions began in 1780 and lasted two years, discharging noxious gas and lava from a 27-kilometer fissure. An estimated 20 percent of the population (10,500 people), 50 percent of the livestock, and acres of vegetation succumbed in the destruction. Soon following,

100 million tons of sulphur dioxide emitted into the atmosphere dropped the temperature 1.3° C for over two years, stunting crops for food and feed (Byock, 1992; Crofts, 2011). Yet the winter of 1881-1882—deemed The Hard Winter, The Sand Year, or the Winterkill Year—has also been described as one of the harshest in Iceland's history (Crofts, 2011). A blizzard and some of the coldest temperatures on record accompanied severe sandstorms, wreaking havoc across the denuded land and burying farms. Sheep's wool filled with sand until their legs collapsed from the weight; livestock died of suffocation. The dust storms blocked the sun, hindering agriculture, and the following summer had temperatures closer to the average winter. Famine ensued. Yet, the Icelandic rebuilt, the population rebounded (and grew from 71,000 to 320,000 in the 130 years since 1885), and a renowned literary culture including poetry and the medieval sagas persisted despite the meteorological distractions.[38] One interview respondent quoted, "In the culture of Iceland, there is a certain resilience," and then speculated, "This is possibly linked to the climate." Despite the ruinous past, today the country ranks in the top twenty countries based on the Human Development Index, top ten in the Social Progress Index, and top three in the OECD's Your Better Life index for life satisfaction (OECD, n.d.; Social Progress Imperative, 2015; UNPD, 2015). Perhaps self-sufficiency and cultural preservation—which in this study focused on preserving the genetics of the original Icelandic livestock—are values cultivated from this resilience.

National independence: creating identity and combatting erosion – One archetype of great national resilience, and another of meager resilience were glossed over in the description above. These include Iceland's political independence, awarded in 1944, and the country's rampant soil erosion. Not simply for the sake of provocation, I present the two as intertwined.
I raise the theme of resiliency in the face of great hardship as being a source for the values of self-sufficiency and cultural preservation. Taking this one step further, archeologist and medieval Scandinavia historian Jesse Byock suggests this ethos of survival became a unifying factor for the population, and a source of nationalist sentiment starting in the late nineteenth and early

[38] To emphasize this point, Icelandic writer, scholar, and ambassador Sigurður Nordal once made the claim that "No Germanic people, in fact no nation in Northern Europe, has a medieval literature which in originality and brilliance can be compared with the literature of the Icelanders from the first five centuries after the settlement period" (Byock, 1992). Many quote the ways in which modern Icelandic literature as well as fine art are still influenced by the original Sagas (Coleman, 2015; Gislason, 1973; Vincenz, 2012). The Sagas, which tell of the heroics, feuds, and battles among farmers in the Icelandic countryside, may also further foster nostalgia for preserving the pastoralist heritage based on a culturally embedded aesthetic appreciation for the rural (Waage, 2012).

twentieth centuries (Byock, 1992). Political agitation and an urge for seeing Iceland's independence brewed during this era. Iceland had not been a sovereign state since 1262 when the Commonwealth fell to Norwegian rule, superseded by Danish rule after 1380. In Icelandic minds, Denmark's sovereignty in particular held a direct and intimate association with the misery, collapse of livelihoods, famine, and death from 1780-1800 that followed the Laki eruptions (Byock, 1992; Halink, 2014).

The Danes' treatment of Iceland during the 1700s has been described as callous—attributable to Denmark's own political and economic instability during the time. The Icelandic fishing industry had begun to grow rapidly in the 1500s, expanding into foreign commerce with England and Germany—which spurred both political resentment and an interest in capitalizing on the profits from Danish King Christian III and his advisors (Gislason, 1973). In 1602, Danish merchants were awarded a trade monopoly, whereby the Danish king set prices and sold trading permits for Iceland at exorbitant prices. Over the next two centuries, the scheme became oppressive, subjecting the Icelandic to heavy taxes, exploitative trade deals, and low export prices (Byock, 1992; Gislason, 1973). Access to foreign imports declined, poverty grew, and a small pox plague rampaged. Danish rule remained unresponsive; during the famine of 1784, Iceland was still required to export fish (Byock, 1992).

While food and money were scarce, literature was not. Byock argues that during the nineteenth century, the proliferation of inexpensive editions of the Icelandic Sagas helped to shape national consciousness. The old texts documented the prosperous, noble years of feast and fortune—the *Gullöld Íslendinga*, the Golden Age of the Icelanders[39]—and a marked era of independence, placing their current misery in stark contrast. In the 1830s, ideologies attributed to German philosopher Johann Gottfried Herder took hold: nations controlled by foreigners and foreign institutions were destined for stagnation. In other words, the Icelandic were poor, because they could not develop their national spirit (Byock, 1992). The nationalism that grew during this period—tied to notions of what Iceland once was and what it could be—underpinned the momentum towards independence. Iceland gained sovereignty of internal affairs in 1918; the

[39] Interestingly, however, the historical accuracy of sagas remains debated. Traditionally (and to a certain degree to this day), it has been the country's farmers—many of whom still live on farmsteads whose names are mentioned in the sagas—who have defended the sagas' factual base (Byock, 1992).

nation then gained full independence in 1944. The nationalism observed in this study likely emerged during this era, enhanced by the Cod Wars in the 1950s through 1970s when the Icelandic people continued to defend the land and the resources considered rightfully theirs.

What does this have to do with soil erosion? By the early 1900s, the woodlands that once covered 25 percent of the country[40] were nearly eliminated from woodcutting and overgrazing (Ágústsdóttir, 2015; Arnalds, 2015). The loss of vegetation weakened ecosystems and undercut their resilience, increasing the vegetation's susceptibility to climatic and volcanic impacts and further amplifying its vulnerability to over-grazing—a vicious spiral bringing desertification in its wake. Crofts (2011) suggests that the Icelandic people first fully acknowledged the magnitude of the country's land degradation and its connection to human activity during the sandstorms in the 1880s. In the same way that these desperate years spurred a cognitive correlation with political oppression, I argue that soil degradation became linked—both with the economic hardship (in a recognition that human wellbeing is tied to natural wellbeing) as well as to the erosion of what could have been a prosperous society had it not been subjected to foreign rule. Crofts suggests evidence towards this by illustrating how soil reclamation accrued public recognition and political attention between 1900 and 1944, cultivated by rhetoric embedded with both nationalist sentiment and the values of environmental stewardship. One such piece was a poem written by politician and poet Hannes Hafstein, read as a toast to Iceland on New Years Day in 1901:

> *That time will come, when earth wounds heal,*
> *countrysides mature, fields envelop emptiness,*
> *sons receive bread from fertile Mother Earth,*
> *culture grows in the bosom of new forests.*
>
> *I see in my mind our fleets all self- propelled,*
> *power from the beauty of your waterfalls compelled,*
> *engines employed, and workers who excelled,*
> *a nation in charge with democracy upheld.*

[40] The transformation in the landscape has had interesting and pervasive consequences in different aspects of Icelandic life and history. In linguistics, the degradation facilitated a shift in the meaning of some Icelandic words. "Holt," which once meant "forested hill," now means "unsheltered or barren area" (Arnalds, 2015).

Many the tasks, but your people are united,
the edict is this: all citizens invited whatever role,
or task that has been cited: to cherish,
build and trust your country unrequited.

("Poem of Iceland," Hannes Hafstein, 1901)

This growing sentiment coupling the health of the land, the improvement of economic opportunity, and the refining of cultural and national identity led to advances in agriculture and the proliferation of associations and youth groups. "Cultivating people and land—all for Iceland" became the universal motto (Crofts, 2011). While not explicitly referring to soil erosion, Halink (2014) makes a similar claim: through history there has been an effort on the part of the Icelandic to both recreate and embrace the image of the country's abnormal, "diabolic" landscape. In the course of the country's "national awakening," the cultivation of quintessentially Icelandic landscapes—or what Halink deems "ideologically-charged, national mythscapes"—became a cultural and political pursuit (Halink, 2014).

At the dawn of Iceland's independence, this emphasis on restoring Iceland's assets (natural and social) became increasingly explicit. On May 12, 1944, an article in the national daily newspaper, *Morgunblaðið*, titled "Land Reclamation is an Issue of Independence" emphasized Iceland's ability to "recoup the original land resources." And—announced simultaneously—the country had set forth to do so. Funds for the seed capital for the country's Land Reclamation Fund had been raised at the polling stations on the same day that the Icelandic population voted for establishing a Republic. As an emblem of national solidarity, the funding was earmarked as a nationwide project to bring back the vitality of the Icelandic landscape, a task in which all Icelandic citizens as well as generations to come could participate (Crofts, 2011).

As a final note, soil erosion and its reclamation continue to this day to tell the story of battle, regrowth, and healing. The separation from Denmark proceeded peacefully and diplomatically, and in contrast, the combat against soil erosion seems to play an emblematic placeholder for the country's battle for independence, or a valiant rearticulation of the country's success staving off

the British in the Cod Wars. Roger Croft's work (2011) is dedicated to members of the Soil Conservation Service who have "worked diligently to *reclaim the land*" [emphasis my own], and although land reclamation is the technical term for an environmental practice, rephrasing places *reclaim* in a new light: to take back what is rightfully Iceland's. The book was commissioned by Sveinn Runólfsson, Director of the Soil Conservation Service, and is preceded by three forwards. Former Minister of Environment Svandís Svavarsdóttir in her forward describes the "heroic spirit" of the soil conservationists in "the great achievement of halting and reversing" land degradation; Sveinn Runólfsson likewise refers to the "struggle against virtually insurmountable natural forces," the "erosive forces [that] overwhelmed communities," and to the citizens who have "resolutely waged battle with the sand, the country's ancient nemesis." Alluding to an era of new growth, President Olafur Ragnar Grimmson quotes that the accomplishments are now a "cause for national pride."

Simultaneously, while the *sand* is forcefully kept at bay, a sentiment of moral responsibility for the *land*'s healing now pervades (Karl Benediktsson, 2015). Epitomizing this rhetoric, a cost-sharing project for land restoration was launched in 1990 called *Farmers Heal the Land*, whereby farmers and the Soil Conservation Service work collaboratively to improve efficacy of soil restoration and concurrently build mutual trust between farmers and conservationists (Aradóttir, Petursdottir, Halldorsson, Svavarsdottir, & Arnalds, 2013; Berglund & Hallgren, 2013; Petursdottir, Arnalds, Baker, Montanarella, & Aradóttir, 2013). In research looking at the effect of attitudes and behavior on agri-environmental policies, Petursdottir et al. (2013) noted that among fifteen Icelandic farmers interviewed, the most commonly acknowledged reasons for partaking in restoration practices were rooted in moral values, stating a responsibility to respect and care for the land to "heal degraded land for its own sake" and to "improve its condition for future generations."

This relatively small sample of references from a perhaps particularly partial field of authors may lead to fortuitous or overstated connections between minimizing environmental degradation and nationalist pride at a country scale. Nevertheless, besides the aforementioned values of self-sufficiency, nationalism, and cultural heritage, through the growth of these simultaneous movements it is possible to see how minimizing environmental harm, or "treating nature more gently," as Crofts would say, "has become a central component of the national psyche."

A justification for nationhood – While history tells of countries building nationalist sentiment to unify citizens in wartime or to encourage self-sacrifice for the good of the country, Iceland's nationalism holds a notably different flavor. In the 1970s book *The Problem of Being an Icelander: Past, Present, and Future*, author Gylfi Gislason calls out the underlying dimension by problematizing Iceland's very existence: "Of what value is it to the Icelandic nation that it is a nation?" While lighthearted in nature (and eventually answered with myriad evidence), the question hits a source of Icelandic existential uncertainty. In many ways, it seems Icelanders continue to find ways to answer that question. I speculate that along with notions of self-sufficiency and nationalistic sentiment, the myriad articulations of health (human and environmental), which recur throughout the interviews and survey responses, serve as one way specific to the food system in which the Icelandic continue to justify and define their uniqueness.

At the time of independence the entire country only boasted a population of 129,000—just slightly larger than today's Topeka, Kansas or Hartford, Connecticut, small cities in the United States. The country was about to take seat at the international table, a position it had not held for over 500 years. Articulated well by Byock (1992) the nationalism that emerged at the end of Danish rule thus had a duel and evolving purpose, "now directed less at convincing the Danes that the country is ready to stand completely alone than at reassuring the Icelanders themselves."

Today, common descriptors of "marginal," "peripheral," and for centuries even "subaltern" in economic or geopolitical discourse (see Karlsson, 2000; Mclean & Bevan, 2013; Zarrilli, 2011) do not support the country's cause. Head of faculty of political science at the University of Iceland Baldur Thorhallsson (2009) (using Robert Keohane's neoliberal international relations discourse based in game theory) suggests that Iceland has only recently moved into the category of "systems-affecting"—an upgrade from "systems-ineffectual"—where now the country *could* have an impact in international relations *as long as it partners with other nations*. Alone, Thorhallsson suggests, it has little impact.

Yet as argued by many academics, writers, politicians, and citizens, Iceland's culture—the persistence of a unique language, the sagas and rich literary history, the mythical interpretation of its otherworldly landscape—are what bring value and identity "worthy" of autonomous status

(Belfrage, Bergmann, & Berry, 2015; Byock, 1992; Gislason, 1973). In other words, the country's uniqueness, justifies its nationhood.

What at one level can be interpreted as a grappling over existential identity, however, can simultaneously be framed as strategy to maintain national solvency under a global neoliberal hegemony. The neoliberal discourse for regional development, in particular, positions regions as competitors in a global market, just like corporations (Harvey, 1989). Amidst globalization, regions must secure a "competitive advantage" to effectively attract inhabitants, tourists, and investment. And the Icelandic government, through the vehicle of Regional Growth Agreements, is doing just that (Júlíusdóttir, 2010). The cheap electricity generated from 'renewable' hydropower and geothermal courts the foreign aluminum industry; the marketing of the dynamic landscape of "fire and ice" paired with a bucolic and mythical cultural heritage attracted 998,600 tourists in 2014, a number three times the size of the country's population and increasing annually by 9.3% since 2000 (Karl Benediktsson & Lund, 2011; Huijbens & Benediktsson, 2013; Oladottir, 2015).

While tourism growth exemplifies relative success in "packaging" Iceland's competitive advantage, the commodification of nature has raised tension, challenging preconceived notions of the Icelandic relationship with its landscape (Benediktsson, 2014; Dibben, 2009). Debates around Iceland's industrialization—the construction of hydropower dams, larger geothermal facilities, and aluminum smelters—have not only been grounded in conservation rhetoric, but rather conflict ideologically based on nature's perceived purpose.[41] Industrialization and environmental tourism draw on Iceland's "natural resources," a term that capitalizes on nature, transforming it into a vehicle for private ownership.[42] In contrast, under a Nordic cultural tradition of public access rights, Icelanders are allowed to traverse any land by foot (including

[41] Anderson, Williams, and Ford (2013), through a discussion of plantation forestry, explain divergent views about resource use through a framework of "place meanings"—images and beliefs that are socially produced within groups that create place-based identity or attachment. Conflicts over resource use can be described through incompatible place meanings.

[42] These trends in commodification emerged simultaneously to the development of the fisheries' individual transferrable quota (ITQ) system in 1984. This privatization scheme championed by neoliberal politicians and resource economists was designed to manage healthy stocks of resources under a system of market efficiency—and ultimately resulted in noticeable structural inequality by concentrating quotas in the hands of a few large companies (Benediktsson & Karlsdottir, 2011; Benediktsson, 2014).

private property). Icelandic land is a physical mass surrounded by miles of sea; its land *constitutes the nation*; its characteristics form the Icelandic identity. The landmass by definition is communally shared by the Icelandic people (Dibben, 2009).

Thus, by way of defending its nationhood, or ensuring a competitive advantage, or recognizing a loss of nationhood through nature's commodification the Icelandic landscape and cultural heritage becomes articulated and rearticulated in the construction of national identity. Quoting Halink (2014), "identity is per definition contrastive." It is perhaps for this reason that cultural preservation is valued and nationalism emerges—the sense that Icelandic products are better than foreign products. They are spared hormones, free from pesticides, grass-fed, taste better, or are grown with Icelandic fresh water. There is a seeming lack of interest in organic agriculture despite the further assurance of fewer chemicals; the organic market, after all does not differentiate value via the Icelandic identity. While health can be considered universally valued (and consequently the most highly ranked value in this study) it is possible through the association of health with the quality of Icelandic products, health within the food system has developed some underpinnings of national identity as well.

The temptress of finance; disgust in its collapse – Lastly, I explore the rise and fall of Iceland's financial sector, an economic, political, and social saga, aggravating some the country's starkest dichotomies: urban and rural, technology and environment, regulation and deregulation, capitalist and socialist, traditional and futurist, global and local. In the 1980s, although technically classified as a Nordic welfare state, Iceland could largely be described as governed through statism and corporatism (Benediktsson, 2014). The government invested heavily in healthcare, schools, and pensions, and the "Octopus," the country's wealthy mercantile barons had a heavy hand in steering political outcomes to direct investment and to protect economic interests (Benediktsson, 2014; Boyes, 2009).

Although not yet championing neoliberal ideology at this time, the power blocs—and new capitalists who would soon emerge through the financial growth—played a large role in ushering in a Reaganism/Thatcherism-based political economy. Independence Party's David Oddsson who became Prime Minister in 1991 spearheaded the transition, pushing the reduction of corporate income tax and liberalization of the currency. Between 1997 and 2003 (to the chagrin of

environmentalists), the aluminum smelting industry (powered by nine new hydropower dams) expanded under Oddsson's stewardship, assuming 37 percent of the country's exports by 2008 (Boyes, 2009). Following suit, Icelandic banks were privatized in 2002, an action that not only offered greater regulatory freedom, but set bankers in a new world of financial engineering with access to a global market. Although not drawn into collateralization markets like those on Wall Street, Icelandic banks jumped into the alchemy of derivatives, the currency futures markets, and the "carry trade," shifting clients' money from low interest countries like Japan into Iceland (Boyes, 2009; Zarrilli, 2011). High interest rates (15 percent) set to control the country's long-standing high inflation rates (59 percent in 1980!) attracted this foreign investment, and boosted money available to Icelandic banks to invest abroad. The general Icelandic populace was soon pulled into the game, embracing over-extended debt as a liberating commodity; banks competed to offer mortgage packages with loans as high as 100 percent (Boyes, 2009).

Initially, the wheeling and dealing of debt filled Icelandic pockets; bankers' bonuses skyrocketed, wages rose, and by using their new houses as security, the Icelandic population began purchasing new cars, new furniture, and new summer homes. The country's stocks grew by a factor of nine between 2003 and 2004[43] and the average Icelandic family became three times richer from 2003 to 2006 (Boyes, 2009). Likewise, Reykjavik grew by 25 percent between 2003 and 2008 (Mathiesen, Zaccariotto, & Foregt, 2014). The sentiment in this era seemed to be that the Icelandic were playing catch-up with rest of the modern world, buying their way into progress (Belfrage et al., 2015; Boyes, 2009). Wade and Sigurgeirsdottir (2010) go as far to suggest that the success of the finance-dominated growth model allowed Icelanders to "to see themselves as 'independent people' at last" (Belfrage et al., 2015).

At a global scale, national economic development has shown to shift citizens' value logics (Inglehart & Baker, 2000; O'Brien & Wolf, 2010). While Iceland's growth during this time did not involve drawing masses out of poverty, it still begs the question how cultural priorities may have changed. With low unemployment and high economic growth catapulting the population into affluence, it could be easy to understand how technology, innovation, and efficiency (of industry, of financial products, and of markets) could become prominent value logics. Similarly, the recognition that Iceland's growth could never have occurred without tapping foreign investors offers a strong line of reasoning for valuing a globalized free market.

[43] By comparison, the US stock market doubled that year.

Unfortunately, however, the bubble burst, caused in part by the defective lending practices of US mortgage banks with rippling consequences on a global scale. If the Icelandic people had been buying progress, it had been purchased on credit; wealth proved only illusionary. When the crisis hit, assets turned to liabilities, foreign investors raced to withdraw investments, and on October 9, 2008, the value of the Króna dropped by 78 percent in a few hours (Belfrage et al., 2015). Three of the major privatized banks defaulted. The country's financial sector had outgrown the national GDP at a rate of ten to one, to the point that last-resort lending from the Central Bank proved untenable (Belfrage et al., 2015; Boyes, 2009; Zarrilli, 2011). The government reclaimed control of the country's three major privatized banks in an attempt to stabilize the economy, and Iceland became the first Western country since 1976 to apply to the International Monetary Fund (IMF) for emergency financial aid (Coleman, 2015).[44]

The ensuing years were a fall from grace; negative equity among homeowners rose from 6 percent in 2007 to 37 percent in 2010, at which point the parents of every fifth child could not repay their debts (Mathiesen et al., 2014). Relatively peaceful, and then increasingly less peaceful, riots took to the streets and the parties in power were forced to resign. The bankers—once "gilded elite"—became unemployed (Boyes, 2009). Narratives of the crisis frequently draw parallels between the Icelandic Viking ancestry and the "new Vikings" of financial markets—an image that at best recalls unbridled adventuring, but also the pursuit of global influence, rape, and pillage (Boyes, 2009; Earnest, 2013; Zarrilli, 2011). This negative view of the pursuit of profit for profits sake became manifested in social culture. Ostentatious cars remained hidden in garages; knitting one's own clothes came into vogue. Many quote a back-to-nature sentiment, a looking inward to the resources in one's backyard, a renewed appreciation for what Iceland locally had to offer, including fish, and agriculture, and nature tourism (Karl Benediktsson, 2014; Jonsdottir, 2012; Mathiesen et al., 2014). It is in this light that many of the earlier values—technology, innovation, efficiency, and globalization, which could be manifested in the food system through the introduction of GMOs, large-scale farm operations, and increased integration into global markets—may be called into question.

Yet the collective memory can be selective or short-term. In 2013, the same political party in charge during the crisis was voted into office once again. A "return to 2007" has become a

[44] Greece, Ireland, and Portugal received IMF support two years later.

commonly used phrase to describe the attitudes of the public and political leadership alike—but one that rather than being universal continues to aggravate a long-standing schism between traditionalist and futurist, environmental and technological visions (Byock, 1992). As Boyes (2009) articulates, "Iceland has a tangled view of the modern: its creative power, its potential for destruction." We see this tension in the conflicting values and interpretation of risks embedded in Iceland's food system.

Implications for the risk-value relationship

By crafting a lens into the social-political-economic-geographic context above, I suggest that values are culturally and contextually embedded—potentially shaped by traumatizing events as much as discursively enforced worldviews. The unit of analysis used in discussion was national in scale; the resiliency, the justification of nationhood, the financial crisis were all, in a schematic sense, shared nationwide. Yet, as alluded to in the mention of the years post-crisis, there is not a uniform Icelandic value logic, nor would we expect there to be for any country. Values pattern along the lines of gender, occupation, political party, and residence location (as the survey data suggest), and within Iceland's borders, there are distinctive histories embedded in different towns, and diversity in social norms. Ultimately value logics are reformulated through personal interpretation.

Based on the results of the survey—and substantiating Boholm and Corvellec's relational theory of risk—we can assume that there is a correlation between these value logics and risk perception. If to a certain degree values shape the perception of risk, then risk perception, too, will be patterned along equally nuanced lines. Each individual may assess the probability and level to which a value is at stake, and yet these perceptions in the aggregate, when shared, negotiated, and redefined through discourse, gain legitimacy and become reinforced. In this manner, a national risk, or in other words a national security issue, may become intersubjectively defined—not existing in a single mind (subjective) nor existing regardless of any mind (objective), but existing in the minds of many (Knox-Hayes, 2016).

With this theory, we can understand the composite value and risk scales generated through factor analysis. In the aggregate, the Agri-Health Risk Scale indicates a composite of individual

risks that are consistently perceived collectively by a group, specifically risks associated with the decline of the agricultural sector and associated livelihoods, the replacement of Icelandic products by foreign products, livestock disease, GMOs, and the lack of awareness of vulnerabilities in Iceland's food system. This risk scale shows a significant correlation with the Nationhood Value Scale (indicating high valuation of preparedness, self-sufficiency, local and sustainable food sources, cultural preservation, and nationalism), but not the Enviro-health Value Scale (indicating high valuation of health, the minimization of environmental impact, and cultural preservation as associated with preserving the genetics of the original Icelandic livestock breeds). The extent to which a set of values is mutually understood will influence the intersubjective coherence of the risk perception. Thus the value-risk correlation suggests that risk perception is both contextual and evolving with the transformation of value logics.

What are the implications? Individuals and institutions respond to perceived risk accordingly, shaping decision-making within a riskscape formulated by the collective imagination. This is not to say that the chance of an event itself exists only within the realm of perception, but the extent to which the event represents a societal loss will be collectively—yet not universally—defined. This framework aligns with securitization theory, which facilitates the conceptualization of security as a sociopolitical construct rather than an ontologically independent state (Katzenstein, 1996; Knox-Hayes, 2016). One prominent line of thought posits security as a speech act; the articulation of security by political actors constructs the threatening condition and subsequent security-based social order (Buzan, Waever, & Wilde, 1998). In other words, security is linguistically manifested. Balzacq (2005) argues further that securitization is pragmatic and strategic, a practice that is audience-centric and responsive to the power dynamics between speaker and audience. With the assumption that this dynamic manifests within Iceland, risk analyses conducted by political or epistemic communities will only be seen as valid to the extent that the audience shares the view that a value is at stake. Again, the mutually shared value builds intersubjective coherence. To a large degree, the Farmers Association of Iceland seems able to grasp the collective imaginations of select groups, but has yet to legitimate the food security claim among the broader populace.

And ultimately, the variation in risk perception towards Iceland's food system has generated a complex, interwoven riskscape, underpinned by conflicting ideologies. The interviews and gray

literature make it clear that the risk perceptions about various aspects of the food system have tangible outcomes. Market and political mechanisms are used as an interface for protecting values, and these values have crafted a sociopolitical economy that swings between neo-mercantalist and neoliberal agendas (Belfrage et al., 2015). The fear of livestock disease devastating the native livestock has led to uniquely strict regulations for animal and food imports. The need to maintain these regulations, and the risk of harming agriculture and fishing profit has played a noticeable role in Iceland's choice to withdraw its EU membership bid (Bjarnason, 2012; Farmers Association of Iceland, 2011). Based on a fear for farm financial sustainability, agricultural assistance rates are set far above average for Western Europe (Josling, 2009), dictating both output intensity and environmental restoration practices depending on the support scheme. Thus these perceived risks affect policies, shape international relations, as well as dictate the biological workings of the agri-ecosystems. "In other words," Benediktsson and Lund (2010) articulate, "Conversations between humans and landscapes are almost never conducted from a neutral position. They are often very much tied to the interests at stake." And, as risk perceptions shape the landscape—both political and ecological—the landscape in turn reshapes the perception of risk. For example, risk of financial decline in the farming sector may be replaced with risk of environmental deterioration if agricultural intensification serves as the risk mitigation tactic. The relationship between value logics and risks within the context of an evolving political ecology—the dynamic riskscape—suggests that the interpretation of food security risk will constantly be redefined. What might this mean for defining and building resilience?

VIII. FROM RISK TO RESILIENCE

Resilience as defined by values

Cities, regions, and nations are developing resiliency plans to mitigate and manage risk. In reflecting on that process, we return to the question of how to judge whether a location or community is resilient. How are the ideal outcomes of a resilient system defined? If the colloquial understanding of resilience—the ability to bounce back—unwittingly sets us up for cultural, social, and political stagnation, the evolutionary resilience-based thinking challenges us to more consciously define the trajectory of that evolution.

In thinking metaphorically, resilience can thus be considered the immune system of a particular place or community. It is not an end goal, nor a process per se, but rather the capacity for a system to still function healthfully despite a level of external stress. Building up the location's resilience strengthens its capacity *to grow and change*. The physical form is not expected to remain the same, nor are the laws that govern that form, nor the people who create those laws. Making reference to Holling's original ecological conceptualization, an ecosystem renders itself resilient if, for example, despite new biota or changes in atmospheric composition, it is able to execute its *fundamental functions* such as maintaining a balanced food web, fixing nitrogen, or recycling organic waste.

In a social-ecological system, what defines that function? We can determine a fundamental list of human needs (for example, the Fundamental Human Needs theorized by Manfred Max-Neef, or Abraham Maslow's Hierarchy of Needs[45]), but doing so limits the focus to generalizable elements rather than the particularities that constitute a community, context, and culture. The results of this study suggest an alternative. If we assume risk is intersubjectively defined based on values perceived to be at stake, then by the inverse logic, we could assume that the community's values are what we seek to preserve in the process of building community resilience. Under this logic, resilience entails developing new and evolving built, social, ecological, and political forms that uphold these collectively understood values—thus suggesting that resilience will ultimately look different for every community.

[45] See Max-Neef (1991) and Maslow (1943) for further details.

Operationalizing this framework: Iceland's food system

Thinking about Iceland's food system in terms of this framework formulates an interesting lens for considering risk and resilience. As a starting point, is food security a nationally perceived risk? Again, prior studies suggest not (see Jóhannsson, 2011a). Rather, select groups of citizens, but not a national majority, see the capacity (or the lack of capacity) to ensure adequate quality and quantities of food to the Icelandic people at all times as a national concern. Nevertheless, in the current survey, citizens ranked various *aspects* of the food production and distribution system as vulnerable; nine of the ten food system risk constructs identified through the interviews were on average ranked risky to some degree. Perceived risk associated with the decline of the agricultural sector and associated livelihoods, foreign products replacing Icelandic products, livestock disease, GMOs, and a lack of awareness of vulnerabilities in Iceland's food system all loaded highly on the Agri-health Risk Scale. This suggests insight in and of itself. (For example, these aspects of food system risk are collectively perceived by a subset of the population, while other aspects, such as environmental degradation are not necessarily seen as risks by this subset). However, focusing on the value logics that correlate with these risks can offer greater depth of interpretation, with insight for policymaking. The Nationhood Value Scale most highly correlated with the Agri-health Risk Scale. Two variables that loaded on this value scale were Preparedness and Self-sufficiency, which conceptually seem to align with food security. That is, failing to have sufficient food for the Icelandic population would jeopardize notions of preparedness and self-sufficiency. However, also integrated within this scale are the value constructs: Local and Sustainable, Cultural Preservation, and Nationalism. Based on these components, it can be suggested that aspects of the Agri-health Risk Scale are feared just as much for their threat to the Icelandic identity as for not having an adequate supply of food. Through this logic, it seems that "food security" may not be the most effective discourse for articulating what is perceived to be at stake.

Two main insights can be drawn from these findings. First, understanding risk-resilience tradeoffs requires an analysis that surpasses economic valuation. O'Brien and Wolf in their 2010 article "A values-based approach to vulnerability and adaptation to climate change" make a similar claim. Risk, particularly climate change risk, is consistently assessed on a narrow set of values: monetary worth, relative worth, or a fair return on exchanges, calculated quantitatively and justified with utilitarian rationale. And yet, as O'Brien and Wolf quote well, risk influences not only people's

"objective, exterior world, but also their subjective, interior world." Risk is interpreted differently between people based on what the potential change or impending loss means both objectively and subjectively to those that are affected. This makes calculating future value problematic; through economic rationale, discounting assumes that today's prioritized values can be applied to future generations. Can that assumption be applied to moral, ideational, or attitudinal values? Unlikely, as these values are destined to change, and not necessarily on a one-dimensional trajectory. In fact, it is likely that climate change and the ensuing sociopolitical and physical impacts may play a large part in shifting communities' values globally.

Second, by understanding the underlying values, the process of "building resiliency" can be approached in a much more targeted, contextually nuanced way. Resilience building will only be considered legitimate or effective if it aligns with what people consider to be worth preserving and accomplishing—including non-physical assets like culture or identity. In the case discussed, building more facilities to store imported feed in the case that grain shipments are blocked enhances preparedness, but does little to directly build the capacity for local and sustainable food sources or cultural preservation. Thus for Iceland, effectively building resiliency may, for example, entail establishing programs or communication networks among farmers sustainably producing traditionally Icelandic products (such as Skyr) to share best practices, offer training programs, create collective marketing campaigns, or share resources for financial support.

With this framework in mind, Iceland's food system can be looked at as a multi-layered socio-ecological system with vulnerabilities that are simultaneously subjectively and objectively defined. Based on the value logics and perceived risks explored in this study, the following interventions could be effective tactics for building resilience:

- *Fostering alternative markets for farmers to sell meat and produce* – Community shared agriculture (CSA) models have shown success in the United States and Europe for supporting small-scale family farms (Ertmańska, 2015; Schnell, 2007). Because community members pay for their shares (e.g., a weekly box of vegetables) at the beginning of the season, it provides guaranteed upfront capital to the farmer, allows farmers to focus on marketing before rather than during the growing season, and fosters a stronger direct relationship between consumers and their community's farms. Developing the CSA model in Iceland would foster

resilience in a way that supports cultural preservation, nationalism, self-sufficiency, and local and sustainable values. Non-market based methods, such as the growth of community gardens (and the accompanying legal framework to ensure land use rights in Reykjavik, for example) could also support the value emphasis on local and sustainable food sources. Steps in this direction are underway in Reykjavik: New policy guidelines are currently under development for incorporating agriculture—such as urban gardening and poultry raising—into land use plans, and the city aims to create facilities for farmer's markets in all city districts (City of Reykjavik, 2014; Jonsdottir, 2012). From what is known, however, the CSA model remains unpiloted.

- *Ensuring ecosystem integrity and the resources to support it* – Shifting towards organic agriculture and adopting methods of agroforestry would better ensure the longevity of the soil and agri-ecosystems by retaining water, organic matter, and biodiversity on agricultural plots. Shifting to such methods will increase the system's sustainability, reduce pollution, offer health benefits to both humans and animals, and support greater yields (and thus more sustainable livelihoods) over longer timeframes (Dyrmundsson, 2009; Tilman, Cassman, Matson, Naylor, & Polasky, 2002; Van Leeuwen et al., 2015). The biodiversity of the plots will also build up the ecological resiliency against new pests, which are predicted to increase in prevalence inadvertently as flora and fauna cross borders in and out of Iceland and as the climate warms due to climate change (Jónsdóttir, 2012). Adjustments to agricultural support schemes—such as offering greater support for conversion to organic agriculture[46]—could facilitate adoption of these methods. However, addressing broader points in the system would also be necessary. For example, research at the Agricultural University of Iceland currently focus predominantly on conventional farming methods (Dyrmundson, 2013). Building increased interest, teaching, research, and extension around topics such as organic agriculture, permaculture, and agroforestry could advance knowledge, develop the practice, and test new notions, particularly with respect to adopting these fields to Iceland's climate

[46] In 2009, conversion support included: 30,000 ISK per hectare of cultivated land per year (for two years); 300 ISK per square meter in greenhouses (for two years); and 40,000 ISK per farm as a contribution towards the cost of certification (10,000 ISK was approximately $645 USD in 2009) (Dyrmundsson, 2009). These support schemes have been insufficient to encourage farmers to convert; revisions are planned for 2016.

and ecological context.[47] Lastly, more coordinated networks could be established for procuring organic resources, such as animal feed or fertilizer, to support organic farms. An online platform, for example, could better link farmers and their resources—for example, one organic farmer's manure could serve as the fertilizer for another. This platform could also connect farmers importing the same products, such that bulk purchases can be made and small farms can gain from the economies of scale. These tactics for building resilience would support values pertaining to health, environmental health, local and sustainable food sources, and nationalism (Icelandic products).

- *Decreasing the barrier to entry for the food production sectors* – Between 2002 and 2003, the Agricultural Bank of Iceland, Búnaðarbankinn, was privatized and merged with Kaupthing Bank. Several interviewees noted that since this transition it has been difficult for young individuals and families to enter the farming sector, due to the high cost of purchasing quota, farmland, infrastructure, and equipment, and the unfavorable loan terms that inevitably saddle new farmers with crippling levels of debt. As reported by the OECD Agriculture Policy Monitoring and Evaluation report (2015), 70 percent of Iceland's agricultural support comes by way of influencing market prices (through tariffs and quotas) and through output-linked payments. Shifting a portion of this agricultural support to the creation of more favorable agricultural loan products (such as interest concessions or longer amortization periods) could reduce the financial strain on new farmers and make it more feasible for small family farms to enter the market. This strategy would build resiliency with respect to the values self-sufficiency, cultural preservation, local and sustainable food sources, and nationalism. Reducing the debt burden on farmers may facilitate further investment in new equipment or products, and allow for greater experimentation in methodologies (such as transitioning to organic farming) if there is less risk that "growth years" under the new methodologies will not render them bankrupt in the meantime. In turn, this strategy thus also supports technology and innovation and efficiency and performance value logics. Lastly, by shifting to input-based support (and not by way of subsidizing fertilizer, which can lead to overuse and environmental degradation), this support scheme may allow for a reduction in "trade-

[47] For example, currently there is a shortage of suitable legumes that can fix nitrogen in Iceland's cold temperatures; research into legume cultivation could increase naturally available nitrogen (Loes et al., 2015). By-products and effluent from the fishing industry could also serve as organic fertilizers (Dyrmundson, 2013).

distorting" support systems such as tariffs, thereby building resilience in a way that supports globalized free market values.

The substantial hazard of value-based resilience

Interpreting resilience through a community's values has its merits. It represents a culturally and contextually specific lens into the aspects of life that are important to a group of people; it offers guidance to mitigating risk by knowing why an event is perceived as risky. However, it also presents a substantial hazard—precisely due to the same underlying fact that resilience is subjectively or intersubjectively defined. Building resilience guided by a community's values is highly likely to define priorities through a dominant value logic at the risk of marginalizing those divergent from mainstream views. I contend that this hazard underpins any efforts to build community resilience regardless of the framework; articulating resilience in terms of values simply makes this bias and power dynamic increasingly explicit.

There are ultimately myriad ways to build resilience. In Iceland, for example, there has been a century-long effort to bolster the resilience of the soil by cultivating vegetation. This process can be facilitated by two distinct lines of thought: some naturalists have brought in species from similar climates that have shown a striking ability to thrive in Iceland's landscape and have built up new ecosystems as a result; other naturalists have argued that introduced species, which threaten to become invasive, will compromise Iceland's native ecosystems and thus only native plants will be able to bolster Iceland's natural resiliency (Karl Benediktsson, 2015). Both are resiliency-based rationales. They differ based on value logics. Similar ecological examples outside Iceland can be seen in the variety of forest restoration paradigms (see Stanturf, Palik, Williams, Dumroese, and Madsen, 2014) or in the debate between land-sharing or land-sparing agricultural methods (see Fischer et al., 2008), which offer alternative processes shaped by diverging ideologies to reach "resiliency" manifested in different forms.

To offer a further example, Keynesian and neoliberal economics are both macroeconomic paradigms that hold the health—or the resiliency—of the economy in mind. The former holds the philosophy that economic output is influenced by aggregate demand, and that private sector decisions often lead to inefficiencies that require public sector interventions. The latter believes in the efficiency of a purely free market based on individual decision-making, and that the role of

the private sector should be enhanced by liberalization policies such as privatization, fiscal austerity, and deregulation. While we can debate the empirical evidence (or counter-evidence) for either paradigm, the underlying point is that both are proposed methods for increasing macroeconomic resiliency based on conflicting value logics.

Because of this pluralism, policies and programs designed to build resilience become grounded in an intersubjectively shared imagining of what constitutes resilience. Campbell (1998) uses two theories (historical institutionalism and organizational institutionalism) to explain how ideas affect policy, suggesting that underlying normative structures as well as engrained cognitive frameworks (such as habits, routines, or scripts) create path dependencies and restrict which policy ideas political elites consider acceptable. Extending this theory, planners, policymakers, and other community leaders will "enact resilience" based on particular dominant sociopolitical, normative, and ideological frameworks. In doing so, efforts to build resilience will have a tendency to privilege certain values over others—fortifying power dynamics, reinstating the status quo, and ironically perpetuating vulnerabilities that were likely originally established due to that dominant value logic. It is based on this reasoning that many critics fear the high emphasis on self-reliance in many resiliency plans in neoliberal political economies, suggesting that this type of resilience is perpetuating the retreat of responsive and accountable governance (Davoudi, 2012).

While not explicitly using a resiliency-based framework, Júlíusdóttir (2010) points to a key example of this dynamic playing out in Iceland. The country's rural policy is guided by four-year Development Plans that aim to prevent rural depopulation, minimize regional disparities, and ensure quality public services and "optimal community conditions" in rural areas (OECD, 2011b). Since 2000, the Growth Agreements within these plans have emphasized tourism and cultural heritage (heritage tourism) as an intertwined path to regional growth. Although the economic benefits for investing in culture are articulated in the plans, Júlíusdóttir points out that the development of community identity based on historical, local cultural lineages is problematic. The plans position the reinvention of cultural heritage as necessary for social cohesion and the successful development of a tourism product. This "geographical imagination" which merges land and people with cultural roots in a particular territory makes the assumption that everyone living in the region shares a cultural origin. Through an "othering" discourse centered on boundary

making, the agenda marginalizes the growing number of people of foreign origin as well as Icelandic-borne who remain outside that community's exalted heritage (Júlíusdóttir, 2010).

Furthermore, by analyzing the agenda of the Network of Women in East Iceland (Tengslanet austfirskra kvenna or TAK), which focuses on reducing the gender gap, improving equality, and making East Iceland an interesting place for women to live, Júlíusdóttir makes clear the ways in which the regional development plans counter that agenda and hold a substantially male bias:

> Emphasis on direct competition in fund bidding, partnerships with the local private business sector, and a preference for large-scale 'flagship' projects are processes that have been found to reinforce male power within policy-making, as women are poorly represented in leading positions and networks within the private sector. The result… being that the praxis of rural economic policy is increasingly masculine in style and direction. (Júlíusdóttir, 2010)

Through social hierarchies and normative frameworks for business and policy processes, new strategies for developing vibrant and resilient communities instead reinforce old power dynamics. Inadvertently, the plan for regional growth becomes "exclusionary regionalism." Those who are subordinated remain subordinated and the vulnerabilities persist.

This scenario and discussion does not suggest that growth plans will be inevitably malicious, or that building resiliency will succumb to merely reinforcing power interests. Rather, the framework for action will be embedded in a certain set of norms, shaped by discourse and dominant ideologies, and may unconsciously reinstate the original vulnerabilities. As a final example to show this point: in the United States a significant element of food security discussion pertains to whether or not the welfare system effectively allows families in poverty access to adequate quality and quantities of food. In the eighteen interviews conducted in Iceland, neither poverty nor welfare programs were ever mentioned. In reaching out to an academic focused on social work in Iceland, it was further explained that poverty and welfare were never tied to the term food security. This is not because all families in Iceland have access to food, but rather there is no dialectic relationship between the two concepts. "Food security" in Iceland has developed into a very particular, politically charged discourse around ensuring the viability of the Icelandic

farming sector. In developing a resiliency plan for food security in this case, it is likely that access to food at a family level would not be addressed[48] simply because it is not embedded in the discourse. Interestingly, it can be said that this study shares this same bias.

Thinking of resilience as a system, values-based and evolutionary

If there is substantial risk in reinstating old vulnerabilities through resiliency planning, how do we effectively work to mitigate risk? Admittedly, the process remains unclear. The opportunity in a values-based framework for resilience, however, is that it compels us—planners, designers, government officials, communities—to be explicit about the values we are seeking to uphold. Ideally, it fosters recognition that there are multiple conceptualizations of what is desirable, encourages decision-making with transparent intention, and allows for the physical manifestation of resilience-building to be tested against the values it is meant to be serving. Moreover, it identifies conflicts between values—a process not meant to stimulate tension, but rather to expand the conversation about risk and vulnerabilities beyond questions of likelihood and causation, and beyond economic valuation. It asks what matters to whom and why. In other words, values-based resilience calls attention to the question of what defines risk and resilience, and who gets to decide.

Thinking about resilience as part of a system embraces its complexity. In the case of a social-ecological system like Iceland's food system, there are nesting scales of influence: the health of the soil is a system embedded in a network of agricultural practices and social and cultural norms, embedded within a local and global food market, embedded within a set of regulatory parameters that dictate the scale, the intensity, the distribution, and the timeframe of the

[48] It is worth noting that this is the main reason that food security at the personal or family level was largely omitted from this thesis. The majority of the interviewees were recommended based on their involvement with Iceland's food security, which is based around a very specific discourse primarily related to agricultural production. After discovering this, use of the term "food security" was avoided in the survey (instead articulated as "harm" or "vulnerability" to "Iceland's food system") as an attempt to avoid this political connotation. Nevertheless, the risk and value constructs used in the survey were pulled directly from interview discussions, which never made mention of poverty or the inability to pay for food (other than mentioning that Icelandic food tended to be more expensive than imports)—illustrating the division in discourse between welfare and the food security dialogue. Furthermore, because food security is embedded within a particular agricultural discourse, the fishing sector as well as the Slow Food Movement in Iceland have largely disassociated with the term. In future research, it would be useful to consider the social vulnerabilities that may be intensifying due to the fisheries' ITQ system, or due to the growing power of oligopolies—two subjects that were minimally explored in the current study.

production cycles—all nested within a greater sociopolitical context with values that shape the way the systems are understood, discussed, and negotiated. While agency is a factor (a municipal planning office, for example, can only affect what is within its power) consideration for all of these scales is needed to understand drivers and feedback loops, and to effectively change the mechanisms that reinstate vulnerability.

With a systemic values-based framework in mind, I make the following recommendations for resiliency planning:

- *Map the system; include time, space, and power dynamics.* Conceptually representing the social-ecological system incites a clearer understanding of the components: the stakeholders involved, the resources available, the natural forces, the economic drivers, the causal connections between stakeholders and events—as well as the communities' values and risk perceptions which will shape how resilience is perceived. Consider interactions between nested systems, and power dynamics that enforce certain outcomes. Understanding feedback loops may reveal the repercussions of a system, in particular the changing relationship between social and ecological systems over time. And by identifying vulnerabilities in the system, and even more importantly, how the system reinforces those vulnerabilities, it may also be possible to identify the "levers" that can be pulled in order to facilitate change (Meadows, 2008).

- *Uncover non-economic values; seek many perceptions; involve many metrics.* Identifying the underlying value logics embedded in risk perception offers a more nuanced understanding of *why* an outcome is considered a risk. In considering these values, the process of building resilience can develop new strategies to preserve what is of value (e.g., cultural heritage) rather than a particular physical manifestation that is otherwise perceived to mitigate the risk (e.g., a quota system set to make sure the farms do not fail). As more citizens are engaged, a greater range of values and risk perceptions can be considered. This step moves towards understanding the non-dominant or even marginalized perspectives in a community. Maximize participation in risk and value identification, but also in mapping the system in order to consider the fullest scope of stakeholders, resources, and forces. And in considering

how to build resilience, involve many metrics—representing moral, ideational, and affective values and goals—as opposed to only economic parameters.

- *Ensure flexibility; inspire evolution*. The process of building evolutionary resilience—by definition—is reflective and iterative rather than aiming to reach a single end goal. Devising flexible and adaptive policies and programs will help to avoid embedding further path dependencies and policy and infrastructure lock-in. Building in feedback loops—in other words, methods of measurement and communication to understand and respond to changing features in the system, such as educational programs that will encourage continued research and development around particular practices—will help to build that flexibility, allowing policies and programs to adapt with the changing social, political, economic, and ecological landscape, particularly in the face of climate change.

Ultimately, the capacity for resilience in any system will evolve—as the stressors to the system change, as the components of the system change, and as values and risk perceptions redefine the conception of what is resilient. If risk is contextually dependent and attached to values, then defining resilience must be as well. In an ideological sense this agenda seems clear, and ideal—suggesting that the community values are the metrics by which we can measure the goals of resiliency programs. Rather than a universal resiliency plan, this framework calls upon communities to write their own contextually relevant definitions of resilience, based around value logics with respect to changing social and ecological systems. Yet, as planning histories suggest, the nature of an intersubjectively defined metric has its downfalls—values are not all created equal and we must be cognizant of the value logics we privilege as well as marginalize through operating within normative paradigms. Although this hazard is unavoidable, we can be iterative in our process and transparent in our aims, putting in place a full range of voices, and the infrastructure for flexible and adaptive resilience-base thinking. Value-based resilience is thus a call to planners, designers, government officials, and communities to recognize the vulnerability built into the plans we make. Those in charge of building resilience must focus on the subordinated voices, focus on the learning process, and seek not to compromise values but rather answer to their evolution.

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APPENDIX

A. LIST OF INTERVIEWEES (anonymous)

Interview Date	Type of Organization	Title of Interviewee
11/13/15	Farming Sector (policy)	National Advisor to the Farmers Association of Iceland, Reykjavik
11/25/15	Farming Sector / Academia	Researcher and agriculturalist, Reykjavik Academy; former member of Iceland's committee on GMOs, Selfoss/Reykjavik
12/15/15	Academia	Adjunct Lecturer in Political Science, School of Social Sciences, University of Iceland, Reykjavik
01/14/16	Government	Senior Advisor, Department of Food, Agriculture, and Rural Affairs, Ministry of Industries and Innovation, Reykjavik
01/18/16	Academia	Professor in Sustainability Science, School of Engineering and Natural Sciences, University of Iceland, Reykjavik
01/18/16	Farming Sector (policy)	Deputy Director, Farmers Association of Iceland, Reykjavik
01/19/16	Academia	Professor in Human Geography, School of Engineering and Natural Sciences, University of Iceland, Reykjavik
01/19/16	Angling (policy)	Managing Director, Federation of Icelandic River Owners, Reykjavik
01/20/16	Academia	PhD student in Marine Biology, School of Engineering and Natural Sciences, University of Iceland, Reykjavik
01/25/16	Farming Sector (horticulture)	Owner, Geothermal greenhouse, Reykjavik

01/25/16	Food Industry	Chief Engineer, Icelandic food and biotech research and development company, Reykjavik
01/25/16	Farming Sector (dairy)	Owners (x2), Organic dairy farm, Kjos
01/26/16	Academia	Adjunct Lecturer in Political Science, School of Social Sciences, University of Iceland
01/27/16	NGO (environment)	Project Manager, Environmental Association, Reykjavik
01/27/16	Academia	Former product design graduate student (involved ins local food project), Iceland Academy of the Arts, Reykjavik
01/29/16	NGO (food)	Founding Member and Project Manager, NGO focused on local and sustainable foods, Reykjavik
03/17/16	Grocery import and retail	Purchasing Manager, major Icelandic grocery retail chain, Reykjavik
03/22/16	Academia	Professor in Social Work, School of Social Sciences, University of Iceland, Reykjavik

B. SURVEY INSTRUMENT

Risk perception: Iceland's food system

Þú hefur verið beðin(n) um að taka þátt í rannsóknaverkefni Holly Jacobson við department of Urban Studies and Planning at the Massachusetts Institute of Technology (MIT) í Bandaríkjunum. Markmið verkefnisins er að skoða áhrif gildismats á mat fólks á áhættu varðandi matvælakerfið á Íslandi. Niðurstöðurnar verða birtar í mastersritgerð Holly Jacobson. Vinsamlega lesið upplýsingarnar hér fyrir neðan áður en ákvörðun um þátttöku í könnuninni er tekinn.

- Þátttaka í könnuninni er frjáls. Þú getur tekið ákvörðun um að sleppa spurningum eða hætta við að fylla könnunina út hvenær sem er og af hvaða ástæðu sem er.
- Litið er á öll svör sem trúnaðarmál; svörum verður safnað og unnið með þau án þess að nafn svaranda komi fram.

Ekki ætti að taka meira en 5 mínútur að svara könnuninni. Með því að merkja við boxið hér fyrir neðan samþykkir þú að taka þátt í þessari könnun. Bestu þakkir fyrir þátttökuna.

Vinsamlega hafið samband við Jacobson, hjacobso@mit.edu, varðandi allar spurningar eða athugasemdir.

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You have been asked to participate in a research study conducted by Holly Jacobson from the Department of Urban Studies and Planning at the Massachusetts Institute of Technology (MIT). The purpose of the study is to understand how values influence risk perception by looking at Iceland's food system. The results of this study will be included in Holly Jacobson's Master's thesis. Please read the information below before deciding whether to participate.

- This survey is voluntary. You have the right not to answer any question, and to stop the survey at any time or for any reason.
- All survey answers will be kept confidential; answers will be collected and analyzed anonymously.

This survey should take less than five minutes to complete! By clicking the start button below, you are agreeing to participate in this survey, and the survey will begin. The insight you can offer is greatly valued – thank you for your participation.

Please contact Holly Jacobson, hjacobso@mit.edu, with any questions or concerns.

Risks – áhætta

Note: all questions in this section offered the following response options:

- very high risk - mjög mikil áhætta
- high risk - mikil áhætta
- neither high nor low risk - hvorki mikil né lítil áhætta
- low risk - lítil áhætta
- very low risk - mjög lítil áhætta

1. When you think about Iceland's food system, how big of a risk is it that financial stress in the farming sector could harm domestic agriculture?

   Hve mikil hætta er á að erfið rekstrarskilyrði í búskap skemmi fyrir innlendum landbúnaði?

2. When you think about Iceland's food system, how big of a risk is it that foreign products could replace Icelandic products?

   Hve mikil hætta telur þú að sé á því að erlendar vörur gætu rutt íslenskum vörum í burtu?

3. When you think about Iceland's food system, how big of a risk is it that animal disease could harm a large portion of the livestock?

   Hversu miklar líkur telur þú á því að búfjársjúkdómar geti skaðað stóran hluta búfjár á Íslandi?

4. When you think about Iceland's food system, how big of a risk is it that climate change could harm Iceland's food production?

   Hversu miklar líkur telur þú á því að loftslagsbreytingar geti skaðað íslenska matvælaframleiðslu?

5. When you think about Iceland's food system, how big of a risk is it that a natural event such as a volcanic eruption or a very cold season could harm Iceland's food production?

   Hversu miklar líkur telur þú á því að eldgos eða erfitt tíðarfar (t.d. kuldatímabil) geti skaðað íslenska matvælaframleiðslu?

6. When you think about Iceland's food system, how big of a risk is it that environmental degradation could harm Iceland's food production?

   Hversu miklar líkur telur þú á því að hnignun umhverfis (t.d. rýrnun landgæða) geti skaðað íslenska matvælaframleiðslu?

7. When you think about Iceland's food system, how big of a risk is it that an over-reliance on imports, such as oil, fertilizer, and feed, could harm Iceland's food production?

   Hversu miklar líkur telur þú á því að oftraust á innflutningi á vörum eins og eldsneyti, áburði, fóðurvörum geti skaðað íslenskan landbúnað?

8. When you think about Iceland's food system, how big of a risk is it that genetically modified organisms (GMOs) could harm Iceland's food system?

   Hversu miklar líkur telur þú á því að erfðabreyttar lífverur geti skaðað íslenska matvælakerfið?

9. When you think about Iceland's food system, how big of a risk is it that protectionist measures, such as tariffs, could harm Iceland's food system?

   Hversu miklar líkur telur þú á því að innflutningshöft og skattar á innfluttar landbúnaðarafurðir geti skaðað íslenska matvælaframleiðslu?

10. When you think about Iceland's food system, how big of a risk is it that people are unaware of the potential risks to Iceland's food system?

    Hversu miklar líkur telur þú á því að þekkingarskortur á hugsanlegum skaðvöldum eða áhættu á matvælaframleiðslu á Íslandi geti skaðað íslenska matvælakerfið?

---

11. In considering the various threats to Iceland's food system below, choose five that you consider the most important, and rank them from 1 (the most important) to 5 (the fifth most important), without allowing for ties.

    Hverjar metur þú helstu ógnir við matvælaöryggi á Íslandi? Veldu 5 helstu ógnvaldana, 1 fyrir mestu ógn og 5 fyrir minnstu (ekki setja sömu tölu tvisvar)

    Decline of the farming sector and associated rural livelihoods
    Samdráttur í landbúnaðargeiranum og í dreifbýli ☐

    Animal disease outbreak ☐

Búfjársjúkdómar

Climate change ☐
Loftslagsbreytingar

Harsh climatic conditions or volcanic eruptions ☐
Erfitt tíðarfar

Environmental degradation ☐
Hnignun umhverfis

Blocked access to critical imports ☐
Stöðvun á innflutningi vara sem nauðsynleg eru fyrir matvælaframleiðslu (t.d. eldsneyti eða tilbúinn áburður)

GMOs ☐
Erfðabreyttar lífverur

Foreign food products ☐
Erlendar matvörur

Restrictive trade regulations ☐
Skattahömlur

Lack of awareness of risks to the food system ☐
Skortur á almennri þekkingu á áhættuþáttum sem skaðað getur matvælakerfið

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12. Is there another dimension of risk to Iceland's food system that was not covered by this survey? If so, please enter below (or if not, please leave blank).

Telur þú einhverjar aðrar ógnir standa að matvælakerfinu á Íslandi, ef svo þá hverjar?

12. b. [If entered a response for question 12:] Please rank the answer you gave according to its level of risk.

Hversu mikla telur þú áhættuna vera?

[Note: answer options to this question are the same as questions 1-10]

Values – gildi

Note: all questions in this section offered the following response options:

- very important - mjög mikilvægt
- important – mikilvægt
- neither important nor unimportant - hvorki mikilvægt né ómikilvægt
- unimportant - ekki mikilvægt
- very unimportant - alls ekki mikilvægt

13. When you think about Iceland's food system, how important to you is it that as few chemicals as possible (such as pesticides, fertilizers, or growth hormones) are used?

    Hversu mikilvægt fyrir matvælakerfið á Íslandi að eins lítið sé notað af efnum (t.d. skordýraeitri, tilbúnum áburði eða vaxatarhormón) við framleiðslu matvæla og hægt er?

14. When you think about Iceland's food system, how important to you is it that there is a preparedness plan to ensure people in Iceland have safe access to food in case of a crisis?

    Hversu mikilvægt fyrir matvælakerfið á Íslandi að til staðar sé aðgerðaráætlun sem tryggir fólki í landinu öruggan aðgang að matvælum á neyðartímum?

15. When you think about Iceland's food system, how important to you is it that Iceland is as self-sufficient as possible?

    Hversu mikilvægt fyrir matvælakerfið á Íslandi telur þú að matvæli séu framleidd á Íslandi í eins miklu magni og mögulegt er til að mæta þörfum landsins án þess að það sé háð öðrum ríkjum?

16. When you think about Iceland's food system, how important to you is it that your food is produced locally and in a sustainable way?

    Hversu mikilvægt telur þú að fæða sem þú neytir sé framleiddur í nærumhverfi á sjálfbæran hátt?

17. When you think about Iceland's food system, how important to you is it that the genetics of the original Icelandic breeds are preserved?

    Hversu mikilvægt telur þú að erfðafjölbreytileiki íslenskra tegunda, notaðar í framleiðslu á matvælum, sé verndaður?

18. When you think about Iceland's food system, how important to you is it that efforts are made to try to decrease carbon emissions in food production and distribution?

    Hversu mikilvægt telur þú að reynt sé að minnka útstreymi gróðurhúsalofttegunda í framleiðslu á matvælum?

19. When you think about Iceland's food system, how important to you is it that Iceland participates fully in a free market, global economy?

    Hversu mikilvægt telur þú fyrir matvælakerfið á Íslandi að Ísland verði fullur þátttakandi í frjálsum óheftum viðskiptum með matvæli á alþjóðamarkaði?

20. When you think about Iceland's food system, how important to you is it that the products are Icelandic?

    Hversu mikilvægt er það fyrir sjálfa(n) þig að varan sé íslensk?

21. When you think about Iceland's food system, how important to you is it that Iceland maximizes technological ingenuity to increase food production?

    Hversu mikilvægt telur þú að Íslendingar hámarki tækniþekkingu til að auka framleiðslu á matvælum?

22. When you think about Iceland's food system, how important to you is it that the agricultural sector is able to maximize efficiency and affordability?

    Hversu mikilvægt telur þú fyrir matvælakerfið á Íslandi að landbúnaðargeirinn hámarki afkastagetu sína og hagkvæmni?

23. In considering the various values associated with Iceland's food system listed below, choose five that you consider the most important, and rank them from 1 (the most important) to 5 (the fifth most important), without allowing for ties.

    Hvaða sjónarmið telur þú mikilvægast að hafa í huga við framleiðslu matvæla á Íslandi? Merktu við 5 mikilvægustu atriðin (1 allra mikilvægast, 5 minna mikilvægt; ekki gefa sömu einkunn tvisvar).

Health ☐
Heilbrigði

Safety / preparedness ☐
Öryggi / viðbúnaður

Local and sustainable food sources ☐
Staðbundin matvæli framleidd á sjálfbæran hátt

Cultural preservation ☐
Menningarvernd

Self-sufficiency ☐
Að landið sé sjálfu sér nægt

Minimal environmental impact ☐
Umhverfisáhrif í lágmarki

Globalized free market ☐
Frelsi í alþjóðaverslun

Icelandic products ☐
Íslensk vara

Technology and innovation ☐
Hátækni og nýsköpun

Performance and efficiency ☐
Afköst og hagkvæmni

Demographics – lýðfræði

24. Gender:
    Kyn:

    - female – kona
    - male - karl
    - other - annað

25. Age:
    Aldur:

    - 18-25
    - 26-35
    - 36-45
    - 46-55
    - 56-65
    - over 66 - yfir 66

26. How many people live in your household?
    Fjöldi íbúa á heimili þínu?

    - o 1
    - o 2
    - o 3
    - o 4
    - o 5
    - o over 5 - yfir 5

27. Household income per month:
    Heildartekjur heimilis á mánuði:

    - o 200 þús. kr. eða lægri
    - o 201 - 300 þús. kr.
    - o 301 - 400 þús. kr.
    - o 401 - 500 þús kr.
    - o 501 - 600 þús. kr.
    - o 601 - 700 þús. kr.
    - o 701 - 900 þús. kr.
    - o 901 þús. - 1,1 milljón kr.
    - o Yfir 1,1 milljón kr.

28. Educational attainment:
    Menntun:

    - o secondary (high school) - menntaskólapróf
    - o undergraduate - gunnmenntun í háskóla
    - o postgraduate - framhaldsmenntun í háskóla
    - o other – annað _____

29. Were you born in Iceland?
    Ertu fæddur á Íslandi?

    - o yes – já
    - o no – nei

30. How many years have you lived in Iceland?
    Hversu lengi hefur þú búið á Íslandi?

    - o less than 1 - skemur en 1 ár
    - o 1 - 5 ár
    - o 6 - 10 ár
    - o 11 - 20 ár
    - o over 20 - lengur en 20 ár

31. Zip code of where you live for the majority of the year:
    Póstnúmer á þeim stað þar sem þú býrð meginhluta ársins:

    _____

32. Political affiliation:
    Stjórnmálaflokkur sem þú hyggst kjósa:

    - o Independence Party – Sjálfstæðisflokkurinn
    - o Left-Green Movement - Vinstrihreyfingin grænt framboð
    - o Pirate Party - Píratar
    - o Progressive Party – Framsóknarflokkurinn
    - o Social Democratic Alliance - Samfylkingin
    - o other – annað _____

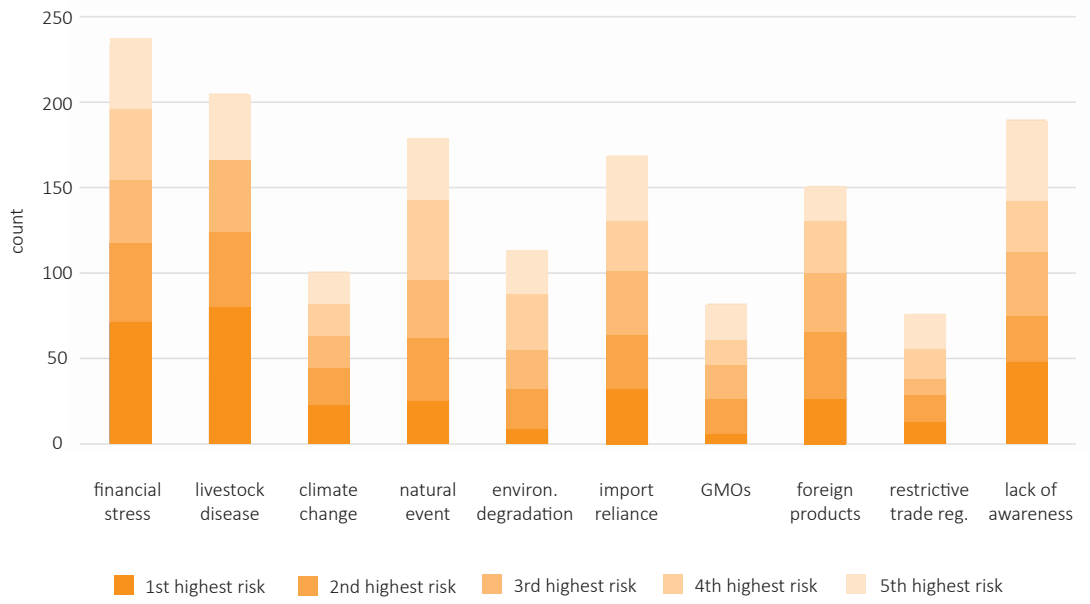
33. Occupation:
    Starf:

- o agriculture or fishing industry - landbúnaðarstörf eða störf við sjávarútveg
- o other private sector / industry / business / for-profit organization - almennur vinnumarkaður / iðnaður / viðskipti
- o non-profit, non-governmental organization / civil society - frjáls félagasamtök
- o government / national institute / regulatory agency - ríkisstarfsmaður, starfsmaður við ríkisstofnun
- o university / school / academic institution - starf við skólastofnun eða sérfræðistofnun
- o other – annað _____

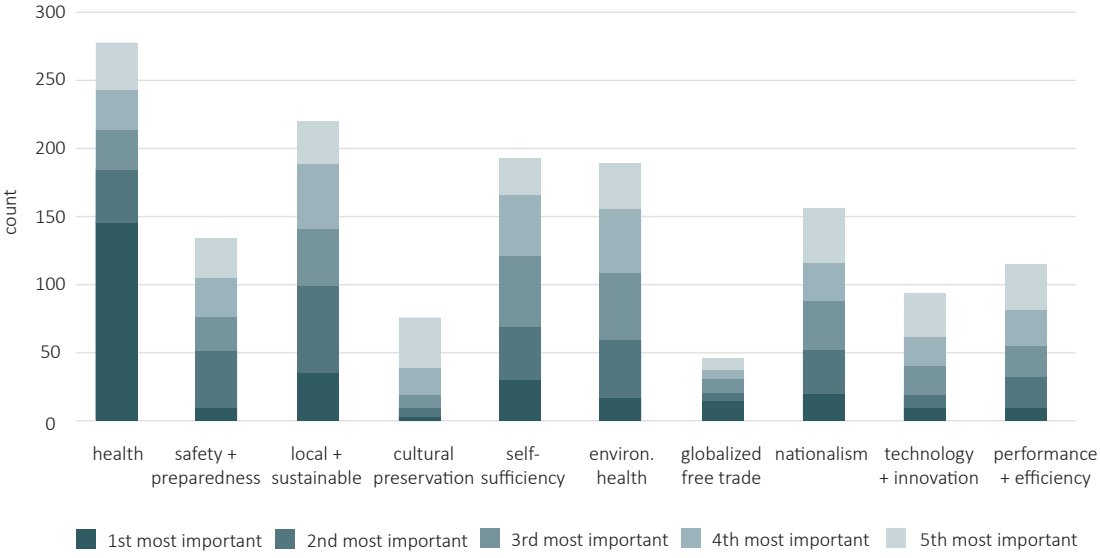
Thank you for your participation!
Bestu þakkir fyrir þátttökunina!

C. DISTRIBUTION OF HIGHLY RANKED RISKS AND VALUES

Distribution of top five ranked risks. The last question in section one of the survey instrument asked respondents to choose five risk constructs that they see as the most risky and to rank them from riskiest to the fifth most risky. Livestock Disease followed by Financial Stress were ranked in the top five by the greatest number of people, and were ranked the top risk by the greatest number of people.



Distribution of top five ranked values. As with the risk constructs, the last question of the second section of the survey instrument asked respondents to choose five value constructs that they see as the most important and to rank them from most important to fifth most important. Health was ranked in the top five by the greatest number of people, and was by far the top ranked value by the greatest number of people.



D. MULTIVARIATE REGRESSION OF RISKS AGAINST DEMOGRAPHICS

Summary of ninety multivariate regressions analyses assessing correlations between each of the ten risk constructs against demographic parameters. Negative values represent higher perceived risk than the baseline.

Variables	Financial Stress	Foreign Products	Livestock Disease	Climate Change	Natural Event	Environ. Degradation	Import Reliance	GMOs	Protectionist Trade Reg.	Lack of Awareness
Gender										
Female (baseline)										
Male	0.33***			0.38***	0.18**	0.23**	0.20*	0.31**	- 0.20*	0.18*
Age										
18-25 (baseline)										
26-35				0.64**						
36-45	0.32*									
46-55	- 0.30*									
56-65										
Over 65									0.72*	
Household size										
1 (baseline)										
2		- 0.34*								
3						0.33*		0.55**		
4		- 0.38*					- 0.36*			
5						0.49**				
Over 5				0.67**		0.55*				

*p < 0.10, **p < 0.05, ***p < 0.01

(continued) MULTIVARIATE REGRESSION OF RISKS AGAINST DEMOGRAPHICS

Variables	Financial Stress	Foreign Products	Livestock Disease	Climate Change	Natural Event	Environ. Degradation	Import Reliance	GMOs	Protectionist Trade Reg.	Lack of Awareness
Education										
High school (baseline)										
Undergraduate								0.37*		
Graduate								0.44**		
Less than high school								- 0.44*		
Monthly household income										
200K ISK or less (baseline)										
201-300K ISK						0.62*				
301-400K ISK						0.62*				
401-500K ISK										
501-600K ISK						0.58*				
601-700K ISK						0.87***	0.70**			
701-900K ISK		0.84***				1.04***	0.70**			
901K - 1.1 MM ISK						1.02***	0.61*			
Over 1.1 MM ISK			0.84**		0.58**	1.18***	0.84***			
Occupation										
Farming or fishing industry (baseline)										
Other private sector	0.30**	0.85***	0.45**						- 0.49***	0.49***
Nonprofit sector								0.54*	- 0.50*	0.46*
Government sector	0.31**	0.77***	0.44**					0.60***		0.43**
Academic /education sector		0.45***	0.57***			- 0.46***			- 0.42**	
Other		0.50**								

*p < 0.10, **p < 0.05, ***p < 0.01

(continued) MULTIVARIATE REGRESSION OF RISKS AGAINST DEMOGRAPHICS

Variables	Financial Stress	Foreign Products	Livestock Disease	Climate Change	Natural Event	Environ. Degradation	Import Reliance	GMOs	Protectionist Trade Reg.	Lack of Awareness
Political affiliation										
Independence Party (baseline)										
Left-Green Movement			- 0.43*		- 0.35**	- 0.63***	- 0.35*		0.66***	- 0.43**
Pirate Party		0.44**				- 0.75***				
Progressive Party		- 0.46**	- 0.62**						0.76***	- 0.43**
Social Democratic Alliance	0.61***		0.49*		- 0.38*					0.57**
Other		0.41**				- 0.48***				
Years lived in Iceland										
1-5 years (baseline)										
6-10 years										
11-20 years		1.02**				1.44***				
Over 20 years		0.74*				1.47***	0.77*			
Postal code, primary residence (1st digit)										
1 (baseline)										
2		- 0.31**								
3	- 0.40*	- 0.71***	- 0.62**	0.48**				- 0.47*	0.44*	
4					0.69**					
5	- 0.49**	- 0.63***	- 0.45*					- 0.58**		- 0.51**
6		- 0.42**							0.43*	
7			- 0.46*					- 0.49*		
8		- 0.47**			0.32*		0.36*		0.57**	
9										

*p < 0.10, **p < 0.05, ***p < 0.01

E. MULTIVARIATE REGRESSION OF VALUES AGAINST DEMOGRAPHICS

Summary of ninety multivariate regressions analyses assessing correlations between each of the ten value constructs against demographic parameters. Negative values represent higher stated importance than the baseline.

Variables	Health	Safety + Prepared.	Self-Sufficiency	Local + Sustainable	Cultural Preserv.	Environ. Health	Globalized Free Trade	Nationalism	Tech. + Innovation	Efficiency + Performance
Gender										
Female (baseline)										
Male	0.22***	0.29***	0.50***	0.43***	0.28***	0.27***		0.41***		
Age										
18-25 (baseline)										
26-35										
36-45	- 0.39**									
46-55	- 0.31*									
56-65										
Over 65	- 0.44**									
Household size										
1 (baseline)										
2										
3					0.38**		- 0.60**			
4					0.31*					
5		- 0.24*								
Over 5		- 0.44**		0.48**					0.47*	

*p < 0.10, **p < 0.05, ***p < 0.01

(continued) MULTIVARIATE REGRESSION OF VALUES AGAINST DEMOGRAPHICS

Variables	Health	Safety + Prepared.	Self-Sufficiency	Local + Sustainable	Cultural Preserv.	Environ. Health	Globalized Free Trade	Nationalism	Tech. + Innovation	Efficiency + Performance
Education										
High school (baseline)										
Undergraduate		0.19*								
Graduate			0.30**					0.39***		
Less than high school					- 0.35*					
Monthly household income										
200K ISK or less (baseline)										
201-300K ISK										
301-400K ISK					- 0.52*		0.90**			
401-500K ISK										
501-600K ISK										
601-700K ISK	0.35*									
701-900K ISK									- 0.49*	
901K - 1.1 MM ISK										
Over 1.1 MM ISK									- 0.53*	
Occupation										
Farming or fishing industry (baseline)										
Other private sector			0.49***	0.30**	0.28**		- 1.04***	0.77***		
Nonprofit sector			0.46**					0.58***		
Government sector			0.48***			- 0.44***	- 0.68***	0.53***		
Academic /education sector			0.42***			- 0.32***	- 0.69***	0.47***		
Other						- 0.29*		0.31*		

*p < 0.10, **p < 0.05, ***p < 0.01

(continued) MULTIVARIATE REGRESSION OF VALUES AGAINST DEMOGRAPHICS

Variables	Health	Safety + Prepared.	Self-Sufficiency	Local + Sustainable	Cultural Preserv.	Environ. Health	Globalized Free Trade	Nationalism	Tech. + Innovation	Efficiency + Performance
Political affiliation										
Independence Party (baseline)										
Left-Green Movement	- 0.26**			- 0.34**	- 0.38**	- 0.59***	0.46**	- 0.30*	0.59***	0.41**
Pirate Party			0.36**			- 0.35***	- 0.51**	0.45***		
Progressive Party	- 0.35***		- 0.41**	- 0.28*	- 0.55***		0.79***	- 0.45**		
Social Democratic Alliance	- 0.23*				- 0.45**	- 0.47***				
Other	- 0.23**				- 0.27*	- 0.23**			0.31**	
Years lived in Iceland										
1-5 years (baseline)										
6-10 years		0.75*					- 1.67**			
11-20 years										
Over 20 years				0.58*						
Postal code, primary residence (1st digit)										
1 (baseline)										
2					- 0.36***					
3	0.32**						1.04***	- 0.37***	0.33*	
4								- 0.79***		0.56**
5			- 0.65***		- 0.59***		0.54**			
6	- 0.26**		- 0.55***		- 0.34*			- 0.74***		- 0.37*
7	- 0.29**		- 0.59***				0.69***	- 0.63***		0.40**
8	- 0.24*				- 0.32*		1.02***	- 0.59***		
9										

*p < 0.10, **p < 0.05, ***p < 0.01

The values underpinning Iceland's food system risk
Implications for resilience planning

Holly Johanna Jacobson

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