



## Article

# Building strategic resilience in food supply chain

Manning, Louise and Soon, Jan Mei

Available at <http://clock.uclan.ac.uk/18001/>

*Manning, Louise and Soon, Jan Mei ORCID: 0000-0003-0488-1434 (2016) Building strategic resilience in food supply chain. British Food Journal, 118 (6). pp. 1477-1493. ISSN 0007-070X*

It is advisable to refer to the publisher's version if you intend to cite from the work.  
<http://dx.doi.org/10.1108/BFJ-10-2015-0350>

For more information about UCLan's research in this area go to <http://www.uclan.ac.uk/researchgroups/> and search for <name of research Group>.

For information about Research generally at UCLan please go to <http://www.uclan.ac.uk/research/>

All outputs in CLoK are protected by Intellectual Property Rights law, including Copyright law. Copyright, IPR and Moral Rights for the works on this site are retained by the individual authors and/or other copyright owners. Terms and conditions for use of this material are defined in the [policies](#) page.



## Building strategic resilience in the food supply chains

Journal:	<i>British Food Journal</i>
Manuscript ID	BFJ-10-2015-0350.R2
Manuscript Type:	Research Paper
Keywords:	Benchmarking, indicators, Stakeholders, Value, performance

SCHOLARONE™  
Manuscripts

View Only

## Abstract

**Purpose:** The aim of this paper is to consider the concept of strategic business resilience in order to postulate innovative mechanisms to drive business performance in the food supply chain.

**Design:** The research included a literature review and the development of a resilience model that can be adopted in the food supply chain at both a strategic and an operational level.

**Findings:** Conflict of interest **exist** for organisations that are seeking to strategically and effectively manage the pluralistic nature of internal and external supply chain risks. The model derived in this research can be used in the food supply chain to drive supply chain agility, organisational stability and longevity, and as a result continuous improvement.

**Originality/value –** This research is of academic value and of value to policy makers and practitioners in the food supply chain.

**Keywords** benchmarking, performance, indicators, stakeholders, value

## 1. Introduction

Implicit in the definition of resilience is the requirement for flexibility and adaptability as well as the capacity to absorb market and environmental shocks and still maintain a fully functioning food supply chain (Folke, 2006). Factors that influence food supply chains include: natural disasters, technological accidents, infectious diseases, terrorism, and food safety **incidents** (Leat and Revoredo-Giha, 2013), food fraud and wider food crime and market and pricing strategies. Factors that affect supply chain resilience can be *internal* i.e. within the supply chain network or *external* factors often outside the control of the organisations involved. These factors can be categorised as: *processes* such as transport, communication and infrastructure; *controls* including protocols, policies, procedures, systems

1  
2  
3 30 and assumptions; and *demand and supply* related issues such as the fear of, or actual  
4  
5 31 disturbances to, the multi-directional flow of materials, product, finance and information  
6  
7 32 (Christopher and Peck, 2004). Driving a business strategy focused primarily on cost reduction  
8  
9 33 without sufficient regard for the risks that this strategy creates will make the food supply  
10  
11 34 chain more brittle (Viswanadham and Kameshwaran, 2013; Waters, 2007). Food supply chain  
12  
13 35 brittleness is centred on factors such as low financial margins, low profitability and low  
14  
15 36 resource stocks i.e. a lean management approach that can combine in multiple ways with  
16  
17 37 social factors (e.g. consumer trust and brand loyalty) and factors such as weather vulnerability  
18  
19 38 that affects quality or yield, price volatility or natural variation. The degree of financial  
20  
21 39 brittleness in a particular food supply chain will depend on the level of profitability, **liquidity**,  
22  
23 40 the ability to meet loan repayments and continue to implement capital investment plans that  
24  
25 41 underpin business growth. Ultimately, lower operating margins reduce financial flexibility  
26  
27 42 and create a more brittle supply chain that is vulnerable to major risks such as animal disease,  
28  
29 43 volatility in commodity markets and an increasing cost of legal and/or social compliance.  
30  
31 44 Conversely, food supply chain agility is determined by **the** level of financial return,  
32  
33 45 efficiency, innovation, resource management and the ability to have alternative sourcing  
34  
35 46 mechanisms in place for key ingredients, organisational responsiveness and **underpinning**  
36  
37 47 product quality that consistently meets customer requirements. For resilience to be assured in  
38  
39 48 the food supply chain brittle structural aspects need to be effectively managed and where  
40  
41 49 possible agility enhanced. Thus, it can be questioned whether the single concept of social-  
42  
43 50 ecological food supply chain resilience is normative (Keessen *et al.* 2013) or if there are  
44  
45 51 multiple meanings for what it is for an organisation, a discrete supply chain or indeed the  
46  
47 52 whole global food system to be deemed as being resilient. There is heterodoxy in the  
48  
49 53 vocabulary surrounding the meanings of resilience (Table 1) from it being the opposite of  
50  
51 54 vulnerability (Folke, 2006; Levina and Tirpak, 2006) to the ability to return to a stable state  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 55 i.e. business as usual (Morecroft et al. 2012; Holling et al. 1996; Pimm, 1991) through to the  
4  
5 56 capacity for change, growth, and renewal. Folke (2006:259) suggests that resilience needs to  
6  
7 57 embrace “*the opportunities that disturbance opens up in terms of recombination of evolved*  
8  
9 58 *structures and processes, renewal of the system and emergence of new trajectories*”.

10  
11 **Take in Table 1**  
12

13  
14 60

15  
16 61 Five drivers identified by Foresight (2011) that will propel change in global food supply  
17  
18 62 chains are: global population increase; change in the size and nature of per capita demand for  
19  
20 63 food especially for meat and fish; climate change; competition for key resources (land, water  
21  
22 64 and energy); and changes in values and ethical stances of consumers. Folke (2006) determines  
23  
24 65 three concept of resilience: engineering resilience, ecological and socio-ecological resilience  
25  
26 66 and this has been adapted to the food supply chain (Table 2). Engineering resilience is a  
27  
28 67 transactional concept where the focal point for management is task-orientated and is one of  
29  
30 68 recovery, constancy, and continuity. Ecological resilience considers the ability to withstand  
31  
32 69 business shock requiring aspects of management such as persistence and robustness whilst  
33  
34 70 socio-ecological resilience reflects transformational aspects of management that encompass  
35  
36 71 learning, innovation and dynamic development. This self-organising process is in essence the  
37  
38 72 equilibrium that is derived from reorganising, evolving and adapting as an organisation to the  
39  
40 73 wider socio-economic environment that it operates in. Buffer capacity (also a key  
41  
42 74 characteristic of ecological resilience) is the ability for an organisation or a supply chain to  
43  
44 75 withstand shock and remain as a fully functioning business. Examples of how buffer capacity  
45  
46 76 can be built is the use of buffer material and product stocks, or analysis of required skillsets  
47  
48 77 for the organisation and a programme of capacity building in individuals through training and  
49  
50 78 development. Thus, food supply chain resilience can be described and organisational goals  
51  
52 79 can be developed either transactionally using financial, quantitative metrics or qualitatively in  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 80 terms of the ecological or holistic properties of resilience interfacing with what would  
4  
5 81 generally be considered to be elements of an organisation's corporate social responsibility  
6  
7 82 (CSR) strategy. However, organisations are increasingly expected to review their ethical  
8  
9  
10 83 performance in relation to stakeholders' expectations, identify how improvements could be  
11  
12 84 made and then communicate these deliberations back to their stakeholders in order to deliver  
13  
14 85 continued value (Manning *et al.* 2006; Manning, 2015). The whole process of value creation  
15  
16 86 in food supply chains is realised through multi-organisational involvement and building  
17  
18 87 mutual benefit (Caiazza and Volpe, 2012). Further they argue that a value chain is in fact an  
19  
20  
21 88 economic and social reality involving a set of actors and activities that interact and work  
22  
23 89 together to satisfy the needs of specific markets. This definition supports the socio-economic  
24  
25 90 view of strategic resilience (Caiazza *et al.* 2014; Caiazza and Volpe, 2012).

26  
27 91 Whilst exploitation of natural resources could be considered as a key element of a global  
28  
29 92 multinational corporation's (MNC) model of operation, this can create ecologically defined  
30  
31 93 market failures in resource rich developing nations especially as a result of soil and  
32  
33 94 groundwater depletion, reduction in forested areas etc. (Stiglitz, 2006). An organisation can  
34  
35 95 seek to offset the environmental impact of these activities by a variety of means e.g. reducing  
36  
37 96 waste, using emissions or outputs from one process as inputs into another, offsetting  
38  
39 97 emissions by developing other sequestering activities. However, this stratagem focuses on  
40  
41 98 mitigation of current practice rather than innovating and adapting the whole process to embed  
42  
43 99 long term organisational resilience. Organisational ability to adapt to change can stall if there  
44  
45  
46  
47 100 are high levels of complexity in terms of products, processes and intra- and inter-  
48  
49 101 organisational structures (Power, 2005). Therefore, organisational resilience is to be the  
50  
51 102 ability to reinvent dynamically business models and associated corporate strategies as  
52  
53 103 circumstances change (Hamel and Välikangas, 2003). Ultimately, resilience must be  
54  
55 104 embedded strategically and within the operating system, driving agility, an ability to be  
56  
57  
58  
59  
60

1  
2  
3 105 adaptive and deliver solutions especially with regard to emerging or re-emerging risks. The  
4  
5 106 aim of this paper is to consider the concept of strategic business resilience in order to  
6  
7 107 postulate innovative mechanisms to drive business performance in the food supply chain.  
8

## 9 10 108 **2. Strategic and operational resilience**

11 109 Resilience is in part “the ability of an organisation to approach crisis situations as a  
12  
13 110 potentially positive experience, and to utilise an enhanced ability to change as the economic,  
14  
15 111 physical, political and social situation demands” (McManus, 2008:26). Strategic resilience is  
16  
17 112 not about responding to a single crisis or rebounding from a setback, it encompasses  
18  
19 113 anticipating and reacting to secular trends that can permanently impair the earning power of  
20  
21 114 the core business (Hamel and Välikangas, 2003). Alternatively it has been suggested that  
22  
23 115 strategic resilience “results when the organisation gains the capability to quickly convert  
24  
25 116 threatening surprises into opportunities and to identify unique opportunities and act  
26  
27 117 effectively before their competition” (Välikangas and Romme 2012:45). Further Välikangas  
28  
29 118 and Romme (2012) differentiate between operational resilience and strategic resilience where  
30  
31 119 the former is recovery focused e.g. after experiencing a crisis and tenacity in the face of threat  
32  
33 120 i.e. reactive management and the latter is renewal focused in terms of changing without the  
34  
35 121 driver of a crisis i.e. proactive management. The research has considered the concept of  
36  
37 122 strategic and operational business resilience and postulated that innovative mechanisms need  
38  
39 123 to be developed in order to embed resilience and drive performance and continuous  
40  
41 124 improvement in the food supply chain.  
42  
43  
44  
45

46  
47 125 Development of risk management strategies is a core executive process. Shareholders will  
48  
49 126 place specific emphasis on ensuring the inherent risk to their financial investment is addressed  
50  
51 127 in the strategic planning processes undertaken by senior management executives and  
52  
53 128 executive boards. Indeed definition of organisational risk and the means for its control forms  
54  
55 129 part of an executive annual report. A formulated approach has been described (Mintzberg,  
56  
57  
58  
59  
60

1  
2  
3 130 1978) where *internal risks* associated with the organisation itself should be easier to quantify  
4  
5 131 and thus mitigate than *external risk* (national or global social, political or economic forces)  
6  
7 132 especially where there is a strong organisational operating system in place. Management can  
8  
9 133 alleviate the effect of such risks by developing a risk register and then having contingency or  
10  
11 134 disaster recovery strategies in place, but such a formulated, executive approach may still not  
12  
13 135 react quickly enough to a sudden supply chain “shock” or an emergent, previously unknown  
14  
15 136 risk. Strategic change is often by its nature ad hoc and irregular, never steady and results from  
16  
17 137 the interaction of periods of continuity, change, flux and inertia (Mintzberg, 1978).

18  
19 138 Ensuring resilience in a wider business environment that is evolving rapidly requires two  
20  
21 139 kinds of strategy firstly *intended strategy* i.e. what was planned and, secondly what is *realised*  
22  
23 140 *strategy* i.e. what happened in practice. This emergent strategy is actually, what is exhibited  
24  
25 141 by the organisation (Figure 1).

#### 26 27 28 29 142 **Take in Figure 1**

30  
31 143 Business continuity management (BCM) is the management process that identifies an  
32  
33 144 organisation’s exposure to internal and external threats and as a result synthesizes hard and  
34  
35 145 soft assets to provide effective prevention and recovery for the organisation i.e. operational  
36  
37 146 resilience, whilst maintaining competitive advantage and value system integrity namely  
38  
39 147 strategic resilience (Elliott *et al.* 2002). Operational BCM should be driven by an interactive  
40  
41 148 rather than a purely reactive or proactive strategy and during contingency planning  
42  
43 149 consideration should be given to ensure that plans developed in isolation can be actualised  
44  
45 150 whether they are needed or not (Elliott *et al.* 2002; Mintzberg, 1978). The scope of  
46  
47 151 contingency plans in the food supply chain can include factors such as natural disaster,  
48  
49 152 climate variation, flood, fire, crop failure, yield reduction, animal disease outbreak, and  
50  
51 153 failure of product to meet minimum quality specifications. Product recall, foodborne disease  
52  
53 154 outbreak, supply chain failure (bankruptcy or financial failure of supply chain partners,  
54  
55  
56  
57  
58  
59  
60



1  
2  
3 155 logistical failure), food crime, threat or supply chain sabotage, and disruption to services e.g.  
4  
5 156 internet, electricity, waste disposal, water, and distribution networks as with the historic  
6  
7 157 incident of volcanic ash preventing movement of air freighted food should also be considered.  
8  
9 158 Transactional consideration of engineering resilience in the context of BCM reflects the time  
10  
11 159 to return to a stable state following shock, or perturbation, i.e. how quickly supply can be  
12  
13 160 resumed (Folke, 2006; Morecroft *et al.* 2012), but this is limited in terms of the socio-  
14  
15 161 ecological resilience requirements of creating supply chain value. This latter, self-organising,  
16  
17 162 approach drives the interplay between supply chain disturbance, reorganising, sustaining and  
18  
19 163 developing i.e. continuous improvement through enhancing adaptive capacity. **In this context,**  
20  
21 164 the focal point for management is facilitating transformability, learning, and innovation rather  
22  
23 165 than recovery or constancy. This requires fully integrated feedback systems and cross-chain  
24  
25 166 dynamic interactions between organisations (Table 2). In order to develop an appropriate  
26  
27 167 business continuity plan (BCP) that ensures strategic and operational resilience, consideration  
28  
29 168 must be given to the environment in which the BCP will operate, and to the degree of  
30  
31 169 turbulence in terms of the rate of change that is externally or internally driven. Therefore, the  
32  
33 170 strategy must be flexible, and include the ability to deliver a set of value-based aspirations.  
34  
35 171 Organisations need to consider resilience as being well beyond a BCP and develop strategies  
36  
37 172 that, as Mintzberg (1978) describes, are not just formulaic but allow for an iterative approach  
38  
39 173 to maintaining resilience. This requires management focus not to be purely on the  
40  
41 174 organisational process and the architectural framework of policies, protocols and systems  
42  
43 175 (system measures as defined by Tangen, 2005) but go further to consider how performance  
44  
45 176 measures can be developed that will inform and lead strategy.  
46  
47 177 In determining risk, there are a number of factors that can be considered including marketing  
48  
49 178 and pricing strategies, food safety incidents, food fraud and food crime, infections livestock  
50  
51 179 diseases, technological and infrastructure risks and national and localised natural disasters or  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 180 accidents (see Figure 2). These will have an impact on strategic resilience in terms of both  
4  
5 181 market and technology turbulence. Market turbulence is determined as the change in the  
6  
7 182 composition of customers and their preferences whereas technological turbulence refers to the  
8  
9 183 amount and unpredictability of change in production or service technologies (Slater and  
10  
11 184 Narver (1994) cited by Terawatanavong et al. 2011). Market and technology turbulence can  
12  
13 185 have both a push dynamic (from the challenges at primary production in terms of natural  
14  
15 186 resource availability, livestock disease outbreak, weather and seasonal impacts, influence of  
16  
17 187 ability to freely distribute product) through to a pull dynamic by the consumer. Primary level  
18  
19 188 food production is subject to a number of potential “shocks” that can cause poor yields or  
20  
21 189 crop failure either on an acute level in a single year or have chronic effects over a number of  
22  
23 190 years, even decades. These factors can often have more influence in terms of supply and  
24  
25 191 demand dynamics than ongoing technological research work in continuously developing the  
26  
27 192 genetic potential of the crop to yield (Ray *et al.* 2012). Due to multiplier factors, poor feed  
28  
29 193 crop yield and low product quality at primary production level impacts on further stages in the  
30  
31 194 food supply chain e.g. the escalating effect, in terms of net efficiency, of poor feed quality and  
32  
33 195 then lower feed conversion rate in the animals the feed is provided for. In food supply chains  
34  
35 196 accumulative weak performance will influence food availability, and affordability for the  
36  
37 197 world’s increasingly urban population with an aggregation of marginal losses, rather than  
38  
39 198 marginal gains. The aggregation of marginal gains theory is that multiple, seemingly  
40  
41 199 miniscule, improvements throughout any given process, can collectively achieve a far  
42  
43 200 superior output (Durrand *et al.* 2014; Eisen *et al.* 2014; Hill, 2014; Smith *et al.* 2014).  
44  
45 201 Conversely the aggregation of marginal losses theory is worthy of consideration in the wider  
46  
47 202 context of resilience and supply chain performance.  
48  
49 203 Assurance of strategic and operational resilience requires the integrated engagement of supply  
50  
51 204 chain actors at all stage of food production, distribution and information exchange in order to  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 205 limit vulnerability, external and internal risks. Threat Assessment Critical Control Point  
4  
5 206 (TACCP) is described in PAS 96 (2014:3) as the “*systematic management of risks through*  
6  
7 207 *the process of assessment of threats, identification of vulnerabilities, and implementation of*  
8  
9 208 *controls to raw materials, packaging, finished products, processes, premises, distribution*  
10  
11 209 *networks and business systems by a knowledgeable and trusted team with the authority to*  
12  
13 210 *implement changes to procedures*”. Thus, an appropriate and well-integrated TACCP plan is  
14  
15 211 just one element of a wider strategic resilience risk assessment that can be undertaken from  
16  
17 212 primary production through to the consumer. In order to drive a quantitative approach to  
18  
19 213 strategic resilience risk assessment, an architecture of analysis needs to be clearly defined,  
20  
21 214 although the architecture must be agile enough to accommodate sudden and unexpected  
22  
23 215 supply shocks in the event that they occur. Ultimately, corporate goals should be formulated  
24  
25 216 and these need to cascade into specific, relevant and time bound measures. These measures  
26  
27 217 can be strategic and influence the whole supply chain e.g. a supply chain level approach to  
28  
29 218 reducing waste or be operationally based measures that define performance at a single supply  
30  
31 219 chain stage. These corporate goals will as a result have influence either as a whole chain actor  
32  
33 220 or as a single stage actor. Interest in CSR benchmarking for demonstrating social and  
34  
35 221 environmental performance has promoted the development of supply chain guidelines and  
36  
37 222 codes of practice (Manning and Baines, 2004). Benchmarking as an activity can then monitor  
38  
39 223 the degree of integration between different measures and the actual organisational and/or  
40  
41 224 supply chain performance that is realised. The use of methods to construct and to assess  
42  
43 225 measureable socio-ecological indicators has been proposed (Mitchell *et al.* 1995; Hansen  
44  
45 226 1996; Bockstaller *et al.* 1997; Rigby *et al.* 2001; Hak *et al.* 2012). This approach suggests that  
46  
47 227 quantitative measures can be used to drive what for many are deemed qualitative social  
48  
49 228 aspirations and when the use of qualitative and semi-quantitative measures is open to  
50  
51 229 interpretation. Bell and Morse (2003) stated that supply chain performance indicators must be  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 230 *specific* (outcome bound); *quantitative* (measurable); *usable* (of practical value); *available*  
4  
5 231 (data easily collated); *cost-effective* (not expensive to collect); and *sensitive* (demonstrate  
6  
7 232 changes in circumstances). This does not preclude the use of qualitative indicators, but by  
8  
9 233 their nature, qualitative indications do not drive business performance and continuous  
10  
11 234 improvement in the same way as quantitative indicators. Bourlakis et al. (2014) differentiate  
12  
13 235 between four categories of socio-ecological supply chain indicators (efficiency, flexibility,  
14  
15 236 responsiveness and product quality). In Table 3, the work of Bourlakis *et al.* 2014 has been  
16  
17 237 adapted for the four factors with consideration of economic, environmental and social  
18  
19 238 characteristics that they can quantify. Consideration of this work highlights **that** a resilience  
20  
21 239 indicator framework could be developed that can be used at a strategic level or an operational  
22  
23 240 level to provide socio-economic organisational and supply chain measures that define  
24  
25 241 business goals and objectives which are measurable i.e. quantitative.  
26  
27  
28

29  
30 **Take in Table 3**  
31

32 243  
33  
34 244 Benchmarking is the means by which targets, priorities and operations **are** established that  
35  
36 245 will lead to competitive advantage (Oakland, 1993). Lau et al. (2005) characterise  
37  
38 246 benchmarking as the systematic comparison of elements of performance in a company against  
39  
40 247 those best practices of relevant companies, and then obtaining information that will help the  
41  
42 248 observing company to identify and implement improvement. In order for benchmarking to be  
43  
44 249 effective, it requires a measured consideration of whether the process will be implemented  
45  
46 250 either at a strategic management level or at an operational, activity or enterprise level, or both.  
47  
48 251 To reflect on this in another way, the benchmarking approach to developing resilience can be  
49  
50 252 designed to underpin BCM strategies, long term strategic aims and objectives at the supply  
51  
52 253 chain, or product category scale, as well as operationally drive the implementation of a CSR  
53  
54 254 strategy or simply provide baseline data and then drive improvement. Synthesizing the  
55  
56  
57  
58  
59  
60

1  
2  
3 255 literature reviewed in this study as Hamel and Välikangas (2003) propose strategic resilience  
4  
5 256 is not about simply responding to a single crisis or rebounding from a setback. Strategic  
6  
7 257 resilience considers, anticipates and mitigates pressures, and drivers that influence the socio-  
8  
9 258 economic environment in which the business operates. The factors considered are strategic  
10  
11 259 leadership, strategic decision-making, supply chain dynamics, value based dynamics and the  
12  
13 260 use of performance indicators in the context of external and internal influences and at the  
14  
15 261 executive, organisational and individual level (Table 4).  
16

17  
18 262 **Take in Table 4**  
19

20  
21 263

22  
23 264 Building on Table 4 and utilising the so-called 3Rs (ready-respond-recover) approach to  
24  
25 265 resilience proposed by Ponomarov and Holcomb (2009) a 3Rs strategic resilience risk  
26  
27 266 assessment framework for the food supply chain has been developed (Figure 2). This  
28  
29 267 framework via consideration of internal organisational and external supply chain risks, and  
30  
31 268 the ability of an individual organisation or a food supply chain to ready, respond and recover.  
32  
33 269 Six examples of risk are illustrated in the framework, although this is not an exhaustive list,  
34  
35 270 namely natural disasters, technological accident and infrastructure threats, infection or  
36  
37 271 disease, food fraud and wider food crime, food safety incidents, outbreaks and product recalls  
38  
39 272 and marketing and pricing strategies. The strategic resilience risk assessment framework  
40  
41 273 identifies industry risk assessment tools that are already utilised to determine risk, TACCP  
42  
43 274 with regard to food fraud and wider food crime and hazard analysis critical control point  
44  
45 275 (HACCP) which is an approach used to consider food safety risk and its mitigation.  
46  
47

48  
49 276 **Take in Figure 2**  
50

51  
52 277

53  
54 278 Supply chain relationships depend on the abilities of the individual organisations in the food  
55  
56 279 supply chain to individually and collectively act efficiently, flexibly, in order to be agile,  
57  
58  
59  
60

1  
2  
3 280 responsive and meet the complicated customer specifications for their products and services  
4  
5 281 each time. This requires a hierarchy of strategic resilience aims and objectives and an  
6  
7 282 architecture of analysis to be built around the supply chain metrics that are developed  
8

9  
10 283 **Take in Figure 3.**  
11 284

12  
13 285 In the context of a generic food supply chain, a conceptual resilience indicator framework  
14  
15 286 (Figure 3) has been **proposed** using the secondary processing stage as an example. Similar  
16  
17 287 strategic resilience indicator frameworks can be developed for other stages of the food supply  
18  
19 288 chain, bespoke to particular products, processes or scenarios. The framework also includes a  
20  
21 289 range of indicators that can be used as part of a supply chain monitoring process to create  
22  
23 290 value for the organisation itself improving its strategic and operational resilience and **provide**  
24  
25 291 value for **a range of** stakeholders. **These stakeholders include** shareholders who may reflect on  
26  
27 292 their being less financial risk and a greater underpinning of brand value, insurance companies  
28  
29 293 who are requested to provide insurance against risks such as product recalls, stock rejection,  
30  
31 294 etc. and supply chain partners, community groups and consumers who may each define  
32  
33 295 supply chain value in their own distinct ways. The use of a strategic resilience indicator  
34  
35 296 framework can provide opportunity for an organisation to address internal and external risk  
36  
37 297 and mitigate such risk wherever possible. This approach is of value to practitioners in the  
38  
39 298 food supply chain in order to reduce risk. Risk is determined at many levels in an organisation  
40  
41 299 from executive risk registers in corporate documents to the development of BCM protocols  
42  
43 300 and the use of TACCP and HACCP at an operational level as described in the paper. The  
44  
45 301 resilience assessment tools explored in this research can assist practitioners to consider a more  
46  
47 302 integrated approach to managing risk and developing strategic resilience management  
48  
49 303 programmes.  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

## 306 **6. Conclusion**

307 The aim of this paper is to consider the concept of strategic business resilience in order to  
308 postulate innovative mechanisms to drive business performance in the food supply chain. A  
309 3Rs (ready, respond and recovery) business resilience risk assessment framework and an  
310 associated resilience indicator framework has been developed to enable organisations in the  
311 food supply chain to determine and improve their strategic resilience in terms of both internal  
312 organisational and external supply chain risk factors. This incorporates the five strategic  
313 resilience factors (values-based dynamics, supply chain dynamics, strategic decision-making,  
314 strategic leadership, and use of performance indicators) into the 3Rs strategic resilience risk  
315 assessment framework (Figure 3) to identify ways to ensure readiness through formal  
316 procedures and protocols, effective response and recovery. The strategic resilience indicator  
317 framework (Figure 4) can be use to develop and utilise performance indicators that  
318 demonstrate the degree of vulnerability within the socio-economic environment in which the  
319 organisation operates. Conflict of interest exists for organisations that are seeking to  
320 strategically and effectively manage the pluralistic nature of internal and external supply  
321 chain risks. The model derived in this research can be used in the food supply chain to drive  
322 supply chain agility, organisational stability and longevity, and as a result continuous  
323 improvement.

## 324 **References**

- 325  
326 Ackoff, R.L. (1990), Strategy: Redesigning the Future, *Systems Practice*, 3 (6): 521-524  
327  
328 Adger, W. N. (2006), Vulnerability. *Global Environmental Change*, Vol. 16, Iss. 3, pp. 268-  
329 281.
- 330 Bell, S., and Morse S. (2003), *Measuring sustainability: learning by doing*, Earthscan  
331 Publications Ltd, London  
332  
333 Berkes, F., Colding, J., and Folke, C. (Eds.), (2003). *Navigating Social–Ecological Systems:*  
334 *Building Resilience for Complexity and Change*. Cambridge University Press, Cambridge,  
335 UK.



- 1  
2  
3 336 Bockstaller, C., Cirardin, P. and van der Werf, H.M.G. (1997), Use of agro-ecological  
4 337 indicators for the evaluation of farming systems. *European Journal of Agronomy*, Vol. 7, Iss.  
5 338 1-3, pp. 261-270.  
6 339
- 7 340 Bourlakis, M., Maglaras, G., Gallear, D. and Fotopoulos, C. (2014), Examining sustainability  
8 341 performance in the supply chain: The case of the Greek dairy sector, *Industrial Marketing*  
9 342 *Management*, Vol. 43, Iss. 1. pp. 56-66.  
10 343
- 11 344 *Caiazza R., and Volpe T., (2015), Interaction despite of diversity: Is it possible? Journal of*  
12 345 *Management Development*, Vol.34, Iss. 6. pp. 743-750  
13 346
- 14 347 *Caiazza R., Volpe T., and Audretsch D.B., (2014), Innovation in Agro-food System: Policies,*  
15 348 *actors and activities, Journal of Enterprising Communities: People and Places in the Global*  
16 349 *Economy*, Vol. 8, Iss.3, pp. 180-187  
17 350
- 18 351 *Caiazza R., and Volpe, T. (2012), The Global Agro-food system from past to future, China-*  
19 352 *USA Business Review*, Vol. 11, No 7. Pp. 919-929  
20 353
- 21 354 Christopher, M. and Peck, H. (2004), Building the resilient supply chain, *International*  
22 355 *Journal of Logistics Management*, Vol. 15, Iss. 2, pp. 1-13  
23 356
- 24 357 Delmas, M., and Burbano, V.C. (2011), The Drivers of Greenwashing, *California*  
25 358 *Management Review*, Vol. 54, Iss. 1, pp. 64-87.  
26 359
- 27 360 Driessen, P.P.J, and Van Rijswijk, H.F.M.W. (2011), Normative aspects of climate  
28 361 adaptation policies. *Climate Law*, Vol. 2, Iss. 4, pp. 1-23
- 29 362
- 30 362 Durrand, J.W., Batterham, A.M. and Danjoux, G.R. (2014), Pre-habilitation (i): aggregation  
31 363 of marginal gains, *Anaesthesia*, Vol. 69, Iss. 5, pp. 403-406  
32 364
- 33 364 Eisen, S., van der Poel, L., Clough, L., Musial, M., Walsh, O., and Salt, P. (2014), G183  
34 365 Improving the patient pathway: aggregation of marginal gains in a secondary paediatric  
35 366 allergy service, *Srch Dis Child*, Vol. 99, Iss. Suppl 1. p187 doi:10.1136/archdischild-2014-  
36 367 306237.187  
37 368
- 38 368 Elliott, D., Swartz, E., and Herbane, B. (2002), *Business Continuity Management. A crisis*  
39 369 *management approach*, Routledge, Oxon.  
40 370
- 41 371 Folke, C. (2006), Resilience: the emergence of a perspective for social-ecological systems  
42 372 analyses. *Global Environmental Change* Vol.16, Iss. 1, pp. 253-267.  
43 373
- 44 373 Foresight. *The Future of Food and Farming (2011) Executive Summary*. The Government  
45 374 Office for Science, London.  
46 375
- 47 376 Gunderson, L., and S. S. Light. 2006. Adaptive management and adaptive governance in the  
48 377 Everglades ecosystem. *Policy Sciences* Vol. 39, Iss. 4, pp. 323-334.  
49 378
- 50 378 Gunderson, L.H., and Holling, C.S. (Eds.), (2002). *Panarchy: Understanding Transformations*  
51 379 *in Human and Natural Systems*. Island Press, Washington DC.  
52  
53  
54  
55  
56  
57  
58  
59  
60



- 1  
2  
3 380 Hak, T., Kovanda, J. and Weinzettel, J. (2012,) A method to assess the relevance of  
4 381 sustainability indicators: Application to the indicator set of the Czech Republic's Sustainable  
5 382 Development Strategy. *Ecological Indicators*, Vol. 17, Iss. 1, pp. 46-57  
6 383  
7 384 Hamel, G., and Välikangas, L., (2003), The Quest for Resilience, *Harvard Business Review*,  
8 385 September 2003.  
9 386  
10 387 Hansen, J.W. (1996), Is agricultural sustainability a useful concept? *Agricultural Systems*,  
11 388 Vol. 50, Iss. 2, pp. 117-143.  
12 389  
13 390 Hill, J. (2014), Follow up after curative colorectal cancer resection – aggregation of marginal  
14 391 gains, *Colorectal Disease*, Vol 16. Iss. 8, pp. 575-576  
15 392  
16 393 Holling, C.S. (1996). Engineering resilience versus ecological resilience. In: Schulze, P.  
17 394 (Ed.), *Engineering Within Ecological Constraints*. National Academy Press, Washington DC,  
18 395 pp. 31–44.  
19  
20  
21 396 Keessen, A. M., Hamer, J.M., Van Rijswijk, H.F.M.W., and Wiering, M. (2013), The concept  
22 397 of resilience from a normative perspective: examples from Dutch adaptation strategies.  
23 398 *Ecology and Society*, Vol. 18, Iss. 2 art. 45 <http://dx.doi.org/10.5751/ES-05526-180245>  
24 399  
25 400 Lau, H.C.W., Lau, P.K.H., Fung, R.Y.K., Chan, F.T.S. and Ip, R.W.L. (2005), A virtual case  
26 401 benchmarking scheme for vendors' performance assessment, *Benchmarking: An International*  
27 402 *Journal*, Vol. 12, Iss. 1, pp. 61-80.  
28 403  
29 404 Leat, P. and Revoredo-Giha, C. (2013), Risk and resilience in agri-food supply chains: the  
30 405 case of the ASDA PorkLink supply chain in Scotland. *Supply Chain Management: An*  
31 406 *International Journal*, Vol. 18, Iss. 2, pp. 219-213.  
32 407  
33 408 Levina, E., and Tirpak, D. (2006), *Adaptation to climate change: key terms*. Organisation for  
34 409 Economic Co-operation and Development, Paris, France.  
35  
36  
37  
38 410 Manning, L. (2015), Determining value in the food supply chain, *British Food Journal*, Vol.  
39 411 117, Iss. 11, pp. 1-17  
40 412  
41 413 Manning, L., Baines, R.N., and Chadd, S.A. (2006), Ethical modelling of the food supply  
42 414 chain, *British Food Journal*, Vol. 108, Iss. 5, pp. 358-370  
43 415  
44 416 Manning, L., and Baines, R.N. (2004), Globalisation: A study of the poultry meat supply  
45 417 chain, *British Food Journal*, Vol. 106, Iss. 10/11, pp. 819–836.  
46 418  
47 419 McManus, S.T (2008), Organisational resilience in New Zealand, Available at:  
48 420 [http://www.resorgs.org.nz/images/stories/pdfs/organisational%20resilience%20in%20new%20](http://www.resorgs.org.nz/images/stories/pdfs/organisational%20resilience%20in%20new%20zealand.pdf)  
49 421 [zealand.pdf](http://www.resorgs.org.nz/images/stories/pdfs/organisational%20resilience%20in%20new%20zealand.pdf) [Accessed on: 29.12.15]  
50 422  
51 423 Mintzberg, H. (1978), Patterns in Strategy Formation, *Management Science*, Vol. 24, Iss. 9  
52 424 pp. 934-948  
53 425  
54 426 Mitchell, G., May, A. and McDonald, A. (1995), PICABUE: a methodological framework for  
55 427 the development of indicators of sustainable development, *International Journal of*  
56 428 *Sustainable Development and World Ecology*, Vol. 2, Iss. 2, pp. 104-123.  
57  
58  
59  
60

- 1  
2  
3 429  
4 430 Morecroft, M.D., Crick, H.Q.P., Duffield, S.J., and Macgregor, N.A. (2012), Resilience to  
5 431 climate change: translating principles into practice, *Journal of Applied Ecology*, Vol. 39, Iss.  
6 432 1, pp. 547-551  
7 433  
8 434 Muthuri, J., Moon J., and Matten, D. (2006), *Employee Volunteering and the Creation of*  
9 435 *Social Capital*, Research Paper Series. International Centre for Corporate Social  
10 436 Responsibility No. 34-2006 - ISSN 1479-5124.  
11 437  
12 438 Oakland J.S. (1993), *Total Quality Management: The route to improving performance*.  
13 439 Butterworth-Heinemann Ltd, Oxford.  
14 440  
15 441 PAS 96 (2014), *Guide to protecting and defending food and drink from deliberate*  
16 442 *attack*, ISBN978 0 580 85537 5 BSI Standards Limited  
17 443  
18 444 Pimm, S.L. (1991). *The Balance of Nature? Ecological Issues in the Conservation of Species*  
19 445 *and Communities*. University of Chicago Press, Chicago.  
20  
21  
22  
23 446 Ponomarov, S. Y. and Holcomb, M. C. (2009). Understanding the concept of supply chain  
24 447 resilience. *International Journal of Logistics Management*, Vol. 20, Iss. 1, pp. 124-143.  
25 448  
26 449 Power, D. (2005), Supply chain management integration and implementation: a literature  
27 450 review, *Supply Chain Management: An International Journal*, Vol.10, Iss. 4, pp. 252-63  
28 451  
29 452 Ray, D.K., Ramankutty, N., Mueller, N.D, West, P.C., and Foley, J.A. (2012), Recent patterns  
30 453 of crop yield growth and stagnation, *Nature Communications*, Vol. 3 (1293) Published  
31 454 18.12.12 doi:10.1038/ncomms2296  
32 455  
33 456 Rigby, D., Woodhouse, P., Young, T. and Burton, M. (2001), Constructing a farm level  
34 457 indicator of sustainable agricultural practice, *Ecological Economics*, Vol. 39, Iss. 3, 463-478  
35 458  
36 459 Slater S.F., and Narver, J.C. (1994), Does competitive environment moderate the market  
37 460 orientation-performance relationship? *Journal of Marketing*, Vol. 58, No.1, pp. 46-55.  
38  
39  
40 461 Smith, J., Meng, Z.W., Lockyer, R., Dudderidge, T., McGrath, J., Hayes, M., and Birch, B.  
41 462 (2014), Evolution of the Southampton Enhanced Recovery Programme for radical cystectomy  
42 463 and the aggregation of marginal gains, *BJU International*, Vol. 114, Iss. 3, pp. 375-383  
43  
44  
45 464 Stiglitz, J.E. (2006), *Making Globalization Work*, Allen Lane. ISBN 13 9780713999099  
46 465  
47 466 Tangen S. (2005), Insights from practice. Analysing the requirements of performance  
48 467 measurement systems, *Measuring Business Excellence*, 9 (4): 46-54  
49 468  
50 469 Terawatanavong, C., Whitwell, G.J., Widing, R.E., and O’Cass, A. (2011), Technological  
51 470 turbulence, supplier market orientation, and buyer satisfaction, *Journal of Business Research*,  
52 471 Vol. 64, Iss. 1, pp. 911-918  
53 472  
54 473 Välikangas, L.A. and Romme, G.L. (2012), Building resilience capabilities at "Big Brown  
55 474 Box, Inc.", *Strategy & Leadership*, Vol. 40 Iss: 4 pp. 43 - 45  
56 475  
57  
58  
59  
60

- 1  
2  
3 476 Viswanadham, N., and Kameshwaran, S., (2013), *Ecosystem-Aware Global Supply Chain*  
4 477 *Management*, World Scientific Publications.  
5  
6 478 Walker, B.H., Holling, C.S., Carpenter, S.R., Kinzig, A.P., (2004). Resilience, adaptability  
7 479 and transformability in social–ecological systems. *Ecology and Society*, Vol. 9, Iss. 2 5.  
8 480 [online] URL: <http://www.ecologyandsociety.org/vol9/iss2/art5/>  
9 481  
10 482 Waters, D. (2007), *Supply Chain Risk management: Vulnerability and resilience in logistics*,  
11 483 ISBN: 9780749448547  
12  
13 484  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

For Review Only

485 **Table 1. Meanings of resilience (Adapted from Keessen *et al.* 2013; Folke 2006 and**  
 486 **others)**

Meaning	Source:
The opposite of vulnerability.	Folke, 2006; Levina and Tirpak, 2006
A criterion to evaluate the quality of a strategy for adaptation to a stimulus e.g. climate change.	Adger, 2006; Driessen and Van Rijswijk 2011
Ability of a system to adapt to change, but also the ability of a system to persist despite change.	Gunderson and Light, 2006
Ability of a system to return to its original state or move to a new, more desirable state after being disturbed.	Christopher and Peck, 2004
The time to return to a stable state following shock, or perturbation.	Morecroft <i>et al.</i> 2012; Holling 1996; Pimm 1991
Capacity for renewal, re-organisation and development.	Berkes <i>et al.</i> 2003; Gunderson and Holling, 2002
The amount of disturbance a system can take before its controls shift to another set of variables and relationships that dominate another stability region.	Folke, 2006
The capacity of a system to absorb disturbance and re-organise while undergoing change so as to still retain essentially the same function, structure, identity and feedbacks.	Walker <i>et al.</i> 2004

487 **Table 2. Concepts of resilience (Adapted from Folke, 2006)**  
 488

Resilience concepts	Characteristics	Focal point for management	Context
<b>Engineering resilience</b>	<b>Transactional:</b> return time, efficiency	Recovery, constancy	Stable equilibrium i.e. returning to a steady state.
<b>Ecological resilience</b>	<b>Buffer capacity:</b> ability to withstand shock and maintain supply chain function	Persistence, robustness	Multiple equilibria, stability at a supply chain level
<b>Socio-ecological resilience</b>	<b>Self-organising:</b> interplay between disturbance, reorganising, sustaining and developing i.e. developing through adaptive capacity	Transformability, learning, innovation	Integrated systems feedback, cross-chain dynamic interactions

489  
 490

491 **Table 3: Resilience indicator framework with indicator categories by type and**  
 492 **characteristic (Adapted from Bourlakis *et al.* 2014)**

Indicator	Characteristic		
	Economic	Environmental	Social
<b>Efficiency</b>	Indicators relating to costs, margins and profitability or return on capital employed.	Indicators relating to resource efficiency, waste reduction, and carbon or water footprint.	Indicators relating to worker welfare and management of human capital e.g. staff turnover, productivity per person.
<b>Flexibility</b>	Indicators relating to the capability to provide individual service to customers e.g. differentiated stock keeping units (SKU), meeting changes in order levels or timings, minimising storage costs.	Indicators relating to environmental flexibility include the ability to irrigate crops if rainfall is insufficient, to change what type of forage is produced on the farm in the event of inclement weather.	Indicators relating to worker training and degree of flexibility e.g. multiple skills so can undertake more than one task. Degree of permanent versus contract staff if the fruit crop is late, orders are reduced from the retailer.
<b>Responsiveness</b>	Indicators relating to customer service, distribution and delivery costs.	Indicators relating to growing of new varieties adapted to climate variation, growing varieties that can tolerate more salt, less rainfall in a given region.	Indicators relating to animal welfare or labour standards e.g. reactivity to livestock mortality, livestock lameness, or health challenges. Responses to worker welfare issues.
<b>Product quality</b>	Indicators relating to compliance with product specifications e.g. carcass quality, intrinsic characteristics of fresh produce.	Indicators relating to environmental performance e.g. shelf-life, biodegradable or less environmentally intensive packaging.	Indicators relating to extrinsic production standards e.g. reduced stocking density, extensive production methods and consideration of worker conditions e.g. Fair Trade.

493

494

Only

495 **Table 4. Strategic resilience factors (Adapted from Caiazza and Volpe, 2015; Caiazza et al. 2014; Bourlakis et al. 2014; Delmas**  
 496 **and Burbano, 2011; Muthuri et al. 2006; Elliott et al. 2002; Ackoff 1990; Mintzberg 1978)**

Factors	External influences		Internal influences	
	Executive level		Organisational level	Individual level
Values based dynamics	Pressure from: <ul style="list-style-type: none"> <li>• Non-market actors (legislation, regulators and regulatory environment and non- governmental organisations);</li> <li>• Market actors (consumers, investors and competitors);</li> <li>• New challenges;</li> <li>• Historic legacies;</li> <li>• Community groups</li> </ul>		Pressure from: <ul style="list-style-type: none"> <li>• Organisational structure;</li> <li>• Organisational culture and sub-cultures;</li> <li>• Effectiveness of intra-firm communication;</li> <li>• Degree of organisational inertia;</li> <li>• New organisational challenges; and</li> <li>• Historic legacies.</li> </ul>	Psychological and cognitive pressure include: <ul style="list-style-type: none"> <li>• Narrow decision framing;</li> <li>• Hyperbolic intertemporal discounting; and</li> <li>• Optimistic bias.</li> </ul> This could be due to the use of inaccurate or incomplete information on which decisions are based.
Supply chain dynamics	Pressure from: <ul style="list-style-type: none"> <li>• Demand/supply dynamics;</li> <li>• Externally driven processes such as transport, communication and infrastructure; and</li> <li>• Externally driven controls including supply chain protocols, policies, procedures, systems and assumptions.</li> </ul>		Pressure from: <ul style="list-style-type: none"> <li>• Internally driven processes including communication and infrastructure; and</li> <li>• Internally driven controls including protocols, policies, procedures, and systems.</li> </ul>	Pressure from: <ul style="list-style-type: none"> <li>• Internally driven processes operating at the individual level including communication and infrastructure; and</li> <li>• Internally driven controls operating at the individual level including protocols, policies, procedures, and systems.</li> </ul>
Strategic leadership	Drives: <ul style="list-style-type: none"> <li>• Leadership at Executive level through stakeholder expectations;</li> <li>• Organisational operating system (external drivers); and</li> <li>• Change management (at executive level).</li> </ul>		Drives: <ul style="list-style-type: none"> <li>• Leadership at managerial level;</li> <li>• Organisational operating system (internal drivers); and</li> <li>• Change management at managerial level</li> </ul>	Drives: <ul style="list-style-type: none"> <li>• Leadership at personal level;</li> <li>• Organisational operating system (internal drivers); and</li> <li>• Change management at a personal level.</li> </ul>
Decision making leadership	Drives: <ul style="list-style-type: none"> <li>• Normative decisions (values and impact and decisions that create value);</li> <li>• Policies and principles (rules and formulation of values for the organisation and in turn product and service value;</li> <li>• Strategic decisions (focus on growth and issues that have an overarching organisational impact); and</li> <li>• Tactical, operational decisions (focus on efficiency and cost) or those issues reported annually to shareholders.</li> </ul>		Drives: <ul style="list-style-type: none"> <li>• Normative decisions (cultural and internal values);</li> <li>• Policies and principles (internal);</li> <li>• Strategic decisions (internally focused issues that have an organisational impact);</li> <li>• Tactical, operational decisions (focus on efficiency and cost); and</li> <li>• Tactical planning (operational, short-term goals)</li> </ul>	Drives: <ul style="list-style-type: none"> <li>• Normative decisions (cultural and internal values);</li> <li>• Policies and principles (internal);</li> <li>• Strategic decisions (internally focused issues that have an organisational impact);</li> <li>• Tactical operational decisions (focus on personal efficiency) ; and</li> <li>• Tactical planning (personal, short-term goals).</li> </ul>
Use of performance indicators	<ul style="list-style-type: none"> <li>• Externally driven from the need for regulatory compliance or market pressures to improve productivity through developing measures to drive efficiency, flexibility, responsiveness and product quality.</li> </ul>		<ul style="list-style-type: none"> <li>• Internally driven from the need for regulatory compliance or market pressures to improve operational productivity through developing measures to drive efficiency, flexibility, responsiveness and product quality.</li> </ul>	<ul style="list-style-type: none"> <li>• Internally driven from the need for regulatory compliance or market pressures to improve personal productivity through developing measures to drive efficiency, flexibility, responsiveness and product quality.</li> </ul>

498

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49

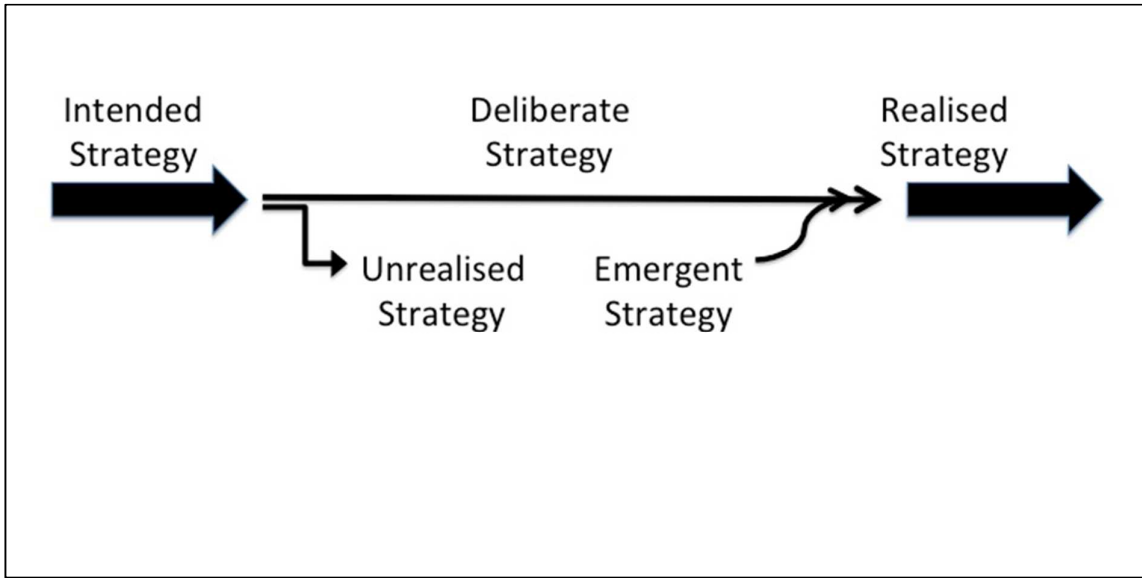


Figure 1. Types of Strategies (Mintzberg, 1978)

499  
500  
501  
502  
503  
504

ew Only



505

External supply chain risks	Internal organisational risks	Ready	Respond	Recover
Natural global disasters affecting suppliers / neighbouring countries e.g. crop failure, drought, war etc.	Natural local disasters e.g. flood, snowstorm, fire etc.	Alternative approved ingredient and service suppliers, appropriate stock levels of key ingredients; weather forecasting, alternative approved packing, processing or storage facilities.	BCM plan in place. Crisis response management team take action according to agreed protocols; introduction of new production plans to avoid productivity loss and minimise disruption.	Continuous improvement at ready and respond sections to ensure quick recovery or change product mix so that continuity can be maintained. Review efficacy of strategies and procedures employed and update as necessary. Develop new protocols, adaption strategies, training programmes as required.
Technological accidents and infrastructure threats (e.g. accidents occurring at suppliers' farms / processing plant, transportation, communication breakdown, loss of data, technical knowledge).	Technological accidents in own processing plant, loss of data, technical knowledge, communication between organisational centres.	Alternative approved ingredient and service suppliers, appropriate stock levels of key ingredients; Predetermined agreement for other organisations even competitors to contract pack product until problem is addressed, clean-up and respond standard operating procedures (SOPs), alternative transport and distribution procedures in place, information back-up, recovery and retrieval procedures developed and ready to implement.	BCM plan in place. Crisis response management team take action according to agreed protocols; Clean-up / repair technological accidents and approval protocols for production to recommence; reduce production of particular products and alternative supply mechanisms put in place to avoid productivity loss. Implement information recovery and retrieval procedures.	
Infectious animal diseases (diseases affecting importing / exporting countries, competitors) e.g. avian influenza, swine fever, foot and mouth.	Infectious diseases (diseases affecting suppliers' farms) e.g. avian influenza, swine fever, foot and mouth.	Infectious disease continuity plans developed and annually tested, emergency procedures developed and tested. Predetermined agreement for alternative suppliers and markets so supply could be diverted to source from other regions or suppliers.	BCM plan in place. Crisis response management team take action according to agreed protocols; Source from different suppliers/ countries if disease outbreak is identified. Implement alternative food products if possible to ensure markets are not lost to competitors. Work with regulatory requirements in terms of movement restrictions etc. until lifted.	
Food fraud and wider food crime incl. terrorism, boycott.	Food fraud and food crime including food tampering, substitution adulteration.	Undertake TACCP assessment and develop response plan. Consider wider potential for food crime associated with products sold e.g. with high value foods, ethnic or specific culture foods. Identify "at-risk" products that require specific monitoring. Horizon scan for emerging and re-emerging food crime hazards. Review security procedures on a routine basis. Develop a plan for alternative suppliers. Implement employee screening and training programmes.	BCM plan in place. Crisis response management team take action according to agreed protocols; Implement controls identified within TACCP Plan or equivalent. Isolate product and implement product withdrawal or recall. Source from different suppliers, investigate reason behind food tampering and include law enforcement agencies where required.	
Food safety incidents / outbreaks / product recall.	Food safety incidents / outbreaks/ contamination from own processing plant.	Undertake food safety risk assessment including HACCP assessment and develop response plan. Determine risk to vulnerable groups. Develop traceability and product recall and withdrawal procedures and test these procedures on a routine basis. Horizon scan for emerging and re-emerging food safety hazards.	BCM plan in place. Crisis response management team take action according to agreed protocols; Implement controls identified within HACCP Plan or equivalent. Isolate product and implement product withdrawal or recall. Source from different suppliers, investigate reason behind food safety incident and include regulatory and law enforcement agencies where required. Undertake sampling and laboratory testing.	
Market and pricing strategies.	Market and pricing, economic crisis.	Financial budgeting and planning including financial contingency plans such as agreed extension to overdraft. Horizontal collaboration to ensure market and price security (Leat and Revoredo-Giha, 2013).	Modify products to address constraints where possible. Market / promote alternative products to address fluctuating food prices/ availability.	

Figure 2. 3Rs (ready, respond and recovery) strategic resilience risk assessment framework for food supply chain

506

507

508



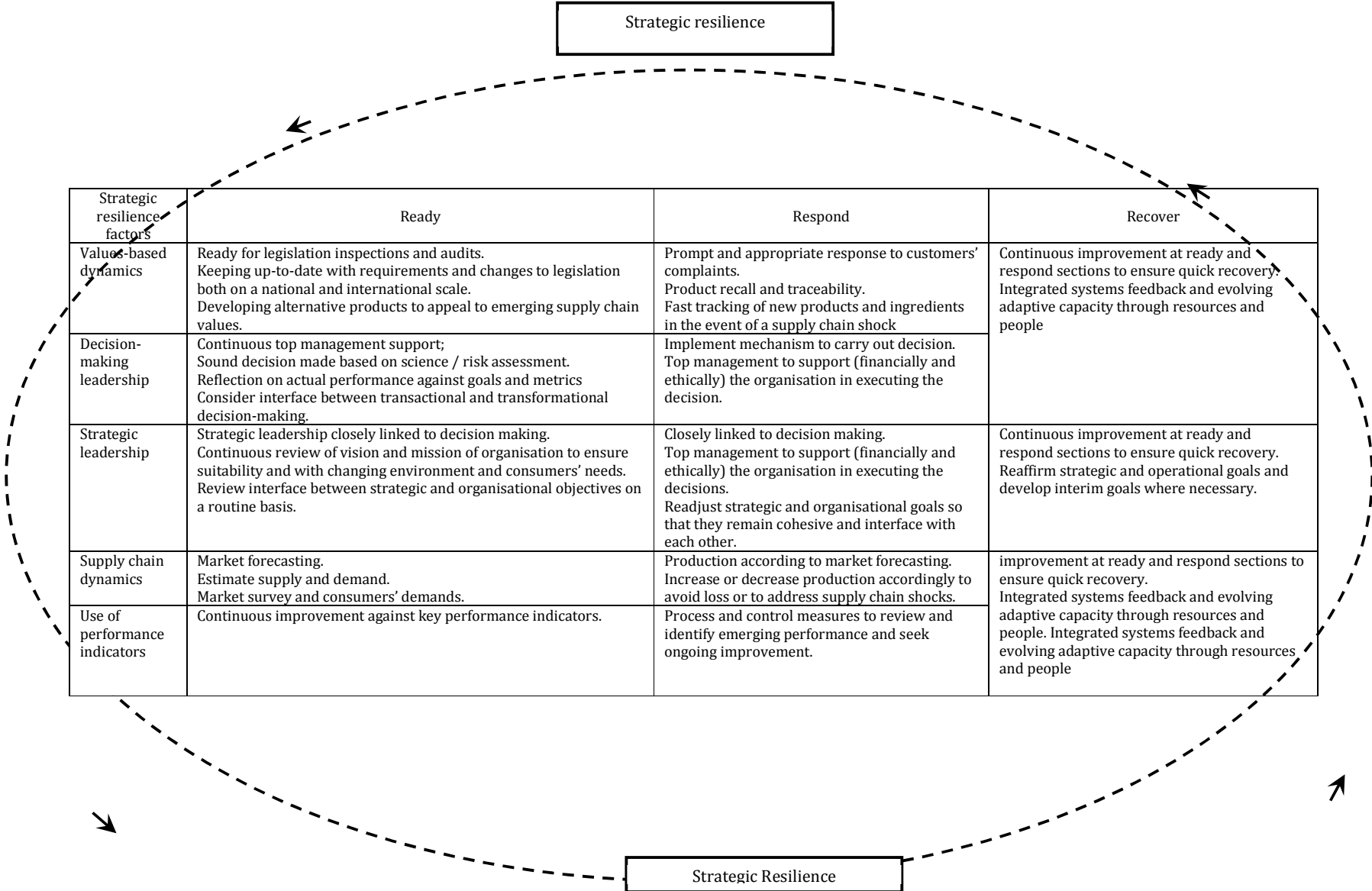
1  
2  
3  
4  
5 509  
6 510  
7 511  
8 512  
9 513  
10 514

Strategic resilience

Strategic resilience factors	Ready	Respond	Recover
Value-based dynamics	Ready for legislation inspections and audits. Keeping up-to-date with requirements and changes to legislation both on a national and international scale. Developing alternative products to appeal to emerging supply chain values.	Prompt and appropriate response to customers' complaints. Product recall and traceability. Fast tracking of new products and ingredients in the event of a supply chain shock	Continuous improvement at ready and respond sections to ensure quick recovery. Integrated systems feedback and evolving adaptive capacity through resources and people
Decision-making leadership	Continuous top management support; Sound decision made based on science / risk assessment. Reflection on actual performance against goals and metrics Consider interface between transactional and transformational decision-making.	Implement mechanism to carry out decision. Top management to support (financially and ethically) the organisation in executing the decision.	
Strategic leadership	Strategic leadership closely linked to decision making. Continuous review of vision and mission of organisation to ensure suitability and with changing environment and consumers' needs. Review interface between strategic and organisational objectives on a routine basis.	Closely linked to decision making. Top management to support (financially and ethically) the organisation in executing the decisions. Readjust strategic and organisational goals so that they remain cohesive and interface with each other.	Continuous improvement at ready and respond sections to ensure quick recovery. Reaffirm strategic and operational goals and develop interim goals where necessary.
Supply chain dynamics	Market forecasting. Estimate supply and demand. Market survey and consumers' demands.	Production according to market forecasting. Increase or decrease production accordingly to avoid loss or to address supply chain shocks.	improvement at ready and respond sections to ensure quick recovery. Integrated systems feedback and evolving adaptive capacity through resources and people
Use of performance indicators	Continuous improvement against key performance indicators.	Process and control measures to review and identify emerging performance and seek ongoing improvement.	Integrated systems feedback and evolving adaptive capacity through resources and people

34 515  
35 516  
36 517  
37 518  
38 519  
39 520

Strategic Resilience



1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49

521 **Figure 3. Strategic Resilience Indicator Framework incorporating values, decision-making, strategic, supply and performance**  
522 **factors into the 3Rs**

For Review Only