

## Impact of conflict on Lebanon's food industry: Challenges, needs, and emergency response

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### Abstract

Against the backdrop of compounded crises, economic collapse, COVID-19, and violent conflict, Lebanon's food system has become increasingly vulnerable. This study examines war's impact on Lebanon's agri-food small and medium enterprises (SMEs), the backbone of its food industry and economic resilience. This study evaluates the impact of

war on operational aspects and identifies key recovery priorities by employing a quantitative survey of members of the QOOT cluster, Lebanon's leading agri-food business network. The results show widespread disruption, with significant challenges in financial performance and market access. Other major concerns include supply chain disruptions, workforce issues, and infrastructure damage. Key business needs identified include emergency financial assistance, alternative market and supplier connections, enhanced workforce safety, and infra-

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*Disclosures etc. are on the next page*

structural support. The findings reveal vulnerability in Lebanon's agricultural sector due to geopolitical shocks and the urgent need for emergency responses focusing on resilience, diversification, workforce protection, and infrastructure. This research guides humanitarian and development efforts to safeguard food security and economic sustainability.

### Keywords

sustainability, food industry, agri-food enterprises, small businesses, emergency preparedness, conflict zones, risk, challenges, Lebanon

### Introduction

Food systems face unprecedented threats due to multiple crises: COVID-19, violent conflicts, economic downturns (particularly domestic food price inflation), and devastating climate extremes (United Nations Industrial Development Organization [UNIDO], 2023). These crises have prompted failures across global food systems and supply chains, fueling hunger and limiting livelihoods, resulting in the worst food crisis in human history (World Bank, 2023). These interlinked disruptions directly undermine Sustainable Development Goal 2 (Zero Hunger) by reversing progress on ending hunger, achieving food security, and improving nutrition worldwide (Atukunda et al., 2021).

The efforts toward global food security have been reversed since the COVID-19 pandemic and exacerbated due to several political conflicts, which have added 200 million people to the pre-COVID global food-insecure population (World Food Programme [WFP], 2025). Worldwide, violent conflicts account for 95% of displaced people (94% of whom reside in climate-vulnerable areas) and were a significant contributor to food insecurity (UN High Commissioner for Refugees [UNHCR],

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### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### Data Availability

Data available upon request.

2024). Based on the most recent data, in 2022, about 2.4 billion people were either moderately or severely food insecure, and more than 3.1 billion could not afford a healthy diet (Food and Agriculture Organization of the United Nations [FAO] et al., 2023).

Lebanon exemplifies the devastating interplay of these global challenges. Since 2019, Lebanon has been hit by the most devastating multipronged crisis in its modern history. The country is facing an unfolding economic and financial crisis, with the national currency losing over 90% of its value since October 2019 and with food inflation soaring 5,000% compared to pre-COVID levels (Human Rights Watch, 2022). The health impact of the COVID-19 pandemic, compounded by the devastating Beirut Port explosion in August 2020, has further strained the country, which was already facing sustained structural and resource pressures, including those associated with the prolonged Syrian refugee crisis and ongoing governance challenges (World Bank, 2025). This economic freefall has intensified the country's struggle to provide for its citizens, creating a vicious cycle of poverty, unemployment, and widespread hunger. Poverty has more than tripled over the past decade (World Bank, 2024).

According to the Integrated Food Security Phase Classification (IPC, 2025), acute food insecurity across the country led to 50% of Lebanese families (13%) being food insecure and unable to put food on their tables, while 29% of the population—1.65 million people—faced acute hunger. This precarious situation was exacerbated by the recent escalation in the last quarter of 2024, which included bombardment and ground operations that damaged and affected main agricultural lands in the south of Lebanon, the Bekaa Valley, and Baalbek-Hermel (considered the reservoir for staple food and location of major food industries), disrupting supply chain operations across the country (Dal et al., 2021). These developments intensified the pressure on an already susceptible agri-food sector composed mainly of small and medium-sized enterprises (SMEs) (UN Development Programme [UNDP], 2024). SMEs are key drivers of Lebanon's economy, accounting for 95% of businesses and employing half of the workforce (Farran &

Fawaz, 2018). SMEs historically account for over 50% of the labor force and contribute around 40% of economic output. Globally, agri-food systems accounted for around 39% of the global workforce in 2021. In agri-food systems, SMEs also form a major component of the agricultural and food value chain, often representing the majority of enterprises and employing a significant share of the workforce. This is particularly the case in the low- and middle-income regions, where agri-food activities constitute a large portion of total employment and economic activity (FAO, 2024). SMEs thrive with support from several initiatives, including financial institutions, accelerators, and venture capital firms (UNDP, 2025). However, the economic freefall, hyperinflation, capital controls, and socio-political unrest have severely undermined the resilience of these enterprises. As key drivers of economic growth and job creation, the weakening of SMEs poses a serious threat to Lebanon's ability to sustain its food systems and broader economy.

Since 2019, several international entities, such as the U.S. Agency for International Development (USAID), UNDP, the European Bank for Reconstruction and Development (EBRD), and the Embassy of the Netherlands, among others, have provided unique programs and funding opportunities to enhance the competitiveness, sustainability, and innovation of agri-food SMEs (UNDP, 2025). Among these initiatives, the QOOT Agri-Food Innovation Cluster was initiated in 2019 by Berytech and the Embassy of the Kingdom of the Netherlands. QOOT is Lebanon's leading agri-food cluster, catalyzing sustainable growth, enhancing capabilities and competitiveness, and opening world markets to Lebanese agri-food businesses. Although these strategies have the potential to support the agri-food sector, Lebanon continues to face persistent challenges due to unstable geopolitical conditions and ongoing financial difficulties (QOOT, n.d.). These factors create recurring obstacles that jeopardize the stability and growth of the sector, making it more vulnerable to external and internal shocks. Appendix 1 depicts a detailed timeline of Lebanon's conflict history from 2006 to 2025 to contextualize the compounded crises that have shaped the current socio-economic landscape.

This compounded crisis environment has

severely strained Lebanon's agri-food sector, leading to heightened vulnerabilities for SMEs. Seventeen percent of the resident population in Lebanon (874,000 people), are facing high levels of acute food insecurity, a figure projected to rise as humanitarian funding declines (IPC, 2025).

These disruptions in the agri-food sector have disproportionately impacted SMEs, which are vital to Lebanon's economy, providing jobs and contributing to food systems stability. Consequently, this study aimed to identify the challenges faced by agri-food sector SMEs in the QOOT cluster during conflict and to provide actionable insights for future interventions to enhance their adaptive capacity and support their critical role in sustaining Lebanon's economy and food systems.

### **Methodology**

This section outlines the methodological approach adopted to examine the impact of war on SMEs in Lebanon's agri-food sector. It describes the study design, questionnaire development, survey dissemination and data collection procedures, methods of data analysis, and ethical considerations that guided the conduct of the study.

### ***Research Design***

This study employed a quantitative research design to investigate how war has affected SMEs in the agri-food sector in Lebanon. A cross-sectional study recruited SMEs in the agri-food business across Lebanon that are members of the QOOT Cluster. An initial online meeting with Cluster members was held to align on the research topic and identify their needs, which facilitated a more targeted approach to data collection. Based on the meeting outcome, a structured questionnaire was designed as a primary data collection tool to gather insights from SMEs in the QOOT Cluster.

### ***Questionnaire Development***

The questionnaire was developed based on extensive literature pertinent to the impact of war on SMEs in the agri-food sector (International Trade Centre, 2023).

The questionnaire contained two main sections: (1) questions related to respondents and company information, and (2) Likert-scale ques-

tions assessing the impact of war on the SME across different business areas, including infrastructure, finance, supply-chain and procurement processes, human resources, and market access. In addition, it assessed company needs in each area. Prior to the full-scale deployment of the questionnaire, a pilot test was conducted to evaluate its clarity, relevance, and overall effectiveness. This preliminary testing involved a sample of three participants drawn from the target population of food SMEs in the QOOT Cluster. The pilot test aimed to identify any ambiguities or issues in the questionnaire and to ensure that respondents understood the questions as intended. Feedback from these participants was collected and analyzed to further refine the questionnaire. The pilot test was carried out over one week, allowing sufficient time for participants to respond and provide insights. Based on their feedback, adjustments were made to improve the questions' clarity and relevance. This iterative process ensured that the final version of the questionnaire was well-structured and aligned with the research objectives.

### *Survey Dissemination and Data Collection Process*

The survey was conducted using the Jotform platform, and the dissemination period lasted for one week, from October 4 to October 11, 2024. The questionnaire was disseminated to 135 members of the QOOT Cluster through two primary channels: email and WhatsApp. Out of the 135 questionnaires sent, 62 responses were received, indicating an acceptable level of engagement among participants.

### *Data Analysis*

Quantitative data collected from the questionnaires were analyzed using Microsoft Excel for Microsoft 365 (Version 2601). Descriptive statistics were calculated to summarize demographic information and key variables related to the impact of war on SMEs.

### *Consent and Ethical Considerations*

The data were collected to obtain insights from SMEs in the QOOT cluster in Lebanon without requiring prior consent, as QOOT routinely col-

lects data from its members. Following the data collection, Notre Dame University–Louaize (NDU) secured institutional review board (IRB) approval for its use (IRB 202430).

## **Results**

### *SME Characteristics*

Out of 135 SMEs invited, a total of 62 companies participated, resulting in a response rate of 46%. Almost half were from the Mount Lebanon region (51.6%), 40% were medium-sized (11-50 employees), and 48.4% were food and beverage producing companies. The companies' characteristics are summarized in Table 1.

### *War's Impact on Financial Losses and Business Operations*

Most companies reported being affected by the war (98.4%), among which 9.8% ( $n = 6$ ) were directly affected through considerable damage to facilities and resources. In addition, 90.3% of the companies reported monetary losses during the war, of which 57.1% ( $n = 32$ ) estimated their losses or additional expenses to be between US\$10,000 and US\$50,000.

Out of the various business dimensions affected during the war, the most frequently reported challenges were financial constraints (91.9%) (e.g., cash flow issues and limited access to credit) and reduced access to markets (91.9%) (see Figure 1). Supply-chain and procurement disruption followed, as it was reported to impact 74.2% of companies, while over half of respondents (51.6%) experienced issues related to human resources, such as employee safety and workforce availability. Production management disruption was reported by 33.9% of respondents, whereas infrastructure damage affected 16.1%.

### *Business Dimension Severities*

Between 17 and 21% of the respondents reported a severe impact of the war on different business dimensions (Figure 2). Financial performance and access to markets were not only the most frequently reported challenges, but also the most significantly impacted, as reported by 66.7% and 63.1% of respondents, respectively. Moreover, nearly half (43.9%) of the respondents experienced significant

effects on staff-related issues such as employee availability and safety, and 34.8% considered the impact on their supply chain to be significant.

**Table 1. Characteristics of the Responding Agri-food Small and Medium Enterprises (SMEs) (N = 62)**

Variable	Frequency	Percentage
<b>Location</b>		
Mount Lebanon	32	52%
Bekaa	15	24%
South	6	10%
North	5	8%
Beirut	4	6%
<b>Size</b>		
Small (1–10 employees)	23	37%
Medium (11–50 employees)	25	40%
Large (51+ employees)	14	23%
<b>SME Sub-Industry<sup>a</sup></b>		
Food	30	48%
Non-food <sup>b</sup>	22	36%
Unspecified <sup>c</sup>	10	16%
<b>SMEs Affected by the War</b>		
Yes	61	98.4%
No	1	1.6%
<b>Directly Affected by the War</b>		
Yes	6	9.8%
No	55	90.2%
<b>Monetary Loss</b>		
Yes	56	90.3%
No	6	9.7%
<b>Ranges of Monetary Loss (US\$)</b>		
Less than \$10,000	6	10.7%
\$10,000–\$50,000	32	57.1%
\$50,000–\$100,000	7	12.5%
\$100,000–\$250,000	6	10.7%
\$250,000–\$500,000	3	5.4%
More than \$500,000	2	3.6%

<sup>a</sup> The types of firms are detailed in Appendix 2.

<sup>b</sup> Non-food refers to SME in the food sector working on software, equipment, and packaging materials or services.

<sup>c</sup> Unspecified refers to responses where participants selected “Other food products” without providing further details.

### *Impact of the War on Business Operations and Recovery Needs*

Table 2 highlights the impact of the war on business operations and corresponding recovery needs across crucial functional areas. Our findings show that businesses faced the most acute challenges in financial performance, with 98% of respondents citing “cash flow problems due to reduced sales, low collection rate or increased costs” as the main issues; 68% cited “increased dependency on a single market,” and 54% cited “difficulty in maintaining liquidity.” The major financial need resulting from the war was establishing emergency funds or securing lines of credit (81%), in addition to access to alternative financial support such as bartering and in-kind trading (65%).

Participants also reported major market-related issues, with 82% affected by economic instability and 75% by changes in consumer behavior. The main reported needs included strengthening local and international market distribution (84%), diversifying market channels (68.4%), and partnering with humanitarian organizations (63.2%).

For the supply-chain and procurement processes, around 70% of the companies suffered from disruption in import routes and supplier relationships, along with shortages in raw materials and essential inputs. The major needs to overcome these issues were securing raw material sources and alternative suppliers (67.4%) and partnering with local suppliers (43.5%).

Further, in the area of human resources and availability of the workforce, participants raised concerns about their staff members’ physical and mental safety (34%) and disrupted access to the workplace (34%). The companies stressed the need to provide safety nets for workers (65.6%) and to develop a staffing contingency plan (46.9%).

### *Specific Needs Related to Infrastructure, Financial Support, and Supply Chain*

Table 2 also provides detailed insights into the specific recovery needs across financial struggles, market access, supply chain challenges, human resources, and infrastructure. These included:

- Financial Struggles: Establishing emergency funds (81%) and access to alternative financial

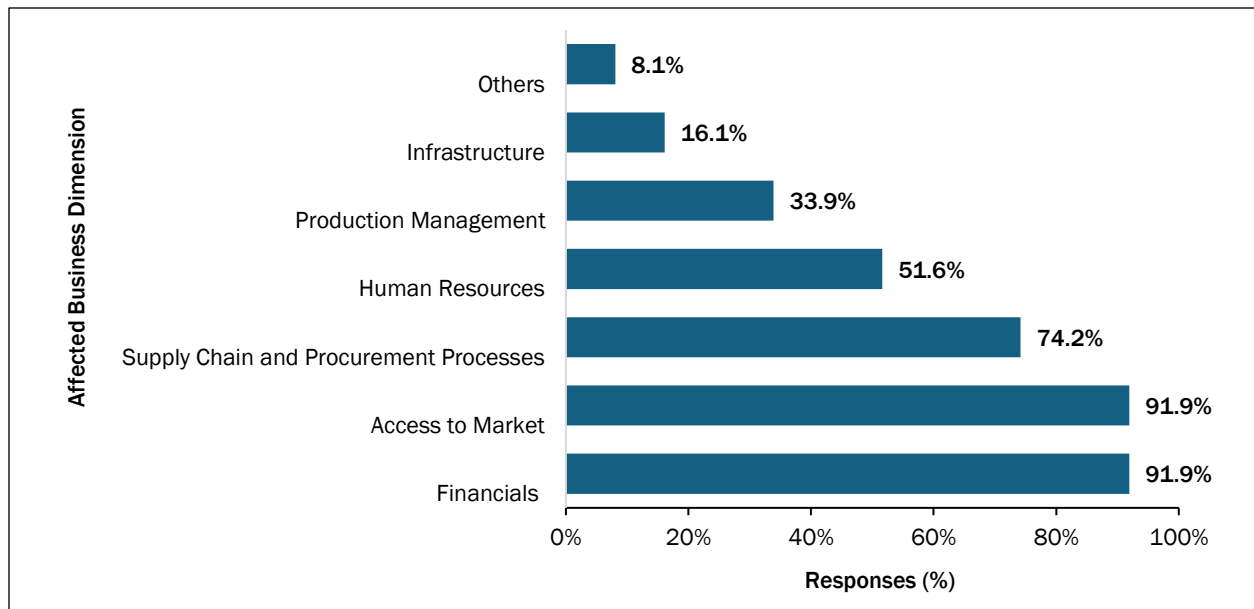
support, such as bartering and in-kind trading (65%).

- Supply-Chain Needs: Securing sources of raw material and alternative suppliers (67.4%) and forming partnerships with local suppliers (43.5%).
- Human Resources: Providing safety nets for

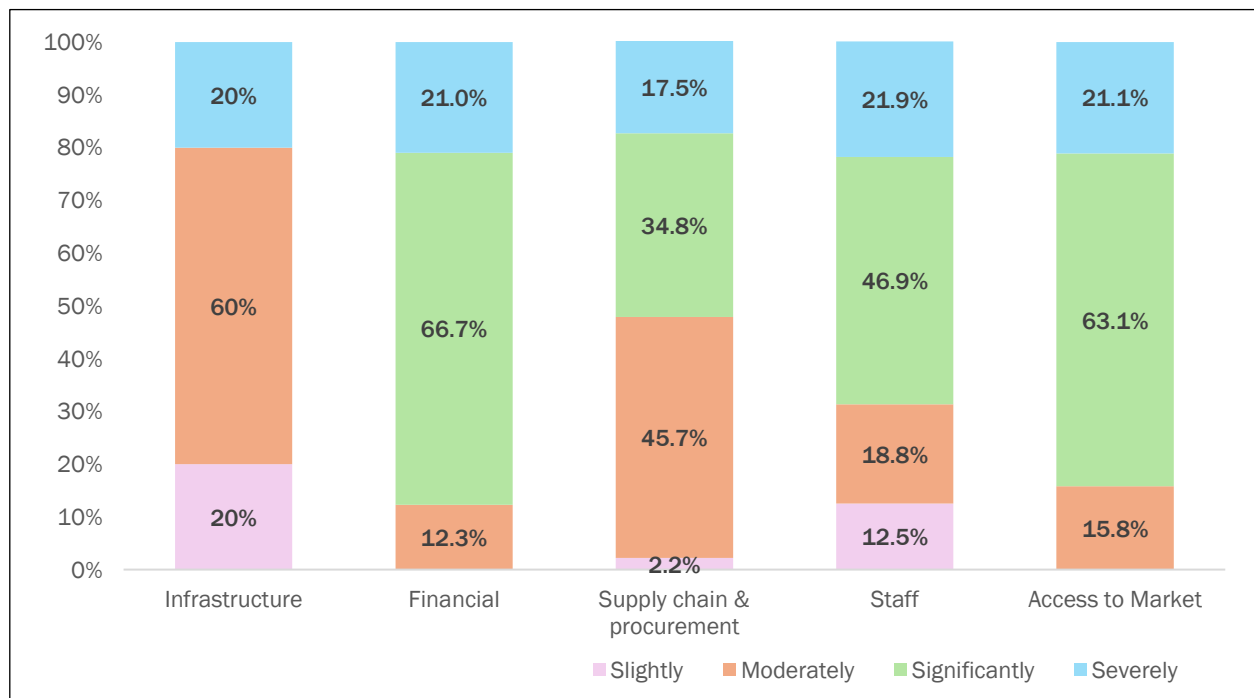
workers (66%), developing staffing contingency plans (47%), and providing mental health and wellness support (44%).

- Infrastructure: Increased diesel supply (70%), relocation of production or storage sites (70%), and insurance for facilities (60%).

**Figure 1. Business Dimensions Affected by the War (N = 62)**



**Figure 2. Severity of Impact on Different Business Dimensions During the War (N = 62)**



**Table 2. Impact of the War on Business Operations and Corresponding Recovery Needs across Key Functional Areas (N = 62)**

	Responses	
	Frequency	Percent
<b>Financial Struggles</b>		
Cash flow problems due to reduced sales, low collection rate, or increased costs	56	98%
Increased dependency on a single market	39	68
Difficulty maintaining liquidity	31	54
Difficulty accessing emergency funds	25	44
Difficulty in cost control and expenditure tightening	24	42
<b>Financial Needs</b>		
Establishment of emergency funds or securing lines of credit	46	81%
Access to alternative financial support (bartering and in-kind trading)	37	65
Support in developing cost control strategies and cash flow forecasting	28	49
Support in financial planning—contingency plan	26	46
<b>Challenges in Access to Markets</b>		
Economic instability affecting market demand and sales	47	82%
Changes in consumer behavior impacting product demand	43	75
Disruption of access to local markets due to damaged infrastructure or blockades	36	63
Disruption of access to international markets due to trade restrictions or instability	32	56
<b>Needs Related to Access to Markets</b>		
Strengthening local and international market distribution	48	84%
Diversifying market channels (e.g., e-commerce, direct-to-consumer sales)	39	68
Partnering with humanitarian organizations for product distribution	36	63
Linking with local partners or peers to enhance product distribution	32	56
Leveraging digital marketing and transparent customer communication	27	47
Adapting to emerging local market (e.g., adjusting pricing, packaging, product offerings)	20	35
<b>Supply Chain and Procurement Processes</b>		
Disruption in import routes or supplier relationships	33	72%
Shortages in raw materials and essential inputs	32	70
Storage areas at risk	14	30
Challenges in maintaining storage management standards	11	24
<b>Supply Chain and Procurement Needs</b>		
Securing raw material sources and alternative suppliers	31	67%
Partnership with local suppliers	20	43

*continued*

Table 2, continued

Just-in-case inventory strategies (buffer stocks)	18	39
Initiate or negotiate suppliers' contracts with contingency clauses	15	33
Relocation or diversification of storage areas	8	17
Consolidation or aggregation of goods import with local partners or peers	8	17
<b>Human Resources Challenges</b>		
Staff safety risks or concerns (employees' mental and physical state)	11	34%
Disrupted access to workplaces or displacement of employees	11	34
Difficulty retaining staff	6	19
Temporary staff shortages	4	13
<b>Human Resources Needs</b>		
Need to provide safety nets for workers (e.g., insurance, relocation plans)	21	66%
Development of a staffing contingency plan	15	47
Mental health and wellness support	14	44
Development of crisis communication plans and safety protocols	13	41
Automation and remote monitoring of key processes to reduce dependency on physical labor	13	41
Employee training for emergency responses	10	31
Flexible working arrangements (remote work, adjusted hours)	8	25
<b>Infrastructure</b>		
Business operations stopped due to lack of safety in the area of operations	8	80%
Affected automobiles and transportation vehicles	3	30
Damage to facility production sites	3	30
Damage to facility warehouses and storage areas	2	20
Damaged power and water supply necessary for the business operations	1	10
<b>Infrastructure Needs</b>		
Increase diesel supply	7	70%
Relocation of production or storage sites to safer areas	7	70
Insurance for facilities and assets at risk	6	60
Security and safety measures (installation of CCTV, hiring or outsourcing security personnel)	4	40
Structural reinforcements (fireproofing, backup power, safe rooms)	2	20
Increase water capacity	2	20
Off-site or cloud data backup systems	1	10

## Discussion

Our study aimed to evaluate the impact of the war on agri-food SMEs and explore solutions to enhance resilience in future crises. Our findings highlight that SMEs are facing numerous challenges, including financial struggles, limited access to markets, constraints in their supply chain and

procurement, and human resources hurdles.

The geographical distribution of SMEs included in our research aligns with the Investment Development Authority of Lebanon (IDAL)'s report on 2018 data, which found that 5% of agri-food SMEs were in Beirut, 48% in Mount Lebanon, 9% in North Lebanon, 6% in South Lebanon,

and 18% in Bekaa (IDAL, 2020). Accordingly, our analysis reflects aggregated findings from all regions across Lebanon and does not compare impacts by regions.

Similarly, the share of small businesses in our study (37%) mirrors the findings of Boumatar et al. (2024), which reported that 37.5% of SMEs employed between six and 10 workers. Our findings highlight that the studied SMEs are facing numerous challenges, including financial struggles, limited access to markets, constraints in supply chain and procurement, and human resources hurdles.

### *Financial Constraints*

The findings of this study highlight the profound and multifaceted impact of war on agri-food businesses, with most companies reporting being affected by the war (98.4%), with the impact most significantly on financial constraints (91.9%) and reduced access to markets (91.9%). These findings are consistent with previous reports showing that SMEs in conflict-affected economies face acute financial pressures due to reduced demand, restricted access to finance, and banking systems instability (Miklian & Hoelscher, 2022; Organization for Economic Co-operation and Development [OECD], 2009). Similar patterns have been documented in Yemen and Syria, where prolonged conflict has depleted financial capital and limited SMEs' access to formal credit, forcing a reliance on internal or informal funding sources (UNDP, n.d.). Furthermore, conflicts pose additional global economic threats, disproportionately affecting SMEs due to their vulnerability and limited capacity to absorb financial shocks (Munro, 2013). While developed nations can mitigate terrorism's economic consequences through security enhancements and fiscal policies (Sandler & Enders, 2008), developing nations lack such resilience (Gaibulloev & Sandler, 2008). Attacks discourage foreign investment, raise operational costs, and disrupt supply chains, all of which increases insurance, transaction, and security risks for SMEs (Asgary et al., 2020). While direct comparisons should be interpreted with caution, these findings suggest that Lebanese SMEs experience financial stress in the framework of reduced demand and constrained

credit access. While financial constraints in this study were largely attributed to war-related instability, rising operational costs and cash-flow shortages were likely intensified by lingering COVID-19 effects, including inflationary pressures, disrupted trade flows, and weakened financial systems. Comparable interactions have been observed elsewhere, where SMEs faced simultaneous demand shocks and restricted access to credit (Genkin & Mikheev, 2020).

### *Market Access and Supply Chains*

Market access remains a significant challenge, with 91.9% of the studied Lebanese SMEs reported experiencing difficulties in reaching customers and 74% reporting disruptions in supply chains and procurement processes. Comparable supply chain disruptions have been observed in other crisis contexts. During the COVID-19 pandemic, food supply networks were disrupted due to labor shortages and transport constraints, as reported in Northern India (Genkin, & Mikheev, 2020; Mahajan & Tomar, 2021) and Wuhan, where logistical breakdowns led to food waste and delayed distribution, as goods remained stuck between farmers, wholesalers, processors, and retailers (Zhao et al., 2024). Similarly, the Russia-Ukraine conflict contributed to global food-price inflation, increasing costs and reducing demand for food-related SMEs worldwide (Leal Filho et al., 2023). These comparisons highlight that while the Lebanese agri-food sector faces conflict-related disruptions, its challenges also reflect broader crisis-driven vulnerabilities in food supply chains. In Lebanon, restricted market access and supply-chain disruptions reflect the combined effects of conflict-related insecurity and post-pandemic logistical fragilities. The evidence from India and Wuhan illustrates how pandemic-induced labor shortages and transport breakdowns magnified existing vulnerabilities in food supply chains, a dynamic that parallels the Lebanese context under war conditions (Mahajan & Tomar, 2021; Zhao et al., 2024).

### *Impact of Conflict on Market Demand and Food Crisis*

Our research indicates that 75% of businesses have been affected by shifts in consumer behavior that

have impacted product demand. Conflict-induced economic instability reduces purchasing power and shifts spending habits, decreasing demand for non-essential products (Hortovanyi et al., 2024). Such shifts in consumer behavior can have a cascading effect on SMEs, especially in the food sector, where businesses rely on stable demand and predictable consumption patterns. A relevant example is the Russia-Ukraine conflict, which caused a 24% year-on-year increase in the global Food Price Index by February 2022, adversely affecting market demand for food-related SMEs worldwide (Leal Filho et al., 2023).

Overall, the findings suggest that the impact of war on agri-food SMEs cannot be fully understood in isolation, as residual effects of the COVID-19 pandemic appear to have amplified financial, logistical, market, and human resources constraints observed in the Lebanese context. In fact, while a significant portion of Lebanon's crisis existed before the coronavirus pandemic, the pandemic has severely compromised the nation's potential pathways to economic recovery (Haytayan, 2021). Furthermore, the COVID-19 pandemic has disrupted consumer habits and supply chains, further illustrating how external shocks can amplify demand volatility and operational challenges for SMEs (Genkin & Mikheev, 2020).

Kemmerling et al. (2022) discussed the link between food crises and war and violent conflicts. They highlighted that overall war and violent conflict have an impact on food insecurity since it is associated with four logics, including (a) destruction; (b) conflict-induced displacement; (c) food control; and (d) hunger as a "weapon of war." These logics explain why governments or belligerents are often unable or unwilling to respond to food crises, and why humanitarian assistance faces challenges in reaching people in need while simultaneously avoiding exacerbating conflict.

### *Human Resources Hurdles*

Human resources (HR) challenges emerged as a significant constraint for agri-food SMEs in Lebanon, with 34% of the respondents primarily reporting concerns related to employees' mental and physical well-being and disrupted access to the workplace. Difficulties in employee retention were

reported to a lesser extent, suggesting that workforce availability remained relatively stable in the sample surveyed at the time of assessment. Comparable challenges have encountered in other conflict-affected regions. Exposure to conflict-related stress and trauma has been associated with increased rates of anxiety and depression, and reduced productivity among workers (Pizarro et al., 2006). In prolonged conflict settings such as Syria and Ukraine, businesses have additionally faced labor shortages driven by population displacement, migration, and disruptions to education and training systems (Bogov, 2023; Syrian Economic Sciences Society, 2018). Additionally, conflicts hinder education systems, reducing the availability of human capital and diminishing employment opportunities (Imhonopi & Urim, 2016). Together, these findings suggest that while Lebanese SMEs currently report well-being and access-related challenges as the primary HR constraints, other conflict contexts illustrate how prolonged instability can further translate into workforce depletion and skills shortages. The mental and physical well-being challenges reported by SMEs in this study may reflect the cumulative burden of prolonged crises, where war-related trauma intersected with pandemic-related stress, job insecurity, and restricted mobility. Similar compounded effects on workforce well-being and productivity have been reported in conflict-affected and pandemic-stricken contexts, contributing to long-term erosion of human capital (Pizarro et al., 2006; Syrian Economic Sciences Society, 2018).

### *Local Infrastructure and Global Limitations*

In terms of infrastructure, 80% of the SMEs in this study reported that business operations were disrupted due to unsafe working conditions. While only 10% of SMEs reported direct damage to their power and water supply infrastructure, energy insecurity was reflected in the high reliance on fuel-based solutions, as 70% of respondents identified increased diesel supply as a key infrastructure need. This underscores how electricity disruptions, even when not directly damaging facilities, significantly constrain business continuity through increased operating costs and dependence on backup power. Furthermore, the nation's electrical crisis and rising

fuel costs have led to problems with water scarcity, making it challenging to transport goods from the producer to the market, as reported by Ibrahim (2022). Our finding aligns with other evidence from conflict-affected contexts where infrastructure damage and insecurity have hindered business continuity. For instance, in Yemen, damage to infrastructure, financial capital depletion, conflict-related insecurity, and rising operational costs have led many SMEs to suspend their activities (UNDP, n.d.). Similarly, in Syria, damage to agricultural lands, irrigation systems, and critical infrastructure has affected business endurance and food security (Gobat, 2016). Additionally, Ben Hassen and El Bilali (2022) and Béné et al. (2024) reported that war interferes with food production, mobility, and storage. Hassoun et al. (2024) highlighted that the war on Gaza (2023-2024) exemplifies this impact through widespread damage to infrastructure and agriculture, with 28% of cropland and over 70% of fisheries destroyed (Anera, 2024). Analogously, in Ukraine, war has led to significant reductions in winter-crop production, labor shortages due to mass displacement, and damage to agricultural infrastructure, resulting in the abandonment of arable land and decreased global food supply (Jia et al., 2024). Available data suggest that the impact of the conflict on Lebanon was comparatively lower than that reported in Gaza and Ukraine. This difference can be explained by factors such as the shorter conflict duration, the less extensive destruction, the timing of the assessment, and the characteristics of the participating SMEs. Additionally, in the present study, infrastructure-related disruptions were primarily driven by insecurity and unsafe working conditions; however, these challenges were further compounded by residual COVID-19 impacts on logistics, mobility, and service availability. Similar compounded effects of COVID-19 on infrastructure and business continuity have also been reported in other contexts, including China and India (Mahajan & Tomar, 2021; Zhao et al., 2024).

### ***Study Limitations***

This study offers key strengths, notably being the first to assess the impact of war on Lebanon's agri-food SME sector and the first to comprehensively

examine various business dimensions and recovery needs. Its findings provide actionable recommendations that can be integrated into future crisis preparedness to minimize losses. The use of empirical data and a structured survey strengthens its relevance and practical value. However, limitations include the sample's restriction to QOOT Cluster members, which may limit generalizability and introduce bias due to shared characteristics. The modest response rate, reliance on self-reported data, lack of qualitative insights, and absence of inferential analysis further constrain the study's depth and applicability. Although the study captures responses from agri-food SMEs across multiple regions in Lebanon, the analysis was conducted at an aggregated national level and does not allow for region- or sector-specific comparisons, which may mask localized differences in impact and resilience.

### **Recommendations**

Based on the findings of our work and the general context of the agri-food sector in Lebanon, we suggest the following recommendations to help mitigate the impacts of crisis situations, including unexpected wars.

#### ***1. Establish Emergency Funds and Access to Credit***

The fact that 92% of the investigated SMEs reported financial struggles because of war highlights the critical need for accessible financial resources. Developing emergency fund plans is essential for maintaining liquidity and operational continuity during crises. Emergency funds can help businesses cover unexpected expenses, maintain operations, and prevent financial collapse during challenging times. Additionally, enhancing financial literacy equips business owners with the necessary knowledge to navigate credit systems effectively and make informed decisions. Encouraging community-based initiatives such as cooperative lending or in-kind trading can provide alternative financing options during times of limited access to formal credit (Abdullah & Othman, 2019).

#### ***2. Diversify Market Channels***

With 92% of companies facing market access issues, SMEs should explore diversifying their mar-

ket channels both locally and internationally. Geographic expansion can help reduce dependency on local markets during crises. Diversification, both horizontally (by adding new products or services) and vertically (by controlling more stages of the food production process), can capture more value from products and improve profit margins. Strengthening local partnerships and targeting niche markets, such as organic products or health-focused items, can provide additional growth opportunities. Furthermore, e-commerce provides broader access to customers and helps SMEs maintain sales during physical market disruptions (Begimkulov & Darr, 2023; Shiferaw, n.d.; Stevens & Teal, 2024).

### ***3. Collaborate with Humanitarian Organizations***

Collaboration with humanitarian organizations can significantly enhance SMEs' resilience. These partnerships provide access to resources, training, and support networks, which can improve market distribution capabilities and provide additional support during crises. SMEs should identify NGOs that align with their business goals and community needs, focusing on economic development, food security, and support for local businesses. In Lebanon, international organizations have implemented input-support mechanisms to improve small farmers' access to essential production inputs during periods of compounded economic, health, and security shocks. This underscores the importance of timely, targeted support measures in enhancing agri-food system resilience under protracted crises (Ibrahim, 2022).

### ***4. Strengthen Supply Chain Resilience***

Given the disruption of import routes and supplier relationships reported by many SMEs, it is essential to secure alternative sources for raw materials and establish partnerships with local suppliers. SMEs should diversify their suppliers, build inventory buffers, and invest in technologies for real-time visibility into the supply chain, such as inventory management systems and data analytics tools. Additionally, SMEs can formalize local sourcing through tools like contract farming, which secures raw materials locally and stabilizes costs. Sharing

logistics in business clusters can also help improve supply chain resilience by reducing costs and fostering collaboration (Ali et al., 2021; Bak et al., 2020; Loh & Tan, 2024).

### ***5. Invest in Infrastructure Improvements***

With 16% of the studied SMEs reporting infrastructure damage, proactive measures are necessary to prevent operational disruptions. SMEs should regularly assess their infrastructure and invest in improvements such as relocating to safer areas or securing insurance for facilities. Climate-smart infrastructure not only enhances resilience against climate change but also contributes to sustainable agricultural practices. Proactive planning can help businesses maintain continuity and reduce their vulnerability during crises (Vostriakova et al., 2022). In parallel, facilitating SMEs' access to energy-efficiency upgrades and renewable energy financing mechanisms may reduce long-term reliance on diesel generators and strengthen continuity during crises (Ministry of Economy and Trade, 2018).

### ***6. Establish a Comprehensive Risk Management Plan***

Lebanon is a high-risk country in terms of instability and political unrest. Therefore, it is crucial for any SME to develop a structured risk management plan that identifies various potential risks and includes risk assessments, prioritization, and mitigation strategies. The plan should be complemented with continuous monitoring, evaluation, employee training, and adaptation to various risk-related scenarios. SMEs should develop tailored approaches that address specific vulnerabilities related to war, including infrastructure damage, supply chain disruptions, and financial instability (Florio & Brotto, 2024).

### ***7. Engage in Knowledge-Sharing through Business Clusters***

SMEs should actively participate in business clusters, such as the QOOT Cluster, to share knowledge, resources, and best practices. Collaborative networks can provide strategic partnerships that help businesses adapt more quickly to challenges posed by war. Formal clusters facilitate structured

collaboration, allowing businesses to leverage collective strengths to address common challenges effectively. Localizing digital tools, early warning systems, and collective risk mapping can enable SMEs to proactively address infrastructure fragility and market unpredictability, enhancing resilience in the agri-food sector (Ali et al., 2021; Bak et al., 2020).

### ***8. Develop Policies to Safeguard Food Systems***

There is a pressing need for policies that recognize the food industry as a critical sector requiring protection during emergencies. Just as cultural sites are safeguarded under international conventions, food systems must be prioritized to ensure continuous access to safe and nutritious food. Policies should include mechanisms for protecting food production facilities, securing supply chains, supporting affected food businesses, and ensuring rapid recovery post-conflict. Governments and international organizations should collaborate to establish legal frameworks that ensure food security even in times of crisis.

In Lebanon, international organizations have implemented input-support mechanisms to improve small farmers' access to essential production inputs during periods of compounded economic, health, and security shocks. This underscores the importance of timely, targeted support measures in enhancing agri-food system resilience under protracted crises (Ibrahim, 2022).


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### **Conclusion**

This study identifies the key challenges faced by SMEs in Lebanon's agri-food sector, particularly those in the QOOT network, during conflict, including financial struggles, supply chain disruptions, and workforce issues. The findings highlight the urgent need for targeted interventions to strengthen their resilience, support sustainable food systems, and enhance their critical role in Lebanon's economy.

Ensuring food and nutrition security amidst recurring and extended crises requires robust agri-food systems and sustainable livelihoods. Strengthening these systems demands integrated disaster risk-management strategies that operate across the humanitarian-development-peace framework. Swift and unified action by nations and the global community is imperative to meet both urgent and enduring needs of at-risk populations, fostering the adaptation of agri-food systems to enhance their resilience against future disruptions. Future research could explore the effectiveness of integrated disaster risk-management strategies in Lebanon's agri-food sector, focusing on how these strategies can enhance the resilience of SMEs and ensure long-term food and nutrition security. Additionally, studies could examine the role of global collaboration and policy interventions in supporting sustainable livelihoods in conflict-affected regions, specifically investigating the alignment of humanitarian, development, and peace-building efforts to strengthen agri-food systems in Lebanon and similar contexts.



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## **Appendix 1. History of Conflict in Lebanon**

### **Lebanon: Conflict and Compounded Crises Timeline (2006–2025)**

#### **2006**

In 2006, Lebanon experienced a 34-day armed conflict that displaced about one million people. Infrastructure damage was substantial, estimated at around US\$2 billion, which represented about 9% of the country's GDP. Additionally, the agricultural, fisheries, and forestry sectors suffered losses amounting to US\$280 million (BBC News, 2018; Electronic Intifada, 2006; Human Rights Watch, 2007; International Monetary Fund [IMF], 2007).

#### **2007–2008**

From 2007 to 2008, recovery efforts focused primarily on infrastructure and housing, with insufficient attention given to small and medium enterprises (SMEs), financing, and rural livelihoods. This period witnessed business closures, supply disruptions, and investor flight due to clashes in Beirut, the Bekaa Valley, Northern Lebanon, and the Chouf Mountains. Agricultural and commercial activities in northern Lebanon were severely disrupted due to the Nahr al-Bared conflict (Harvie & Saleh, 2008; Ministry of Finance, 2011).

#### **2011**

In 2011, Lebanon's government collapsed amidst rising political instability. This period also saw the arrival of over one million Syrian refugees, placing immense pressure on public services, labor markets, and housing. In response to the growing humanitarian crisis, the UN Lebanon Crisis Response Plan was launched to provide relief (Government of Lebanon & UN Office for the Coordination of Humanitarian Affairs [OCHA], 2021; UN High Commissioner for Refugees [UNHCR], 2014)

#### **2015–2018**

The period from 2015 to 2018 was marked by chronic fragility and slow economic deterioration. Public debt rose, economic growth stagnated, and governance paralysis set in. Structural vulnerabilities were exposed during this time, including the country's unsustainable public debt, reliance on foreign capital inflows, and a risky banking system, all of which contributed to the pre-crisis economic instability. (Malaeb, 2018; World Bank, 2018)

#### **2019**

The year 2019 saw nationwide protests that led to a financial collapse, marked by a banking-sector crisis and currency devaluation. The country experienced a dramatic increase in food prices due to import shortages, which worsened the already critical economic situation. Poverty and unemployment sharply increased, and the World Bank recognized the onset of one of the worst economic crises globally. (Action Against Hunger, 2020; World Bank, n.d., 2020)

#### **2020**

In 2020, Lebanon endured a triple shock. The COVID-19 pandemic compounded the economic and social crises, while the Beirut Port Explosion in August caused widespread devastation. The resulting economic contraction accelerated, and Lebanon's health and social systems were overwhelmed by the compounded crises. (UNICEF & International Labour Organization, 2022; World Bank, 2020)

#### **2021–2022**

From 2021 to 2022, Lebanon continued to face a prolonged socioeconomic collapse. The country endured frequent electricity blackouts and fuel shortages, further hampering daily life. There was also a notable decline

in access to healthcare and education, deepening the overall crisis. (UNICEF & International Labour Organization, 2022; UNDP, 2025)

### 2023

The situation worsened in 2023 with renewed armed conflict. Increased insecurity and internal displacement further destabilized the country, exacerbating the humanitarian situation and intensifying the impact on Lebanon's already fragile agrifood sector. (United Nations Development Programme [UNDP], 2024; UNDP & World Bank, 2025)

### 2024

In 2024, the country faced further conflict-related destruction and mass displacement. Over one million people were displaced as a result of the ongoing violence. The conflict compounded pre-existing economic and social collapse, with the agricultural sector suffering an estimated US\$118 million in damages, particularly in southern Lebanon and the Bekaa Valley. The UNDP documented the severe socioeconomic impacts of these ongoing crises. (Food and Agriculture Organization of the United Nations [FAO], 2025; UNDP, 2024; UNDP & World Bank, 2025)

### 2025

By 2025, the ongoing compounded crises continued to devastate Lebanon. The country's GDP had contracted approximately 40% since 2019, and reconstruction needs exceeded US\$11 billion. Political deadlock persisted, exacerbating the humanitarian strain and complicating efforts to recover from the crisis. (UNDP & World Bank, 2025; World Bank, 2025)

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**Appendix 2. Types of Firms in this Study (*N* = 62)**

<b>Firm type</b>	<b>Percentage</b>	<b>Count (<i>n</i>)</b>
Other food products	16.13%	10
Preparations of fruits and vegetables	12.90	8
Food packaging	8.06	5
Dairy products	8.06	5
Wine	8.06	5
Bakery & snacks products	6.45	4
Cacao, chocolate, and sugar confectionery	6.45	4
Agricultural chemicals, seed, and services	6.45	4
Fresh vegetables	4.84	3
Vegetable and animal oils and fats	4.84	3
Agricultural equipment and machinery	4.84	3
Noodles and pasta	3.23	2
Spirits	3.23	2
Software and technology programs	3.23	2
Grain mill products	1.61	1
Fresh fruits	1.61	1