

EXTENDED ABSTRACT

RISK AND RESILIENCE IN AGRI-FOOD SUPPLY CHAINS TOWARDS SUSTAINABILITY: A STUDY OF THE BROILER LINK SUPPLY CHAIN DURING PANDEMIC COVID-19 IN GAMPAHA DISTRICT IN SRILANKA

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Abstract

The paper analyzes a major broiler link supply chain in Sri Lanka and aims to reveal key risks and resiliencies to improve a resilient and a sustainable agri-food supply system during the pandemic Covid-19. Particularly with regards to how resiliencies can increase upstream and downstream product supply. This study involved in-depth interviews with sixty eight partners associated in the chain. The resilience increased with short supply chains, less supply chain collaboration, in contrast the agility amongst partners that create higher supply security with assured customer loyalty with legitimate communication. Findings are greater applicable to other agri-food supply chains as well. Industry efficacious effort to adapt the role of resilience to deal with pandemic risks will be enhancing the chain operation. The case is interesting because profitability of broiler meat has been increasing in a fast pace.

Keywords: Broiler link supply chain, pandemic COVID-19, supply chain risk, resilience

1. Introduction

The broiler industry is one of the major profits earning agri-food industry. Demand and consumption of broiler chicken is increasing in a fast pace. COVID-19 illustrates broiler industries fully appreciate their vulnerability for risk through their supply chain disruption. It is courses significant social, economic, and political disruption. Human pandemics disease affects consumer psychology, food purchasing behavior and a significant source of external risk to the smooth operation of supply chains. This source of risk can destabilize supply chains and disrupt the flow of materials from initial suppliers through to final customers (Jabbour, et. al., 2020), leaving them unable to meet demand and satisfy customers' requirements and needs. Therefore, the disruptions caused by pandemic situation to build smarter and resilient broiler link supply chains. In the UK, Ambler-Edwards et al. (2009) have indicated that the future food system will have to combine, despite possible conflicts, four characteristics, namely: resilience, sustainability, competitiveness and the ability to meet and manage consumer expectations. A next step to broiler link supply chains is a broader adoption and development of sustainability.

2. Methodology

The study was carried out in Gampaha district of Western province Sri Lanka. With higher population, pandemic crisis was highly affected for supply chain function in Gampaha district (Area: 1,387 km² & Density: 1,743/km²). In this study, quantitative approach is used and involved in-depth interviews with sixty-eight supply chain partners; (47) small-scale producers, one processor, (10) wholesalers, and (10) retailers were selected from the districts using the snowball technique. The survey strategy was adapted as the research strategy of this study. Primary data were collected through self-administered structured questionnaires. Risk, resilience and factors selecting resilience were measured through five-point likert scales (highly agree, agree, moderately agree, disagree and highly disagree). The secondary data through the organizational data base, internet published documents, books, articles and journals. According to the study objectives, principle components analyze (PCA) were used. Before analyze the principal components, likert scale variables were move through the reliability test to check Cronbach's alpha value. It's should be higher than 0.7 and near to 1 is acceptable for further analysis (Nunnally and Bernstein, 1994). The results from principal component analysis then check the KMO value and Bartlett test of sphericity. According to the Kaiser (1974) the value of KMO is more than 0.7 is acceptable value. So, then sample taken in the study is adequate to run the factors. Principal components having eigen value greater than one will explain the Cumulative percentage of variance explained to total variance in the sample.

3. Results and Discussion

The objectives of the study were to categories the key risk, resilience and influencing factors in selecting resilience. Thus, a principal component analysis was conducted. Before running the factor analysis, reliability test should be applied for the likert scale data in SPSS.

3.1 Measuring key risk for supply chain partners

For the breeder farmers to processing centers; factor analysis yielded two input risk as factor 1; inability to maintain same quantity and factor 2; labor absenteeism with 96.684% variance. Demand risk as factor 1; inability to supply the demand and factor 2; change customer attitude with 70.472% variance. For wholesalers; Factor analysis yielded two input risk as factor 1; inability to timely transport and factor 2; inability to maintain same quantity with 66.983% variance. As demand risk factor analysis yielded two risk factor 1; communication failure with partners and factor 2; inability to payment with 72.362%% variance. For retailers; factor analysis yielded one factor; Labor absenteeism with 60.020% variance. Demand risk as factor 1; inability to supply the demand factor 2; change the customer attitude with 72.809% variance.

3.2 Key resilience involved in developing a resilient broiler link supply chain

The result revealed that three components such as short supply chain, collaboration and agility as a resilience in broiler link supply chain responses to the ten prepared statements as variables for principal component analysis. According to the result revealed that three factors were extracted from ten items. It was factor 1, 2 and 3. For factor 1 four factors were loaded, which included items 4, 5, 7 and 9. Factor 2 four factors were loaded, which include 1, 3, 6 and 8. Factor 3 two factors were loaded, which include 3 and 10. Item 2 was not included any of the factors identified as they did not show sufficient amount of factor loading. All these identity factors explained 75.120% of total variance. The table 1 shows key resilience yielded from factor analysis.

Table 1. Key resilience use by the partners of broiler link supply chain

Item	Mean	SD	Factor	Factors		
			loading	1	2	3
Resilience						
1. Short supply chain	4.75	.436	.931	.127	.628	-.097
2. Spare capacity	4.51	.680	.209	-.203	.122	-.390
3. Confidence in partners	3.76	.492	.774	.042	.421	.771
4. Collaboration	3.26	.588	.912	.917	.265	.013
5. Agility	3.30	.579	.938	.945	.200	.071
6. Visibility of information	3.28	.729	.891	.326	.885	.036
7. Speed of input influx	3.41	.625	.821	.865	.226	-.045
8. Process convergence	3.30	.738	.910	.306	.903	.037
9. Compensation	3.29	.574	.707	.934	.222	.096
10. Risk management culture	3.85	.738	.420	-.164	-.136	.813

3.3 Key influencing factors that selecting desirable resiliencies

There are many factors influencing when selecting desirable resilience on supply chain, which were flexibility in sourcing (Duclos, et. al., 2003), flexibility in Order Fulfillment (Gerwin, 1993), capacity (Collier and Evans 2006), efficiency (Pettit et. al., 2008), adaptability (Esper, et., al., 2007), recovery (Pettit et. al. 2008) dispersion (Cranfield 2003; Rice and Caniato 2003; Sheffi 2005), collaboration (MacCormack and Forbath 2008), security (Rice and Spayd 2005), visibility, organization, market position, financial Strength, anticipation (Pettit et. al. 2013).The table 2 shows the key influencing factors yielded from factor analysis.

According to the results show factor 1; resilience should be recovery the altered pathway to right way to smooth operation again. Factor 2; resilience should be capacity to produce same or higher production during pandemic crisis. Factor 3; market position was other key factor when selecting resilience and it was a main aspect for commercial broiler production industries. According to the Field, 2005 described the factor loading should be above the 0.4 level. So item 2; flexible in order fulfillment was not included any of the factors identified as they did not show sufficient amount of factor loading. So, respondents in the study did not considered the flexible in order fulfillments as a factor when selecting desirable resilience.

4. Conclusion

The study analyzed the possible reasons for risk in the broiler supply chain and has to propose a key resilience to avoid large-scale disruptions in present and the future. According to the findings of the current study supply chain partners had been able to face numerous risks during pandemic Covid-19 in each stage. When considering farmer level labor absenteeism reduced the quantity of inputs, inability to supply the demand and changed the customer attitude were major risk caused to supply chain disruption. Processing center partners were also affected by these same factors. The processing plant had been faced major risk labor absenteeism. The reason behind that pandemic Covid-19 reduced the movement of labors. A human pandemic crisis like Covid-19 impacts on the behavior and movement of people. For the broiler industries, disease and disease fear-caused workplace labor absenteeism affects the feasibility and continuity of some operations. In addition, the agri-food workforce is comprised with employee around the country and food plants already need high standards of cleanliness. Nevertheless, management will need to ensure increased sanitation, infrastructure and improve where possible social distancing, tracking, and communication of potential exposure

Table 2. Factor analysis result to identifying key factors when selecting desirable resilience

Item	Mean	SD	Factor	Factors		
			loading	1	2	3
1. Flexible in sourcing	4.86	.366	.290	.170	.504	-.086
2. Flexible in order fulfillment	4.72	.380	.208	-.119	.119	-.397
3. Efficiency	4.33	.452	.938	.050	.387	.769
4. Capacity to same productivity	3.90	.788	.967	.919	.276	.014
5. Recovery the smooth operations	3.65	.779	.939	.942	.205	.073
6. Adaptable to any condition	3.20	.629	.921	.321	.917	.025
7. Anticipation	3.33	.625	.936	.861	.250	-.041
8. Dispersion of asset	3.30	.748	.744	.289	.940	.036
9. Collaboration with other entities	3.85	.494	.805	.937	.226	.097
10. Organization for same productivity	3.41	.738	.700	-.170	-.108	.812
11. Market position	3.26	.688	.962	.941	.276	.028
12. Security	3.36	.682	.900	.185	.929	.053

to workplace personnel. This way is costly for employers to administer and then also disruptive to workplaces, with the risk poorly handled workplace communications could scare workers away and exacerbate absenteeism and then decrease the production capacity. When considering risk in supply chain link of wholesaler and retailer, they also explored the risk as they received quantity of processed meat to lower level of their capacity, then inability to supply the demand and changed customer attitude. So, beginning of pandemic Covid-19 had been destroying the supply chain function. But there were surely a need to reassure the public of food security. Nothing fundamental has changed with regard to productive capacity in the broiler industries no livestock, or a natural disaster (like flood, pests and destruction of property) has occurred that destroy food output. Movement of agri-food product from farms through to consumers has been resilient system. According to first objective results that this study was able to verify the key resilience namely short supply chain, collaboration and agility. Suggests that as epidemics Covid-19 propagated some certain duration and disrupts the smooth operation of broiler link supply chain, but simultaneously following resilience can move quickly to previous or right pathway. There are some common features of resilient supply chains. Both physical and relationship features. The being short supply chain and agile is two physical features. It was explored as key resilience in this study. Some of other essentially physical feature, with a resilient supply chain is spare capacity, and so on. Other features refer to relationships is collaboration, this study also explored as it key resilience. Other relationship features are confidence in partners, visibility, process convergence, and speed computation and risk management culture to allow the joint solution of mutual problems arising from pandemic disruption for smooth operation of broiler link supply chain. Resilience should be recovery the altered pathway to right way and. resilience should be capacity to produce same or higher production during pandemic crisis. Market position was other key factor when selecting desirable resilience and it was a main aspect for commercial broiler production industries.

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