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Examining the Moderating Role of Government Interdependence on the Relationship between Agricultural Commodities Innovativeness and Supply Chain Resilience: Evidence from Pakistan-Afghan Trade

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Abstract

The present study investigated the relationship between agribusiness innovativeness and supply chain resilience in the context of agricultural commodities trade between Pakistan and Afghanistan. Moreover, the moderating role of government interdependence also investigated in this relationship. The study distributed 380 questionnaires among the actors, out of which 314 were received back. Primarily, the scale reliability was confirmed through Cronbach's alpha technique and found that all the scales used in the study were reliable. The results showed that agribusiness innovativeness has a positive and significant association with supply chain resilience. Government interdependence significantly moderates the relationship between agribusiness innovativeness and supply chain resilience. Theoretical and managerial implications along with future research directions are also discussed.

Keywords	Agribusiness innovativeness, Supply chain resilience, Government interdependence, Cross border trade

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INTRODUCTION

Agriculture Commodities henceforth Agri commodities Trade between Pakistan and Afghanistan is studied as a mechanism for advancing peace and prosperity amongst the countries through leveraging their interdependence for goods and services. Afghanistan is the fourth largest target for Pakistani exports. Most of Pakistan's exports to Afghanistan are mainly agricultural products; reason being that Afghanistan prefers to import agri. commodities from its neighboring countries like Pakistan, due to reasonable costs and favorite tastes. Afghanistan offers a big market for Pakistani agriculture commodities like fruits, vegetables, and staple crops (Mazhar, 2018).

The cross-border trade between the two countries can be categorized mainly into three types (i) transit trade (ii) bilateral formal trade, and (iii) informal trade. The informal trade has been the main source of livelihoods for communities on both sides of the borders. Although main trade activities are mostly carried out via Torkham border in Khyber Pakhtunkhwa (KP) and Chaman border in Balochistan. There are multiple crossing points in North- and South Waziristan, Kurram, Khyber, Mohmand, Bajaur, Dir and Chitral districts of Khyber Pakhtunkhwa (KP), as well as in Zhob, Killa Saifullah, Pishin and Chagai districts of Balochistan. The recent border fencing and closure of the border crossings at multiple points have curtailed informal trade between the two countries that have temporary/transitional implications for the livelihoods of the communities living on both sides of the border. Over the years, formal trade between Afghanistan and Pakistan got gradual motivation. Afghanistan has a geo-strategic position being an access to Central Asia. The circumstances unfolding in Afghanistan and their implications gave an intimidating challenge to the internal, regional, and international actors who have a stake in Afghanistan for future and making efforts towards rebuilding the war-devastated country (Javaid and Javaid, 2016).

Former research shows that Supply Chain Resilience (SCR) is a reasonably innovative capacity of Agri commodities and its link to risk controlling (Pettit *et al.*, 2010). Particularly, its change commencing conventional risk management methods and requires supplementary assessment and practical analysis. Sketching on earlier research that highpoints are overlooked the role of innovativeness in indeterminate and dangerous environments, therefore, we try to study the Agri commodities trade innovativeness as a hypothesized backgrounds of Supply Chain Resilience under this study. Further explicitly, in which circumstances stable innovativeness can be focused to moderate and divert difficulties; furthermore, to adopt a high level of Agri commodities trade supply chain resilience. We support the new writings regarding the requirements of such identifications in the appearance of the very significant matter of handling supply chain disturbances and irregularities as an agribusiness about the world are gradually uncovered to distractions (Baghersad and Zobel, 2020).

Therefore, the objective of this study is to explore the relationships among of Agribusinesses through value chains development approach being innovativeness, government interrelationship, and supply chain resilience in the entire chain of supply at both levels backward to farm wards market. This study seeks to expose the capabilities of innovativeness in stable supply chain resilience as per the possibilities of supply chain insecurity and value chains players' interdependence. While strong innovativeness is assessed as a basic competency that influences the Agribusinesses

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supply chain resistance, seasonal uncertainty and correlation are assumed as an administrator of such association within value chains players. Our purpose to enable connecting the gap between innovation and supply chain resilience in study streams, moreover, propose to add both Supply Chain Management (SCM) and value chain development literature to explore the nature of association concerning innovativeness and supply chain resilience (Pertheban and Arokiasamy, 2019). It is believed that discovering the possible impact of Agri commodities supply indecision and interconnection in the linking between innovativeness and supply chain resilience can help us to answer the question of how and which situations innovativeness might be applied to improve and secure supply chain resilience in Agri commodities value chains.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Agribusiness innovativeness through value chain approach is a unique model that contribute to directness and capability to propose value addition in the agribusiness supply chain (Khan et al., 2024). Innovativeness is one of the most beneficial resources for agribusinesses in terms of technological improvement, mechanization, marketing, and appropriate logistics (Tait, 2007).) it is exceptionally applicable in disordered market channels and environments (Azadegan and Dooley, 2010). Innovativeness, as an ability, it is a most important basis for different natures of innovations (Deininger and Liu, 2013), comprising high-tech innovations and modern Agri marketing strategies (Huang, 2011).

Value addition in agribusinesses is not as much challenging. It is open to fashioning and modification towards roles of actors involved in the different nodes of value chain (Gereffi and Lee, 2016). Such Agribusinesses additionally demonstrate a greater expertise to accept, adjust, accomplish, and pull new initiatives successfully. Agribusiness innovativeness is persistently applicable subsequently it could be utilized to flourish in vital agribusiness backgrounds. It's essential that these agribusinesses utilize revolutions both good and confronting period (Azadegan and Dooley, 2010). As a conclusion, business innovativeness could be linked to an inclusive diversity of other capabilities incorporating resilience (Tait, 2007).

Problem and Risks in supply chains might indicate terrible adverse effects on agribusiness holder. Therefore, as Hitt (2011) maintain, accepting the expertise important to agribusinesses supply chain resilience happen to exceptionally vital with difficult circumstances. Accordingly, stable agribusiness innovativeness could be developed, positioned, in addition to leverage versus disturbing and unsuccessful results choosing place in the agribusiness's supply chain. Naturally, state-of-the-art agribusinesses are added possible to assume advanced explanations to remain implemented into frame, to cover the adverse influences of arbitrary hardships and interruptions accompanying the place in running supply chains.

Additionally, reflection of an exceptional disturbing result expands the experience of its likelihood. Thus, agribusinesses can re-measure the impacts of consequences and spend additional in innovative resolutions to decrease related challenges in the forthcoming time. Subsequently, an agribusiness's competence to generate understandings quickly in the direction to solve complications, also accomplish long-time explanations beside risks, therefore, its innovativeness, could be indispensable while meeting instabilities and difficulties in supply chains (Ahmed and Khan, 2021).

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Similarly, supply chain resilience might observe as an anticipated result of special stable abilities like as Agribusiness innovativeness. Moreover, resilience implies involvement, readiness, and energy as well, moreover it may be a part of practical approaches to avoid declining into an uninvited situation in waken of calamities and interruptions (Horton et al., 2023). Briefly, we contend that strong innovativeness possibly will help agribusinesses toward answer to troublesome then adverse actions, that arise at their supply chains creation those agribusinesses and their direct supply chains extra resilient by refurbishing the structure that establishes their value contributions.

However, it is extremely uncertain that the effect of agribusiness innovativeness proceeding supply chain resistance, identical moreover general and common. Hence, showing possibility of opportunities on the connection concerning agribusiness innovativeness and supply chain resilience might suggest significant perceptions. Accordingly, in this research we will obtain to discover the role of dependent circumstances in the correlation involving agribusiness innovativeness and supply chain resistance, preliminary by the possible impression of supply uncertainty as a key issue.

The very assumption of both the interactive view and the network theory suggest that agribusinesses are mutually dependent and can benefit each other by sharing their assets and resources (Dyer and Singh, 1998; Borgatti and Foster, 2003). In vertical and horizontal agribusiness innovation networks provide opportunities to exploit harmonizing resources that reside beyond the boundaries of the business (Capaldo, 2007) and that are essential for agribusinesses like small and medium Agri enterprises (SMEs) with internal resource shortage. Apparently, government response to challenges presented by business environments and expectations that the exchange generates benefits for the actors involved are two key drivers for agribusiness holders within the business networks (Gulati and Gargiulo, 1999). Subsequently, government support refers to the extent of mutual dependence between exchange partners (Gulati and Gargiulo, 1999).

On the one hand, Government may create challenges to agribusinesses that face distractions (Kleindorfer and Saad, 2005). Increased role of government to buyers and suppliers confined by the lack of control could make those supply chains highly vulnerable (Hendricks et al., 2009). Likewise, the degree of government and dependence on outside entities is argued to be a key vulnerability factor that could weaken businesses supply chain resilience (Pettit et al., 2010). Specifically, increased dependence usually leads to reduced occasions for operational flexibility, and the high connectivity in turn leads to a lack of consistent alternatives (Hearnshaw and Wilson, 2013). On the other hand, the government support may also have numerous benefits in the wake of calamities and difficulties. For example, within agribusiness forums linkages could serve as a buffer against disturbances (Miner et al., 1990). Agribusinesses may have more prospects to innovate and leverage their innovativeness when they are mutually dependent. Interdependence with government is inseparably linked with commitment (Geyskens et al., 1996), cooperation, mutual utilization of resources, and cross-pollination of practices (Borgatti and Foster, 2003) that are all encouraging to higher understanding and control of innovations (Mahapatra et al., 2010). Innovative behavior of one actor is more likely to be adopted by supply chain partners with high correlation and strong operational and interpersonal embedded ness (Mahapatra et al., 2010). For example, new

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environmental practices are discussed to be strewed at higher degrees in networks with high structural and behavioral embedded ness (Tate et al., 2013). Mutuality and commitment can also facilitate with in business entity transfers knowledge (Geyskens et al., 1996). In fact, the very premise of the diffusion of innovations principle suggests that innovations and their positive outcomes spread out faster and more effectively when actors in the network are highly connected and interdependent (Borgatti and Foster, 2003). Thus, innovative solutions to supply chain disruptions and disasters are likely to be diffused faster and more effectively through businesses networks when network members are more interdependent. Subsequently, a growing body of literature offers relatively strong support for potential strengthening of the role of government interdependence in the relationship between agribusiness innovativeness and Supply Chain Resilience.

Given the alternative accounts on the influence of government interdependence on potential development and utilization across businesses, there is a need to evaluate the pros and cons of government interdependence with agribusiness. An overall evaluation of theoretical evidence signals that the potential benefits of correlation are likely to compensate its limitations. Therefore, we explore that higher levels of interdependence among the members in supply networks also enhance an agribusiness's potential to benefit from a higher level of innovativeness when it comes to supply chain resilience at the agribusiness level. In other words, the influence of agribusinesses' innovativeness on the supply chain resilience is expected to live greater by multiplied interdependence including all members of agribusinesses networks. Based on the cited literate, the following hypotheses were developed.

H_1: Agribusiness innovativeness is significantly related to agribusiness supply chain resilience in the agricultural commodities value chain.

H_2: Government interdependence moderate the relationship between agribusiness innovativeness is significantly related to agribusiness supply chain resilience in the agricultural commodities value chain.

Based on the citied literature and the stated hypotheses, Figure 1 reported below showed the conceptual framework of the current research.

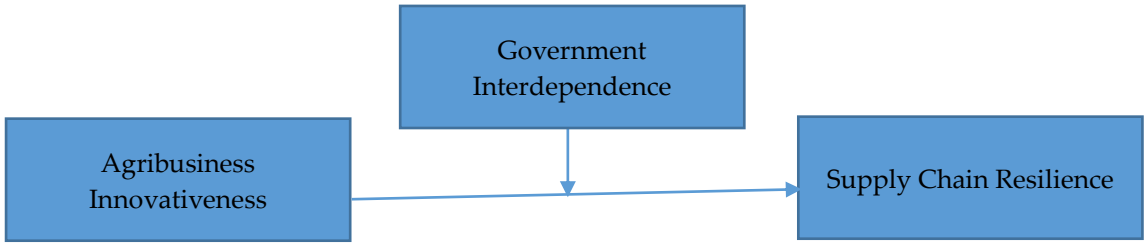

FIGURE 1: CONCEPTUAL FRAMEWORK OF THE CURRENT RESEARCH

METHODS

POPULATION AND SAMPLE

The present study collected the data using structured questionnaire. The research philosophy of the present research is positivism because the researchers believe on facts and figures and used quantitative data for analysis and final conclusion. The population of the current study was stakeholders of agriculture commodities both in Afghanistan and Pakistan at Torkhum and Peshawar. The sample of the present was 380. Using sample random sampling, the study distributed 380 questionnaires and received 320. Some questionnaires were either incomplete or wrongly filled, therefore

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such questionnaires were discarded from the study. Thus, the final sample is comprises of 308 respondents.

MEASURES

Supply Chain Resilience: Supply chain resilience assessed through a scale developed by Chen and Paulraj, (2004). This scale has six items, and all measured using five-point Likert scale. Sample item is "our agribusiness supply chain has the ability to maintain a desired level of control over structure and function at the time of disruption".

***Agribusiness Innovativeness*:**Agribusiness innovativeness assessed utilizing five-point Likert scale developed by Scott and Bruce (1994). This scale has six items. Sample item is "our agribusiness through value chain approach is known as an innovator among different vegetable agribusiness in our area".

Government interdependence: Government interdependence was measured using a scale developed byMonczka et al., (1998). This scale has six items. The sample item is "the tile to replace a lost strategic customer would be extremely long for agribusiness".

RESULTS

To confirm whether the scale used in the present research provides consistent results when it is tested again and again is termed the reliability of the scale. To measure scale reliability a well-practiced technique called Cronbach's alpha is applied. This technique is highly practiced and well-known for reliability analysis.The value of Cronbach's alpha falls between 0 to 1. The recommended value of Cronbach's alpha is 0.70 or above and the value near to 1 shows the higher reliability. Table 1 reported below shows the reliability statistics. As seen the values of all the three scales used in the present research are greater than the recommended value of 0.70. Therefore, it is confidently stated that the scales used by the current study were reliable.

TABLE 1: RELIABILITY ANALYSIS

	No. of Items	Alpha	Status
AgI	6	0.874	Reliable
GI	6	0.768	Reliable
SCR	6	0.863	Reliable

To test the hypothesized relationship between the study's independent variable, i.e., agribusiness innovativeness and the dependent variable, i.e., supply chain resilience a simple linear regression was applied. The results of the regression analysis are reported in the following table.

TABLE 2: COEFFICIENTS

	B	S.E	t	p	f	R^2
Constant	2.641	0.136	19.407	0.000	124.57	0.285
AgI	0.379	0.034	11.161	0.000		

The regression output reported above shows that agribusiness innovativeness (AgI) is positively and significantly related to supply chain resilience (SCR) ($t = 11.161$, $p<.05$). The value of f is also very good showing that the model is fit. The value of R^2 is .285 which indicates that the AgI explain a 28.5% variation in the dependent

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variable SCR. The coefficient value is .379 indicating that a unit change in AgI will bring a .379 unit change in SCR. Therefore, hypothesis 1 which stated that agribusiness innovativeness is positively and significantly related to supply chain resilience is accepted.

To test the moderation hypotheses, the present research followed Hayes (2018) moderation procedure using PROCESS Macro. As the model of the present study is simple moderation, therefore, Hayes (2018) recommends using Model 1 for such type of simple model. Thus, the current research employs Model 1 to test the moderation hypotheses. The results of the moderation analysis are reported in the following tables.

TABLE 3: MODERATION RESULTS

	coeff	se	t	p	LLCI	ULCI
Constant	-4.56	1.17	-3.91	0.00	-6.86	-2.26
AgI	1.84	0.30	6.15	0.00	1.25	2.43
GI	1.54	0.28	5.49	0.00	0.99	2.10
Int_1	0.31	0.07	7.47	0.00	0.17	0.44

Table 3 reports the result of moderation analysis where government interdependence (GI) moderates the relationship between AgI and SCR. As seen, the value of t and p of the interaction effect (Int_1) is significant and positive ($t = 7.47$, $p < .05$), showing that GI moderates the relationship between AgI and SCR. Therefore, the relationship between AgI and SCR is strong when GI is there. Thus, hypothesis 2 which stated that GI moderate the relationship between AgI and SCR is accepted.

DISCUSSION

Agribusiness innovativeness plays a crucial role in strengthening the resilience of supply chains, particularly in the face of supply uncertainty and fluctuating environmental conditions. According to Adhikari *et al.* (2022), agribusiness firms that focus on innovative practices, such as diversifying their product offerings and investing in technology, are better positioned to weather disruptions in the supply chain. By incorporating such strategies, companies not only enhance their competitive advantage but also improve their ability to adapt to changing market conditions. Similarly, Ivanov and Dolgui (2020) emphasize the significance of a resilient supply chain network, noting that resilience strategies, such as flexibility and risk mitigation, are vital for maintaining stability during periods of uncertainty.

The moderating role of government interdependence in the resilience of supply chains is critical in understanding the dynamics of agribusiness sectors. Ketchen and Craighead (2020) highlight how GI can exacerbate the challenges faced by businesses, leading to delays, higher costs, and reduced customer satisfaction. In the context of agribusiness, the unpredictable nature of crop yields, fluctuating input prices, and the variability in consumer demand make supply chains particularly vulnerable to disruption. As a result, supply chain resilience strategies, such as forecasting, contingency planning, and diversification, are essential to mitigate the impact of uncertainty. This aligns with the findings of Sarkis and Zhu (2023), who discuss how enhanced supply chain resilience can buffer the negative effects of uncertainty, allowing businesses to maintain operational continuity.

Government intervention and policy support have been shown to play a pivotal role in strengthening supply chain resilience, particularly in sectors facing external

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challenges like agriculture. Chopra and Sodhi (2023) argue that effective government policies can help agribusinesses recover quickly from disruptions by providing financial assistance, easing trade barriers, and facilitating market access. Nair and Vidal (2021) further suggest that government collaboration with the private sector is necessary for the long-term resilience of supply chains, especially in the food sector. They argue that policy frameworks that encourage partnerships between public and private entities can help streamline processes, reduce inefficiencies, and enhance overall supply chain performance.

Furthermore, collaboration between public and private sectors is a key driver of supply chain resilience. Farahani *et al.* (2023) underscore the importance of collaboration in managing cross-border supply chains, particularly in the agricultural sector where raw materials often cross multiple borders. By creating strong partnerships and sharing information, businesses can improve their ability to respond to disruptions and mitigate risks. This collaborative approach also helps in optimizing supply chain management practices, leading to better outcomes for both the public and private sectors.

In conclusion, fostering agribusiness innovativeness, and enhancing government-private sector collaboration are integral to achieving resilient supply chains. The literature suggests that by focusing on these factors, businesses can build more adaptable, sustainable, and robust supply chains capable of withstanding the challenges posed by market volatility and external shocks.

CONCLUSION

The study highlights the critical role of resilience supply chains in agricultural commodities trade between Pakistan and Afghanistan. The findings indicate that while the supply chain has evolved towards greater innovation and government interdependence, challenges such as inadequate infrastructure, security concerns, and energy shortages continue to impede trade flow, particularly for perishable goods. The agricultural value chain, though bolstered by improved practices and hybrid seed varieties, is still hindered by inadequate facilities and frequent border closures, causing significant delays in exports. Moreover, the use of ICTs in agriculture remains limited in Khyber Pakhtunkhwa, with farmers relying on traditional sources of information rather than newer technologies that could enhance productivity. Pakistani agricultural exports to Afghanistan, particularly in cereals, fruits, and livestock, account for a substantial portion of bilateral trade. However, rising energy costs, limited transportation infrastructure, and inefficient customs procedures further exacerbate the challenges faced by exporters. These factors contribute to Pakistan's diminished competitiveness in the Afghan market. The study also underscores the importance of strengthening trade relationships, addressing quarantine and border clearance issues, and investing in infrastructure. The planned upgrades at border terminals, including the Integrated Transit Trade Management System (ITTMS), are expected to improve clearance rates and enhance the efficiency of trade. However, security concerns remain a major barrier, especially for perishable goods, and have led traders to explore alternative markets and informal crossing points.

THEORETICAL CONTRIBUTION

Theoretical analysis of the study contribution of agriculture commodities trade between Pakistan and Afghanistan, based on various economic theories. Both Pakistan and Afghanistan have comparative advantages in producing different agricultural commodities. Pakistan has a comparative advantage in producing crops

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like wheat, rice, and sugarcane, while Afghanistan has a comparative advantage in producing fruits like grapes, pomegranates, and apricots. The study observed that there could be marvelous gains from trade in agriculture sector and its supply chain resilience and innovativeness. This will arise from specialization and exchange and will have a comparative advantage, increasing efficiency and reducing costs. Agri commodities trade between and its supply chain resilience and innovativeness can lead to economies of scale, as firms in both countries can increase production and reduce costs Pakistan and Afghanistan. This will lead to product differentiation, as firms in both countries can specialize in producing unique agricultural commodities. Furthermore, the competition between firms in both countries, leading to increased innovation and productivity.

Trade agreements and institutions, such as the Afghanistan-Pakistan Transit Trade Agreement, can facilitate trade between both countries. A well-functioning institutional framework, including laws, regulations, and institutions, is essential for facilitating supply chain resilience and inviolateness between Pakistan and Afghanistan. Different Institutions can play a crucial role in trade facilitation, including reducing transaction costs, improving logistics, and enhancing transparency. Hence, Institutions can provide a framework for dispute resolution, reducing the risk of trade disruptions and promoting stability. The supply chain resilience of Agri commodities vale chain can withstand disruptions. The duplication of critical components or processes to ensure continuity. This can speed at which a supply chain can respond to disruptions. The strength of relationships between value chain nodes through supply chain resilience, innovativeness, interdependence create pattern of connections and the ability of the network.

PRACTICAL IMPLICATIONS

The practical analysis of the study contribution of agriculture commodities trade and its supply chain resilience and innovativeness between Pakistan and Afghanistan maintained risk management. Trading multiple agricultural commodities reduces dependence on a single commodity. Using financial instruments to mitigate price volatility. Tracking and tracing, monitoring the movement of goods enables real-time visibility. Moreover, its analysis of trade data identifies potential bottlenecks. This also focused on flexibility, adaptability and adjusting inventory levels or using just-in-time delivery.The study showed to promote value chains Public-private partnerships, industry associations and collaboration to develop and implement resilience strategies. To share best practices and coordinate responses accordingly. Further focus needs to remain on real-time monitoring and data analytics. It will be responding quickly to changing market conditions, reducing lead times and improving supply chain operations. It will enhance access to food through efficient supply chain operations.

The study showed the trade facilitation and supply chain resilience, the development of transportation infrastructure, including roads, bridges, and border crossings, will improve the efficiency and reduce the cost of trade between the two countries. Frequent collaboration and communication among stakeholders, including traders, transporters, and government agencies is the prime part of Agri commodities supply chain resilience to promote value chains. Resilience supply chains can ensure the continuous availability of food, improving food security in Pakistan and Afghanistan.

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LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

Although, the present research provide some important insights to the existing body of knowledge related to agribusiness innovativeness and supply chain resilience, however, there are some potential limitations that need to address in the future studies. First, the current study empirically evaluated the impact of supply chain resilience on agribusiness innovativeness, government interdependence can moderate this relationship. However, there are many other factors which also improve the sustainability of supply chain resilience like environmental sustainability focusing on reduced food waste at the post-harvest level along use of efficient resources and sustainable agriculture practices at the production level. Second, supply chain resilience could be impacted through social sustainability means to improve farmers' livelihoods and enhance food security. These parameters could be measured at production, post-harvest handling and marketing/aggregation stages. The data is collected only at the Torkham border and from Peshawar-based stockholders. While the study research could be enhanced to other multiple crossing points in North- and South Waziristan, Kurram, Khyber, Mohmand, Bajaur, Dir and Chitral districts of Khyber Pakhtunkhwa (KP), as well as in Zhob, Killa Saifullah, Pishin and Chagai districts of Balochistan. Future studies can consider customer perspective or matching studies (collecting data from customers and managers) to evaluate more thoroughly the resilience of the Agri commodities supply chain.

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