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Issues and Challenges in Field Data Collection from Electrical and Electronics (E&E) Manufacturing Firms in Malaysia: A pilot study experience

Ainul Haniza Mohd Rashid[1,2*], Abdul Aziz Othman[2], Syairah Aimi Sharon[2]
**Corresponding Author*

[1] Universiti Teknologi MARA, Cawangan Kedah, Kampus Sungai Petani, Malaysia
[2] School pf Technology Management and Logistics, College of Business, Universiti Utara Malaysia, Sintok, Kedah, Malaysia

haniza496@uitm.edu.my, abdaziz@uum.edu.my, syairah@uum.edu.my
Tel: +60195778056

Abstract
Effective data collection is vital for research, especially within Malaysia's electrical and electronics (E&E) sector, which significantly impacts the economy. This study investigates challenges during field data collection, including accessibility, respondent location, and confidentiality. It highlights the importance of engagement strategies like employee referrals and human resources (HR) support to enhance data reliability. Recommendations include leveraging HR support and broadening respondent selection. Addressing these challenges can improve the industry's human capital development and capability building. Future research should focus on refining data collection methodologies tailored to manufacturing sectors to ensure more robust and reliable data outcomes.

Keywords: data collection; electrical and electronics; issues and challenges; manufacturing

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1.0 Introduction

Data collection involves various issues and challenges related to methodology, contextual factors, and content accuracy, which researchers must address to enhance study quality. Effective field data collection is particularly significant in the Electrical and Electronics (E&E) industry, where complexities can affect the reliability and relevance of research outcomes. According to the Malaysian Investment Development Authority (MIDA), the E&E sector in Malaysia is vital to the economy, contributing 5.8% to GDP in 2023 and targeting RM120 billion in GDP growth and RM495 billion in export earnings by 2025 (The Malaysian Reserve, 2024). Understanding the industry's operational dynamics and risk management strategies for supply chain resilience is crucial for improving firms' performance and ensuring ongoing growth and competitiveness. Building resilience capabilities and performance is essential for firms' business continuity, survivability, and sustainability (Korchi, 2022; Han & Um, 2024). This study investigates Malaysia's E&E industry's resilience performance at the firm level, as companies struggle to understand how resilient they need to be (Ashcroft, 2023). The research objectives are to examine the indirect effects of risk mitigation practices on the relationship between resilience capabilities and a firm's performance. This paper examines the data collection issues and challenges faced in the pilot study within the E&E manufacturing sector.

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The E&E sector is marked by complex, dynamic, and interdependent operations, making data collection particularly challenging. Supply chain management involves planning, coordinating, and controlling the movement of materials, parts, and products from suppliers to customers (Simchi-Levi et al., 2008). The interconnected supply chain functions of the fast-paced E&E industry present significant challenges in acquiring secure, relevant, and timely data. Organisational factors - such as job rotation, department restructuring, and non-specific communication channels - further complicate the identification and engagement of suitable respondents for the study. These challenges risked collecting inaccurate or inconsistent data, undermining the validity and reliability of the study. Additionally, biased samples or incomplete information could limit the generalizability of the research findings (Phillips & Burbules, 2000).

2.0 Literature Review

2.1 Pilot study

According to Harkiolakis (2018), the pilot study phase is a crucial step in developing an instrument before its full-scale implementation. Typically small in size, duration, and budget (Bigliardi & Bottani, 2014), the pilot study provides early insights into how the survey performs under real-world conditions (Martella et al., 1999). It aims to assess whether respondents can understand the questions, eliminate ambiguities, remove biased items, and refine the questionnaire's format (Sekaran & Bougie, 2016). It also evaluates the instrument's practical effectiveness, including completion time, clarity, language, complexity, comfort, and alignment with the respondent's knowledge and experience. Moreover, researchers must pilot test instructions and survey distribution procedures (Nardi, 2018). The feedback collected from the respondents – about their experience, how they interpreted questions, and the instrument's usability helps identify areas for improvement before the main study (Burkholder et al., 2020).

2.2 Field data collection

Field data collection involves direct observation, surveys, interviews, experiments, case studies, and sampling in their real, natural setting (Neuman, 2013). Data collection is a systematic process of gathering and measuring relevant sources to answer specific questions and predict future trends in a particular area of interest (Emily et al., 2016). A survey design provides a quantitative description of trends, attitudes, and opinions of a population, or tests for associations among population variables (Creswell & Creswell, 2018). Self-administered survey allows contact with otherwise inaccessible participants (e.g., Managing Directors, Chief Executive Officers), often the lowest-cost option, perceived as more anonymous, allows participants time to think about questions, and provides access to the computer-literate (Cooper & Schindler, 2011).

2.3 Data quality

Field data can be skewed by biases like observer bias (where a researcher's subjective views influence their observations) or social desirability bias (where participants change their responses to appear more favourable). In this regard, participant observation – a common field data collection in ethnography – requires careful attention to reflexivity, meaning the researcher must be aware of how their presence may influence the data (Flick, 2018). The accuracy of survey data depends on the ability of respondents to accurately interpret the meaning of survey items and correctly and honestly report their attitudes and behaviours (Burkholder et al., 2020).

2.4 Ethical issues

Field data collection, especially in human-centered studies, raises ethical concerns. Researchers must ensure that participants give informed consent and are aware of their rights, including confidentiality and the voluntary nature of participation (Creswell & Cheryl, 2018).

3.0 Methodology

3.1 Strategies of Inquiry

This study uses a structured questionnaire with a 5-point Likert scale to collect data from 511 E&E manufacturing firms in Malaysia, drawn from the 2024 Federation of Malaysian Manufacturers (FMM) Directory (54th edition). To ensure sample diversity and enhance the generalizability of the survey results, 30 firms were selected for the pilot study, from members and non-members of the Federation of Malaysian Manufacturers (FMM). This approach allowed for testing the instrument across various industry segments (Chua, 2012; Malhotra & Grover, 1998). The pre-testing phase involved a small group of respondents to ensure the survey questions were clear, relevant, and easy to understand. Firms were selected using convenience sampling, prioritising those near the researcher's location for easier access and communication. This pilot study aims to refine the survey instrument and address potential issues before the full-scale survey.

3.2 Unit of analysis

This study's unit of analysis is organizations. The inclusion criteria are manufacturers and electronics manufacturing services (EMS) firms, and the exclusion criteria are retailers and contractors.

3.3 Respondents' selection

The respondents' profiles include the following positions: CEO, Managing Director, General Manager, Senior Manager, Manager, Senior Executive, and Executive, having work experience in Supply Chain, Purchasing, Logistics, Production, Operations, Business Coordination, or Sales.

3.4 Survey distribution method

We sent 22 hard copies of the questionnaires to targeted respondents via *'Pos Laju',* Pos Malaysia's courier service. Each questionnaire booklet featured a brightly coloured yellow cover and came packaged in a zip-lock plastic bag. To make returns easy, we included a self-addressed, postage-paid return envelope. We also included a pen as a small gift to encourage participation and reduce refusals (Neuman, 2004).

In addition to the hard copies, we created an online survey using Google Forms and shared it with the same respondents. We emailed the survey link three days after dispatching the hard copies (http://bit.ly/resilienceperformance). For the pilot study, we randomly distributed eight hard copies to the E&E manufacturers within the Bayan Lepas Industrial Zones (Phase 1 to Phase 4). The layout of these zones, an area with multiple separated buildings housing administrative offices and manufacturing facilities, added logistical challenges in reaching our intended respondents.

4.0 Findings

We conducted a pilot study to develop and test the questionnaire's adequacy regarding question wording and meaning. This study will also ensure the instrument's scaling is appropriate and correct (Creswell & Creswell, 2018)We anticipate these findings will further enhance the proposed survey framework and instrument. Ultimately, these findings can assist future supply chain managers understand how to influence firms to mitigate their supply chain risks and enhance their supply chain resilience performance.

4.1 Accessibility in reaching the targeted respondents

We relied on the *Federation of Malaysian Manufacturers (FMM) 2024 Directory* as our primary source, supplementing it with LinkedIn and Google searches. However, a significant challenge during data collection was directly contacting potential respondents. Many manufacturers use Caller-Assisted Operator Services, which creates a barrier to direct communication. This system required additional steps to reach our intended respondents, delaying the process and complicating effective outreach.

We utilized alternative strategies for this study to overcome these challenges and ensure access to our targeted respondents. These included leveraging personal networks, such as employee referrals and connections through friends, relatives, and the researcher's past correspondences. We also contacted Human Resources (HR) personnel within the organization. These methods facilitated a more efficient connection with the relevant individuals and helped mitigate the communication barriers that Caller Assisted Operator Services posed.

4.2 Locating the right respondents based on roles, designation, and department

A key challenge in this study was identifying and contacting the right respondents based on their roles, job titles, and departments. Many manufacturers utilize generic email addresses (e.g., *info@, helpdesk@, recruitment@, admin@, career@, or sales@)* for communications. This complicates reaching individuals with the relevant expertise, particularly those who manage supply chain risks. This non-specific contact approach often delays initial outreach.

Job rotation within organizations also made it harder to pinpoint the right respondents. While job rotation promotes cross-functional knowledge (Rothwell & Kazanas, 2003), it reduced role specialization, making it challenging to find individuals with the specific expertise we needed for this study. For instance, a supply chain manager might be reassigned to roles outside the Supply Chain Department, such as Head of the New Product Technology Division (NPTD), with responsibilities across procurement, logistics, cost control, and business coordination. This reassignment meant adjusting our search criteria and outreach strategies to account for these broader roles.

The integration of functions such as materials management, procurement, production, operations, and logistics management into broader divisions, often renamed as *Supply Chain Groups* or similar terms, has blurred traditional departmental boundaries (Christopher, 2016). As a result, formal job titles or departmental labels no longer accurately reflect individuals' current responsibilities or expertise. Consequently, we found it increasingly difficult as outsider researchers to accurately identify and locate respondents based on their job titles or departmental affiliations. This fluidity in roles and organisational structure presents a significant challenge in determining the right respondents for this study.

4.3 Identifying accurate contact information

Many manufacturers operate multiple branches across different locations and states, and we needed to obtain up-to-date information regarding their specific addresses. This posed a significant challenge in ensuring that the contact details for each area were accurate and current. We found this particularly difficult given the possibility of frequent relocation or expansion, which often led to discrepancies in the information available.

4.4 Verifying respondents' contact information

Before initiating contact, we thoroughly verified the contact details for FMM members listed in the directory. We found several discrepancies in the information, including outdated or inaccurate data such as incorrect factory addresses, changes in the designated person-in-charge, and invalid office telephone numbers. This needed additional time and effort to confirm the correct details, which

delayed our reaching the appropriate respondents. We also identified non-member companies through online searches using keywords such as "E&E companies in Malaysia". We reviewed relevant websites, including https://www.mida.gov.my, https://www.miti.gov.my, https://www.teeam.org.my (The Electrical and Electronics Association of Malaysia), https://en.syarikatjepun.com, https://www.wesley.net, and https://amcham.com.my (The Malaysian American Electronics Industry Committee). Only manufacturers of E&E final products or parts were included in this pilot study.

4.5 Respondents' verification of the researcher's profile

Some potential respondents reviewed the researcher's LinkedIn professional profile as part of their due diligence before agreeing to participate in the study. We believe they undertook this process to verify the researcher's credentials and ensure the study's legitimacy, particularly before sharing sensitive information related to their business operations. In response, we proactively updated and detailed relevant professional experiences to enhance credibility and build trust with prospective respondents. While this cautious approach by respondents reflects their concern for confidentiality and authenticity, it added an extra layer of time and interaction before the data collection process could proceed.

4.6 Initial difficulty in gaining access to manufacturing firms

At the start of the study, gaining access to manufacturing firms and obtaining permission to conduct the research proved challenging. Initial attempts to engage potential respondents met with reluctance, likely due to concerns about the study's legitimacy and purpose. However, the process became smoother once we introduced ourselves as lecturers rather than PhD students or researchers. This approach helped establish credibility, making distributing questionnaires easier and securing cooperation from company representatives (Dillman et al., 2014). Additionally, coordinating pre-arranged appointments for questionnaire distribution and collection proved challenging, as dates and times often change based on respondents' availability. This variability required us to maintain flexibility and careful coordination to ensure timely returns of completed questionnaires. As highlighted in the survey methodology literature, clear communication and professional identity are essential to ensure a smooth survey process and encourage respondents to participate (Bryman, 2016). We found that a proactive and adaptable approach to scheduling was crucial for navigating these logistical hurdles.

Table 1. Issues and Challenges of Malaysia's E&E Field Data Collection

Issues	Challenges
Accessibility in reaching respondents	Difficult to contact potential respondents since most manufacturers use 'Caller Assisted Operator Service'. It is difficult to contact the most suitable respondents since most manufacturers use general email addresses (e.g., info@, helpdesk@, recruitment@, admin@, career@, or sales@) as the official email addresses for any business-related correspondence.
Locating the right respondents based on roles, designation, and department	Due to the job rotation system, respondents with related experience managing supply chain risk who are qualified to answer the survey may be in other departments.
Identifying accurate contact information	Many manufacturers have more than one branch in other locations or states, requiring the researcher to obtain the latest location information.
Verifying respondents' contact information	The contact details for FMM members listed in the directory required thorough verification by the researcher before initiating contact. Some information was inaccurate or outdated (e.g., factory address, person-in-charge, or office telephone numbers).
Respondents' verification of the researcher's profile	Some respondents viewed the researcher's profile via LinkedIn for verification purposes before providing any information regarding their business operations for this study.
Initial difficulty in gaining access to manufacturing firms	It was difficult to get the attention and permission from manufacturing firms to conduct research and collect data. Initial attempts to engage potential respondents were met with reluctance.

(Source: Own Compilation, 2024)

5.0 Discussion

5.1 Limitations of the study

Several factors impacted our data collection process during the pilot study. Some targeted respondents were unavailable due to business travel, new projects, or annual audits. Furthermore, we relied on the Federation of Malaysian Manufacturers (FMM) 2024 Directory,

which may have contained outdated contact information such as staff resignations, email changes, updates to office or factory locations, or business closures. As a result, some questionnaires could not reach their intended recipients or were returned unclaimed. Moreover, discrepancies may exist between what respondents report they do and what they actually do (Nardi, 2018), potentially affecting data accuracy. These limitations impacted our response rates and the completeness of the data. By addressing these issues and refining our methodology, we believe the full-scale survey will enhance both academic insights and practical application in supply chain management.

6.0 Conclusion and Recommendations

In conclusion, this study highlighted key challenges we encountered during the pilot phase of data collection in the E&E manufacturing sector in Malaysia, particularly in identifying the right respondents, verifying contact information, and ensuring data quality. Our findings reveal that organisational complexities, such as job rotation, non-specific communication channels, and the dynamic nature of the sector, can significantly affect the reliability and accessibility of our survey data. Despite these challenges, the pilot study provided valuable insights into refining our survey instrument and improving the overall data collection process.

6.1 Leverage support from the Human Resources (HR) Department

We recommend making the Human Resources (HR) Department the most suitable point of contact for identifying and selecting respondents who meet our specific criteria, particularly those with relevant experience in managing supply chain risk. Given the study's emphasis on obtaining insights from respondents with strong expertise and practical experience in this area, HR personnel are ideally positioned to assist in locating individuals who best align with the survey's requirements. As the central hub for employee records and roles, collaborating with HR is an efficient and effective strategy for ensuring we approach the most qualified candidates for participation, ultimately enhancing the quality and relevance of our study's data.

6.2 Broaden respondent selection by position

This study's initial focus was obtaining responses from senior management positions, including the CEO, Managing Director, General Manager, Senior Manager, Manager, Assistant Manager, and Head of Department. We assumed their perspectives would adequately represent their firm's experiences. However, we recommend expanding the scope of respondents to include individuals in Senior Executive and Executive-level roles within the related departments. Additionally, to enhance the study's depth and breadth, we suggest including staff directly involved in supply chain risk management (SCRM) within E&E manufacturing firms, such as Chief Risk Officers, Risk Officers, and Risk Executives, in the actual study.

This expanded respondent pool would shift the focus from solely managerial perspectives to include executives and industry professionals with practical, on-the-ground experience managing supply chain risk. Ultimately, this study would benefit from a more diverse range of insights, with the common qualifier being respondents' hands-on experience in addressing supply disruptions, particularly in the upstream segments of the supply chain. This broader selection criterion would enrich the study's findings and provide a more comprehensive understanding of supply chain risk management practices across different organisational levels.

6.3 Attend industry-specific events

To improve data collection and enhance future studies, we should actively engage in industry-specific events, particularly those within the E&E sector. Attending events like the annual Vendors Conference Meeting, where manufacturing firms gather suppliers and industry leaders, to celebrate top performers and discuss industry trends, provides direct access to key stakeholders. These gatherings present an ideal opportunity for distributing surveys, as they bring together professionals directly involved in supply chain and risk management decisions, ensuring that respondents possess the relevant experience and knowledge.

Moreover, industry events facilitate networking and collaboration, helping us build relationships and establish trust and rapport with respondents, which can lead to high-quality responses (Babbie, 2013). Attending these events also offers real-time insights into industry challenges and innovations, enriching the study's context and leading to more actionable findings.

To enhance the study's effectiveness, future research should broaden the respondent pool to include senior management and supply chain risk management professionals, ensuring a more comprehensive view of supply chain resilience. Engaging HR departments and attending industry events will improve access to the right respondents and data quality. These steps will ensure that the final instrument effectively captures the perspectives of E&E manufacturing firms in Malaysia. Moving forward, we will aim to develop a preliminary model for supply chain risk resilience by expanding the pilot study to a broader sample of E&E firms across Malaysia. This will refine the model and deepen our understanding of the factors influencing supply chain resilience in the sector.

Paper Contribution to Related Field of Study

This study addresses field data collection issues and challenges in operations and supply chain management research within Malaysia's E&E manufacturing industry. We expect the pilot study results to guide future research and practice. In contrast, the full study will provide supply chain managers with insights into strategies for mitigating supply chain risks and enhancing resilience. By refining our framework and instrument, we aim to help companies strengthen supply chain operations and improve their ability to withstand disruptions.

Additionally, researchers must address data quality issues, ensure sample representativeness, and minimize biases. This research will inform industry practices, helping firms improve decision-making and operational efficiency.

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