Resiliency Perspective in the Roofing Industry: Manufacturers, Distributors and Contractors

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Abstract

Resiliency has recently emerged as a critical focus in the roofing industry. In response to the increasing frequency of extreme natural disasters such as hurricanes, tornadoes, and high-speed winds, stakeholders such as manufacturers, distributors, and contractors are under growing pressure to develop, transport, and install resilient roofing elements. The understanding of resiliency among these stakeholders varies based on their specific roles and responsibilities. It is crucial to have a collaborative effort between these stakeholders to implement resilient practices. The purpose of this study is to investigate the perspective of three key supply chain stakeholders- manufacturers, contractors, and distributors regarding resiliency in the roofing industry. Identifying stakeholders' perspectives on resiliency provides valuable insights into the current state of resiliency practices within the roofing industry. To achieve the purpose of this research, a survey was conducted among the roofing industry professionals, followed by the quantitative analysis of survey responses. A total of 46 complete responses were considered for the descriptive and statistical analysis. From the analysis, resiliency factors such as long service life, ability to adapt, and preparation for major disruptions were found to be important among the supply chain stakeholders. Among the three stakeholders, only contractors showed statistically significant differences in how they rated the importance of factors within the structural and environmental resilience category.

Keywords: Roofing Industry, Construction, Resiliency, Supply Chain, Stakeholders

1. Introduction

Resiliency has long been a critical topic in the construction industry and even more to the roofing industry (FORTIFIED, 2025). It is commonly understood as the capacity of an individual, household, community, nation, or region to endure, adjust to, and rapidly recover from shocks and stressors (Cirrincione et al., 2021). One of the major stressors is climate uncertainty, which has become more frequent with hurricanes, severe hail, blanket of snow, and high winds affecting the roofs of buildings directly. This demands that the roofing systems become more resilient (Energy, 2025). Moreover, resilient roofing helps mitigate urban heat effects by reducing reliance on artificial cooling and optimizing overall energy performance (Lassandro & Cosola, 2018).

The roofing industry in the United States is continuously progressing with the introduction of new technologies, which have streamlined and simplified various roofing operations (American Roofing and Construction, 2024). According to IBIS research, the U.S. roofing industry comprised approximately 37,340 businesses, experiencing an average annual growth rate of 1.2% between 2018 and 2023. During this period, the sector employed around 212,000 workers, also growing at 1.2% annually, while total wages reached USD 14.3 billion, reflecting an annualized increase of 1.7% (Bureau, 2024). The roofing market size of the United States is expected to reach USD 24.79 billion in 2025 and grow at a compound annual growth rate of 6.17% to reach USD 33.44 billion by 20230 (Intelligence, 2024). As the industry continues to expand, so does the need for durable and cost-effective solutions to maintain profitability amid rising material and labor costs. Investing in resilient roofing systems becomes increasingly important, not only to protect the building but also to reduce the long-term operational costs. A resilient roofing system is crucial as it serves as the first line of defense against weather, wear, and rooftop activity (Waterproofing, 2024). Such systems are designed to withstand damage, extending the roof's lifespan under less extreme conditions, which ultimately reduces the maintenance and replacement costs (Waterproofing, 2024).

The U.S roofing market is primarily driven by three key stakeholder groups: manufacturers, distributors, and contractors (Intelligence, 2024). Manufacturers produce roofing materials, distributors act as intermediaries between manufacturers and contractors, and contractors install and maintain roofing systems (Atto, 2023). The roofing supply chain primarily includes these three entities, each playing a vital role in the movement of goods while actively contributing to the advancement of environmental responsibility and resiliency (Faysal, 2024). However, the U.S.

roofing supply chain faces a range of challenges, including labor shortages, shifting consumer demand for sustainable and resilient roofing solutions, and intensifying global competition in solar, green, and cool roof technologies (Faysal, 2024). At the same time, the concept of resiliency remains loosely defined within the roofing industry, with various organizations interpreting this term based on their priorities and objectives (Felicioni et al., 2023). Moreover, compared to sustainability, resiliency has received significantly less attention within the roofing supply chain, an imbalance clearly reflected in the volume of past literature addressing each topic.

To address this gap, the present study conducts a survey with the roofing industry professionals to explore how resiliency is being understood and applied across the industry, with the goal of identifying ong (FEMA, 2021)oing efforts and potential areas for improvement. The objectives of this study were to:

i) To investigate how manufacturers, distributors, and contractors in the roofing supply chain perceive resiliency.
ii) To assess the alignment and differences in their perspectives across resiliency categories and identify statistically significant resiliency factors.

2. Literature Review

Resiliency has a multifaceted meaning, encompassing structural, environmental, functional, and preparedness dimensions that together determine how well systems and communities withstand, adapt, and recover from disruptive events (Wagle et al., 2024; Agboola et al., 2023; Stavros et al., 2023). There are a few studies that have discussed different factors and categories of resiliency related to the construction industry. A review by Wagle et al. (2024) highlighted key resiliency factors, including longevity, flexibility, and recovery. Based on the shared theme, these factors were grouped into three categories of resiliency such as structural and environmental resilience, functional and operational resilience, and preparedness and response resilience.

Structural and environmental resilience together capture how the built and natural systems withstand, adapt to, and recover from shocks (Wagle et al., 2024). Structural resilience emphasizes robustness, ductility, and durability in buildings so communities can safely resume function after events of natural hazards (NIST, Community Resilience, 2025). Environmental resilience focuses on a system's capacity to resist, absorb, accommodate, and recover from environmental perturbations (e.g., heat, storms, floods) (UNDRR, 2025). Factors such as long service life (Alexandrou, 2023), ability to absorb external stresses, climate changes, and environmental changes (Dabija, 2021; Aghabegloo et al., 2023), capability to be repaired or restored (Aghabegloo et al., 2023), rapid recovery (Kurth et al., 2019), and material recycling and reuse (Felicioni et al., 2023) fall under this category.

Functional and operational resilience focuses on keeping essential services (e.g., power, water, life-safety systems) available so a facility remains usable during and after disruptions by embedding redundancy and enabling rapid functional recovery (FEMA, 2021; EERI, 2019). Practical measures include backup energy systems, on-site renewables paired with storage, which lessen the likelihood and duration of long power outages and support continuity of operations. The factors identified from the literature review that are pertinent to this category are retaining critical functions during disruptions (Zhao et al., 2015), recovering rapidly from major disruptions (Sun et al, 2020), and being flexible under partial failure (Fouda & ElKhazendar, 2023). Practical measures include backup energy systems, on-site renewables paired with storage, which lessen the likelihood and duration of long power outages and support continuity of operations (Felicioni et al., 2023).

Preparedness and response resilience encompass the strategies, plans, and capacities to anticipate, absorb, respond to, and recover from disruptive events (Wagle et al., 2024). It emphasizes adaptive assets that can adjust to extreme weather shocks, along with rapidity, recovery, restoration capacity, and stress tolerance (Aghabegloo et al., 2023a). Factors such as the ability to adapt (Aghabegloo et al., 2023b), prepare for major disruptions (Sun et al., 2020), speed with which a structure recovers (Bocchini et al., 2014) fall under this category.

Taken together, these factors are pertinent to the roofing industry, aligning with three interrelated categories: structural and environmental resilience, functional and operational resilience, and preparedness and response resilience. The literature offers limited, comparative evidence on how these factors are prioritized across roofing stakeholders. Accordingly, this study utilizes these factors and surveys manufacturers, distributors, and contractors to assess salience within each category.

3. Methods

This study used a quantitative analysis approach. First, a survey was designed based on the resiliency factors extracted from the literature review. The resiliency factors were grouped in three categories based on a common theme, as there is no official framework categorizing them. The three categories are: i) Structural and environmental resilience, ii) Functional and operational resilience, and iii) Preparedness and response resilience. The three categories consisted of

various factors and questions related to that factor, which were relevant to the category. The survey questions were both open-ended and closed-ended. For most of the survey, participants were asked to rate the factors and categories in a Likert Scale from 1 to 5, 1 being not significant and 5 being very significant. Separate surveys were created for each supply chain stakeholder, i.e., manufacturers, distributors, and contractors.

Survey involves human subjects; therefore, it needs to be reviewed by the Institutional Review Board (IRB), and the survey needs to get approval. Likewise, the designed survey was submitted to the IRB of Clemson University, which was then distributed among the study population after approval. Most of the questions were similar for all supply chain stakeholders, except for some minor changes based on the role of stakeholders in the roofing industry.

To evaluate the feasibility of the survey, it was first tested on a small group of roofing companies. Four companies participated in the preliminary survey. The data was processed, and different potential issues with the survey were identified. The average time to complete the survey was calculated, and changes were made in the survey to limit it to 15 minutes by removing and merging the questions where necessary. In this way, a pilot test was performed by refining the survey before performing a full-scale study. The refined survey was then distributed to the large group of roofing companies with the help of the Roofing Alliance. The survey was conducted anonymously, with no incentives offered, and participation was entirely voluntary. Respondents' identities and program affiliations were kept confidential. Consent was taken from the participants to participate in the survey.

The responses from the participants were collected in Qualtrics, which was then downloaded into an Excel spreadsheet. First, data preprocessing was carried out on the downloaded data. This included removing the incomplete data and removing the repeated ones. Potential response bias was also checked, which includes position bias, straight lining bias, and central tendency bias (Qualtrics, 2025). In this survey, no such pattern of bias was observed, which ensures that the data obtained were reliable and valid for further research. The preprocessed data was uploaded into a quantitative analysis tool known as "SPSS". Different variables were created in SPSS for responses on different categories and factors. Factors within those categories were assigned as numeric values in increasing order, starting from 1 for all the factors. The corresponding responses, which were on a Likert scale from 1 to 5, were uploaded to the data view page in SPSS. The categories and factors were assigned as nominal data, and the responses (from 1 to 5) were assigned as ordinal data.

The respondents- manufacturers, distributors, and contractors were assigned as 1, 2, and 3, respectively. The data were then analyzed both descriptively and statistically. Descriptive data analysis was performed to identify the mean of responses in all categories and factors.. A Kruskal-Wallis test, which is a powerful non-parametric statistical test (Chicco et al., 2025), was used for comparing the independent factors and categories within the supply chain stakeholders and with each other as well. This test was chosen among others because it is especially appropriate in situations where there are three or more independent groups (manufacturers, distributors, and contractors in this study) to compare, and the data are ordinal but not normally distributed (Chicco et al., 2025). For this, null and alternative hypotheses were created for different cases. For instance, to analyze the significant differences across the supply chain stakeholders, the null hypothesis was written as "In the context of structural and environmental resilience, there is no significant difference between manufacturers, distributors, and contractors regarding long service life". Long service life is a resiliency factor, and structural and environmental resilience is the category that can be replaced by other resiliency factors and corresponding categories. Similarly, for the analysis of each supply chain stakeholder within the categories, the null hypothesis was written as "In the structural and environmental resilience category, the manufacturers consider all the resiliency factors to be equally important, showing no significant differences between them." Similar hypotheses for distributors and contractors were developed for all three categories. P-values were used to assess the significance of differences in stakeholder responses across each factor and category. A threshold of $p<0.05$ was applied, which is widely accepted in applied research as a reasonable balance between detecting meaningful differences and minimizing false positives (Wasserstein & Lazar, 2016). Factors with p-values below 0.05 were considered statistically significant, leading to rejection of the null hypothesis.

4. Results

A total of 94 participants took part in the survey, but only 46 participants completed filling out the required sections in the survey. Out of 46 participants, 10 were manufacturers, 3 were distributors, and 33 were contractors. The result of the survey is explained in the following sections.

3.1. Overall responses

Descriptive analysis of resiliency categories for all three supply chain stakeholders is performed and demonstrated in the charts (Fig.1 and Fig.2) below. The means of overall responses from manufacturers, distributors, and contractors for the two categories "Functional and operational resilience" and "Preparedness and response resilience" are both

equal and highest among the three categories. “Structural and environmental resilience” has been rated lowest among the resiliency categories. The chart for the overall responses for resiliency is shown in Fig.1.

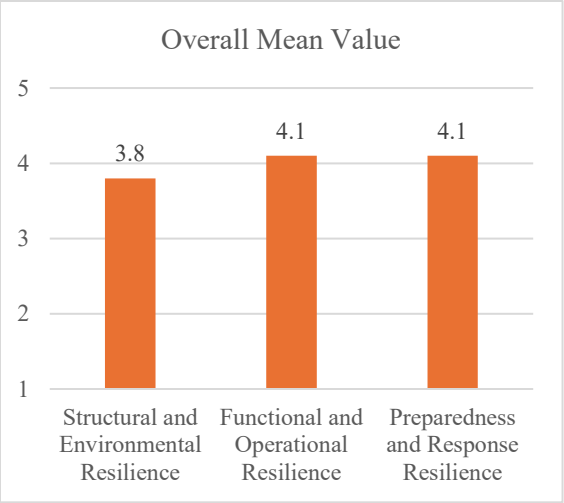

Fig.1. Overall responses resiliency

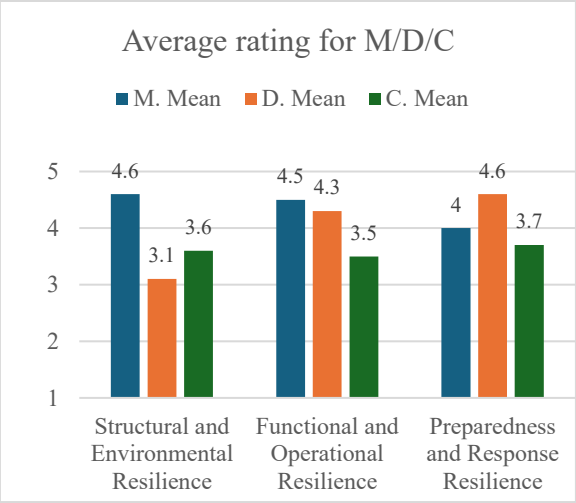

Fig.2. Average rating for M/D/C

The chart, as shown in Fig.2, divides the overall rating into the individual ratings of manufacturers (M), distributors (D), and contractors (C) for different sustainability and resiliency categories. Manufacturers have rated 'Structural and environmental resilience' the highest, while 'Preparedness and Response Resilience' received the lowest rating. The top-rated resiliency category is “Preparedness and Response Resilience” for both distributors and contractors.

4.2. Category-wise responses

This section contains the mean responses of manufacturers, distributors, and contractors for all the factors within resiliency categories. It gives information about which factors were rated lowest and highest by the three supply chain stakeholders.

The category “Structural and environmental resilience” has seven resiliency factors. Manufacturers have rated all the factors higher in comparison to the other two supply chain stakeholders. The average rating for the resiliency factor “Long service life” by manufacturers is the highest, and 5 out of 5. Among the other resiliency factors in this category, “Material recycling and reuse” is the least rated factor by manufacturers. These two factors are also the highest and lowest rated resiliency factors for contractors. Distributors have rated all the resiliency factors lowest in comparison to other stakeholders, as shown in Fig.3.

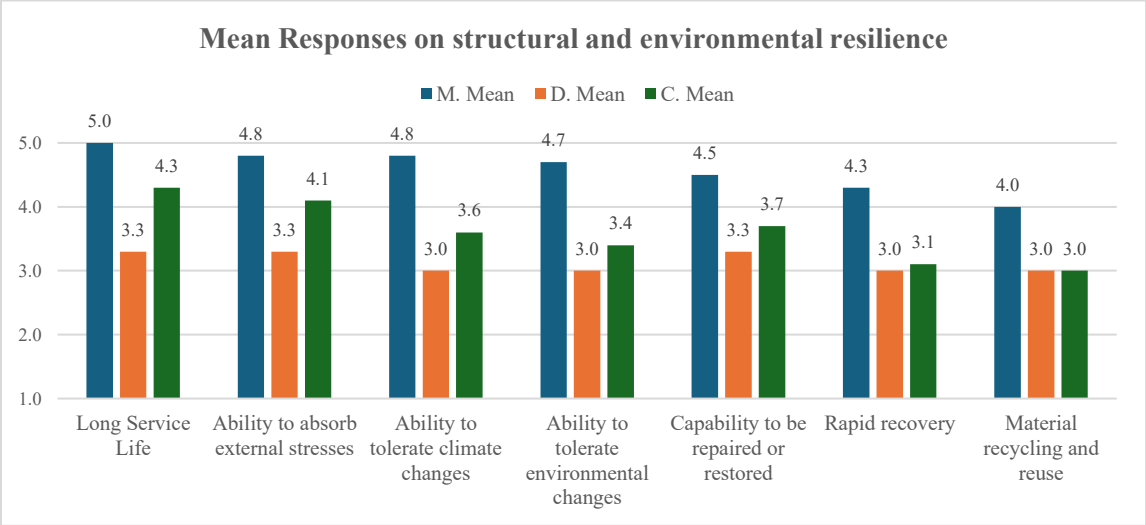

Fig.3. Mean responses for structural and environmental resilience

The category "Functional and Operational Resilience" has three resiliency factors. All the factors have an average rating higher for manufacturers, followed by distributors and contractors. Manufacturers have equally top-rated two resiliency factors: "Retain critical functions during disruptions" and "Recover rapidly from major disruptions". Similarly, distributors have equally rated all three resiliency factors. However, contractors have rated "Retain critical functions during disruptions" the highest and "Flexible under partial failure" the lowest, as shown in the Fig.4.

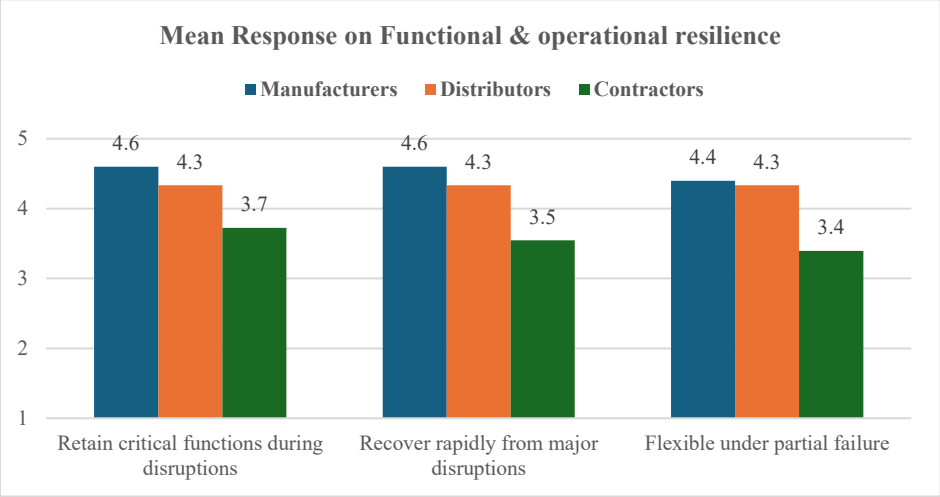

Fig. 4. Mean responses for functional and operational resilience

All three resiliency factors in the category "Preparedness and response resilience" have been highly rated by distributors in comparison to manufacturers and contractors. "Ability to adapt" and "Prepare for major disruptions" are the two equally top-rated resiliency factors by distributors. "Speed with which a structure recovers" is the top-rated resiliency factor by manufacturers, while it is also the least rated by distributors. For contractors, "Prepare for major disruptions" is the top-rated factor, and the remaining two least rated, also shown in Fig.5.

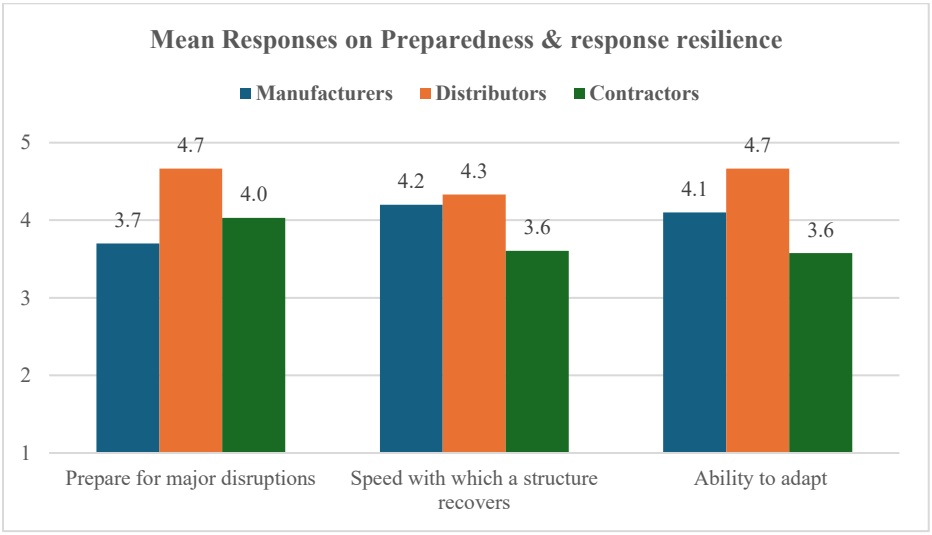

Fig.5. Mean responses for preparedness and response resilience

4.3. Significant categories/factors

A Kruskal-Wallis test was performed to find out the significant categories and factors (within the categories) among the supply chain stakeholders. The hypotheses mentioned in the methodology were followed and a test was performed across supply chains and within the supply chain.

A. Across the supply chains

Table 1. Structural and environmental resilience

S.N.	Category/Factors	Overall Mean	M. Mean	D. Mean	C. Mean	Null Hypothesis (Reject/Retain)	Overall p-value
1.	**Structural and Environmental Resilience**	**3.8**	**4.6**	**3.1**	**3.6**		
i.	Long service life	4.2	5.0	3.3	4.3	Reject	0.002
ii.	Ability to absorb external stresses	4.1	4.8	3.3	4.1	Reject	0.007
iii.	Ability to tolerate climate changes	3.8	4.8	3.0	3.6	Reject	0.002
iv.	Ability to tolerate environmental changes	3.7	4.7	3.0	3.4	Reject	0.002
v.	Capability to be repaired or restored	3.8	4.5	3.3	3.7	Reject	0.022
vi.	Rapid recovery	3.5	4.3	3.0	3.1	Reject	0.019
vii.	Material recycling and reuse	3.3	4.0	3.0	3.0	Retain	0.115

Note: Null hypothesis (H_0): No significant difference in stakeholder responses
Alternative hypothesis (H_a): At least one stakeholder group differs significantly

The majority of resiliency factors under this category, "Structural and Environmental Resilience" were found to be significant among the three supply chains, as shown in Table 1. Resiliency factors like "Long service life", "Ability to absorb external stresses", "Ability to tolerate climate changes", "Ability to tolerate environmental changes", "Capability to be repaired or restored" and "Rapid recovery" have p-values 0.002, 0.007, 0.002, 0.002, 0.022 and 0.019 respectively, all of which are less than 0.05, leading to the rejection of null hypothesis and concluding that these factors are significant among the three supply chains. Post-hoc pairwise comparison with Bonferroni correction was conducted comparing all these factors with three supply chains to find out the significant pairs. Resiliency factor "Long service life" has p-values of 0.032 for manufacturers and contractors, and 0.003 for manufacturers and distributors, both of which are less than 0.05. Therefore, the null hypothesis is rejected, and it was concluded that, in the context of structural and environmental resilience, there is a significant difference between manufacturers and distributors, and manufacturers and contractors regarding long service life.

Resiliency factor "Ability to absorb external stresses" has a p-value of 0.014 for manufacturers and distributors which is less than 0.05, leading to the rejection of null hypothesis and concluding that in the context of structural and environmental resilience, there is a significant difference between manufacturers and distributors regarding the ability to absorb external stresses (ex: wind loads, snow/ice, earthquake, etc.). Another factor, "Ability to tolerate climate changes" was found to be significant for two pairs of manufacturers and contractors, and manufacturers and distributors, with p-values of 0.003 and 0.022, both of which are less than 0.05 and leading to the rejection of the null hypothesis. It was concluded that in the context of structural and environmental resilience, there is a significant difference between manufacturers and contractors, and manufacturers and distributors regarding the ability to tolerate climate change. Similarly, the resiliency factor "Ability to tolerate environmental changes" was also significant, with two pairs just like "Ability to tolerate climate changes". The p-values for manufacturers and contractors, and manufacturers and distributors, were found to be 0.003 and 0.041, both of which were less than 0.05, leading to the rejection of the null hypothesis. It was concluded that in the context of structural and environmental resilience, there is a significant difference between manufacturers and contractors, and manufacturers and distributors regarding the ability to tolerate environmental changes.

The post-hoc pairwise comparison of the resiliency factors "Capability to be repaired or restored" and "Rapid recovery" across the three supply chains yielded similar results. Both factors were found to be significant among manufacturers and contractors. The p-values were 0.043 and 0.023, respectively, which are less than 0.05, thereby rejecting the null hypothesis. This indicates that in the context of structural and environmental resilience, there is a

significant difference between manufacturers and contractors regarding the capability to be repaired or restored to its pre-degraded state and the use of strategies that allow for rapid recovery (e.g., substitutable materials).

Table 2. Functional and operational resilience, and preparedness and response resilience

S.N.	Category/Factors	Overall Mean	M. Mean	D. Mean	C. Mean	Null Hypothesis (Reject/Retain)	Overall p-value
2.	**Functional and Operational Resilience**	**4.1**	**4.5**	**4.3**	**3.5**		
i.	Retain critical functions	4.2	4.6	4.3	3.7	Retain	0.127
ii.	Recover rapidly	4.1	4.6	4.3	3.5	Retain	0.065
iii.	Flexibility under partial failure	4.0	4.4	4.3	3.4	Reject	0.038
3.	**Preparedness and Response Resilience**	**4.1**	**4.0**	**4.6**	**3.7**		
i.	Preparation for major disruptions	4.1	3.7	4.7	4.0	Retain	0.367
ii.	Speed with which structure recovers	4.0	4.2	4.3	3.6	Retain	0.318
iii.	Ability to adapt	4.1	4.1	4.7	3.6	Retain	0.159

Note: Null hypothesis (H_0): No significant difference in stakeholder responses
Alternative hypothesis (H_a): At least one stakeholder group differs significantly

Only one resiliency factor, "Flexibility under partial failure" was found to be significant from two categories, "Functional and Operational Resilience" and "Preparedness and Response Resilience", as shown in Table 2. The overall p-value for "Flexibility under partial failure" was found to be 0.038, which is less than 0.05, and the null hypothesis is rejected. It was concluded that this factor is significant among the three supply chains. Post-hoc pairwise comparison with Bonferroni correction was performed on this factor, like others, to find out the significant supply chain pairs, but it was found that there is no significant difference between the manufacturers, distributors, and contractors regarding flexibility under partial failure.

B. Within the supply chains

Table 3. Analysis within M/D/C

Categories	p-value for M	Null hypothesis	p-value for D	Null hypothesis	p-value for C	Null hypothesis
Structural and Environmental Resilience	0.097	Retain	0.947	Retain	<0.001	Reject
Functional and Operational Resilience	0.650	Retain	1.000	Retain	0.482	Retain
Preparedness and Response Resilience	0.596	Retain	0.670	Retain	0.244	Retain

Note: Null hypothesis (H_0): No significant difference between factors for manufacturers, distributors, or contractors
Alternative hypothesis (H_a): At least one factor differs significantly for manufacturers, distributors, or contractors

While performing the Kruskal-Wallis test separately for manufacturers, distributors, and contractors regarding their perceptions of resiliency factors within the three categories, it was identified that among all three supply chains, contractors do not consider all the resiliency factors to be equally important in the structural and environmental resilience category, indicating significant differences between the factors in that category. The p-value for that category, which is <0.001, is less than 0.05. The post-hoc pairwise comparison identified the significant pairs, which were: material recycling and reuse vs. ability to absorb external stresses (p-value = 0.007), material recycling and reuse vs. long service life (p-value = <0.001), rapid recovery vs. ability to absorb external stress (p-value = 0.021, rapid recovery vs. long service life (p-value = 0.001), and ability to tolerate environmental changes vs. long service life (p-value = 0.02). Manufacturers and distributors consider all the resiliency factors to be equally important, as indicated by the p-values as shown in Table 3.

5. Discussion

This study aimed to assess the significance of resiliency factors from the perspectives of manufacturers, distributors, and contractors in the roofing industry. Descriptive analysis was used to identify the key resiliency categories and factors, followed by statistical analysis to evaluate the significance across and within each stakeholder group.

Descriptive analysis identified top resiliency categories with equal ratings for "Functional and Operational Resilience" and "Preparedness and Response Resilience". From the three categories, the top resiliency factors identified were "long service life" for manufacturers and contractors, and "preparation for major disruptions" and "ability to adapt" for distributors. This finding suggests that the supply chain stakeholders have different priorities and understanding about resiliency. Statistical analysis was conducted both within each supply chain stakeholder group and across the groups. The Kruskal-Wallis test identified several resiliency factors with significant differences in perceived importance among manufacturers, contractors, and distributors. Most of the factors from the "Structural and environmental resilience" category were significant across the supply chains, with factors such as "long service life" identified to have significant differences between two pairs - manufacturers and contractors, and manufacturers and distributors from post hoc analysis. The resiliency factor "flexibility under partial failure" was the only significant factor from the other two categories. However, the post hoc analysis did not reveal any statistically significant pairwise differences among the stakeholder groups. The potential reason behind this could be the variability of responses within each stakeholder group, making it harder to detect clear pairwise differences between groups. Moreover, there are notable differences between the sample sizes of manufacturers, distributors, and contractors, which might have reduced the power to detect the pairwise differences. The use of Bonferroni correction, which is a conservative method for adjusting multiple comparisons, might have also played a role in lowering the statistical power to identify significant differences between individual pairs (Armstrong, 2014).

While performing statistical analysis for each supply chain stakeholder within the categories, only contractors showed statistically significant differences in how they rated the importance of factors within the "Structural and environmental resilience" category. Contractors are directly involved in the physical implementation of roofing projects and, therefore, their hands-on experience with the roofing elements could potentially lead to varied perceptions within the group. Varying levels of influence from external stakeholders, such as clients, might also cause differences in what individual contractors view as important in terms of resiliency in roofing. Manufacturers and distributors are comparatively less involved in the roofing installation process, which could lead to having similar perception regarding the resiliency factors.

While this study offers valuable insights from stakeholder-linked resiliency factors, it is important to acknowledge the limitations posed by sample size, particularly for distributors (n=3) and manufacturers (n=10). These relatively small groups constrain the statistical robustness and generalizability of the findings, especially in comparative analysis across stakeholder types. However, despite the small sample size, the participants represent firms that collectively cover a substantial portion of the U.S. roofing market, lending practical significance to the insights gathered. The inclusion of these stakeholder perspectives, even in limited numbers, provides foundational insights that can inform future research with broader sampling and empirical validation. Future studies should aim to expand the participant pool to strengthen representativeness and enable more rigorous statistical testing.

6. Conclusion

The study performed a comprehensive analysis of the responses obtained from the survey of the roofing industry regarding how the manufacturers, contractors, and distributors perceive resiliency. Quantitative analysis was performed using a statistical tool to identify the importance of resiliency factors to the supply chain stakeholders, also identifying the significant differences across the supply chain stakeholders and within individual groups. From the analysis, it can be concluded that the specific roles and responsibilities of each stakeholder group highly influenced their perceptions regarding the importance of resiliency factors. For instance, among the resiliency factors, distributors rated "preparation for major disruptions" the highest. Since distributors act as a bridge between manufacturers and contractors, it is highly important that they need to be prepared for natural disasters to ensure the efficient supply of roofing elements. Similarly, manufacturers and contractors have more influence on the service life of roofing elements by producing durable roofing elements and installing them correctly, which justifies the highest rating of resiliency factor "long service life". The lack of significant differences among the majority of resiliency factors also suggests that the knowledge regarding resiliency in the roofing industry might have been insufficient. Therefore, future studies covering all the aspects of resiliency in the roofing industry are needed, so that they can benefit from those studies by implementing the resilient practices in their operations.

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